**Jobos Bay NERR Nutrient Metadata**
**July 2002 to December 2002**
**Latest Update: July 22, 2025**

## I. Data Set and Research Descriptors

### 1) Principal investigator(s) and contact persons

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### 2) Research objectives

Inorganic nutrients, particularly nitrogen and phosphorus are naturally found in mangrove and estuarine habitats. They can be significantly increased by human activities reaching the system through non-point source run-off or direct discharge. Eutrophication is defined as gradual accumulation of nutrients and organic biomass accompanied with an increase in photosynthesis and a decrease in the average deep of the water column caused by the accumulation of sediment.

The objective of this study is to provide baseline information on inorganic nutrients and chlorophyll levels in the Jobos Bay estuary. It will also assess nutrients and chlorophyll levels in areas within the reserve that may be receiving impact from human activities from surroundings areas or may act as a habitat gradient in the Bay. In order to compare these with physical water quality parameters, monitoring sites were established at the four YSI's datasonde stations.

Station number nine (9), the impacted site, collects water quality data in a site associated with runoff from littoral and basin mangrove areas. This sampling station is located in the most inland lagoon, closest to the Thermoelectric Power Plant. It is subjected to runoff, which may include potential oil spill contamination from this industrial facility. Information compiled from historical environmental documents, indicate that station nine (9) was used as a disposal site for residues of the previously operating sugar mill operation, and therefore might have high organic input into the sediments.

Station number ten (10), located in a mangrove lagoon area towards the southwestern section of Mar Negro is considered the reference or non-impacted site.

Station 19 is located in Jobos Bay surrounded by sea grass beds composed of *Thallasia testudinum*. This station is close to the Power Plant transit channel, which allows barges to bring oil and gas into the Power Plant pier. This area is exposed to barge standings, sediment re-suspension and oil spills.

Station 20 is located adjacent to Cayos Caribe reef. Water streams coming from the platform may bring to this station an indication of water conditions behind the coral reef wall. This water are part of the main marine current coming from the eastern side of Jobos Bay that runs along the coast, getting in contact with sensitive areas like coal plant, Phillips Core, Chemsource and other industries.

## 3) **Research methods**

### a) **Monthly Grab Sampling Program**

Monthly grab samples are taken at the four datasonde stations. Grab samples are take on the same day at or as near as possible to slack low-tide conditions. Efforts are made to collect samples at approximately monthly intervals. Samples are not influenced by previous storm events. Grab samples are reflective of the water mass sampled by the datasonde. Because we have shallow and well-mixed water on our stations, two surface grab samples are collected that are reflective of the datasonde sampling area. Replicate (N=2) sample were collected by hand at an approximate depth of 30 cm.

Grab samples are taken in duplicate (two separate sample collections not two samples from a single water sample); this will result in a total of eight samples. All samples were collected in amber, wide mouth, nalgene sample bottles that were previously acid washed (10%) rinsed

(3x) with distilled-deionized water, dried and followed by rinsing (3x) of ambient water prior to collection of the sample. Samples were immediately placed on ice, in the dark and returned to the laboratory. All samples are filtered immediately after collection or as soon as possible. All samples were immediately placed on ice again, in the dark and sent to Virginia Institute of Marine Sciences (VIMS) laboratory.

b) **Diel Sampling Program**

Diel grab samples are take in long-term datasonde stations 9. Samples are collected over a Full lunar day (24hr:48min) time period at 2 hour intervals using ISCO auto-samplers. Efforts are made to collect samples at approximately monthly (30 days) interval. Samples are not influenced by previous storm events; an antecedent dry period of 72 hours is desirable but may not be practical at all locations throughout the year. Sampling depth follows the following designs; samples are collected at a fixed depth from the bottom, generally 0.5 meters, and reflect the water mass sampled by the data sonde. This device automatically samples 1000 ml of water every 2 hrs. All samples are pumped into polyethylene sample bottles that were previously acid washed (10%), rinsed (3x) with distilled-deionized water and dried. At the end of the 24 hr period, the 12 samples are kept in the dark and returned to the laboratory for immediate processing. All samples are filtered immediately after collection placed on ice, in the dark (cooler) and sent to Virginia Institute of Marine Sciences (VIMS) laboratory.

4) **Site location and character**

The Jobos Bay National Estuarine Research Reserve (JBNERR) is located on the southern coastal plain of the island of Puerto Rico, a reserve within the West Indies geographical area. JBNERR is composed of two major areas: (1) Mar Negro, located on the western margin of the Bay, and (2) Cayos Caribe, a chain of 15 tear-shaped islets located to the southeast. The Mar Negro area comprises the bulk of the Reserve, and consists of mangrove forests and a complex system of lagoons and channels interspersed with salt and mud flats. Coral reefs and sea grass beds, with small beach deposits and upland areas fringe Cayos Caribe mangrove islands.

Station 9 is an impacted site and is located on the northeastern section of the Mar Negro component. This sampling station is associated with mangrove lagoon areas and receives runoff from mudflats, the Thermoelectric Power Plant, and adjacent areas. The tidal range varies from 12 to 14 inches in the vicinity of the monitoring station. The salinity at the vicinity of the monitoring station varies from 0.0 ppt to 41.1 ppt. The average depth at station 09 is 1 meter. A thick layer of thin sediments with a high content of organic material covers the bottom. Brown and green algae are also present at this site, but a better assessment is needed. The station pole is located at 17° 56' 36.8" N and 66° 14' 18.5" W.

Station 10 is located in a mangrove lagoon not impacted directly by any upland or marine activities. It provides a reference for comparison of data obtained in other stations, especially to the station in Mar Negro lagoon. The tidal range varies from 12 to 14 inches.

The salinity at the vicinity of the monitoring station varies from 0.0 ppt to 41.7 ppt. The average depth at station 10 is 1 meter. The bottom is covered with a layer of fine sediments with organic material, followed by a layer of calcareous material mainly from shells and oysters. At this site we can find sea grass (Thalassia), calcareous algae (Halimeda sp.), green algae (Caulerpa sp.) and brown algae (Dictyota sp.) among
others. The pole is located at 17° 56' 20.3" N and 66° 45' 26.7" W.

Station 19 is located in the Bay surrounded by sea grass beds (*Thallasia testudinum*). The tidal range varies from 12 in. to 14 in. in the vicinity of the monitoring station. No fresh water input in the vicinity of the station is probable. The salinity at the vicinity of the monitoring station is approximately 35 ppt. The pole is located at 17° 56' 28.15885" N and 66° 13' 45.28784" W.

Station 20 is located near Cayos Caribe islets. The sonde is in contact with three streams of water that comes from Cayos Caribe reef platform. The tidal range varies from 12 in. to 14 in. in the vicinity of the monitoring station. No fresh water input in the vicinity of the station is probable. The salinity at the vicinity of the monitoring station is approximately 35 ppt. The pole is located at 17° 55' 49.14258" N and 66° 12' 41.29771" W.

5) **Coded variable code definitions**

Station Code Names
job09nut – Station 9
job10nut – Station 10
job19nut - Station 19
job20nut - Station 20

Monitoring Programs
Monthly grab sample program (1), Diel grab sample program (2)

6) **Data collection period**

**Diel Sampling**

| Station | Start Date | Start Time | End Date | End Time |
|---|---|---|---|---|
| job09nut | 7/23 | 0850 | 7/24 | 0650 |
| job09nut | 8/19 | 0800 | 8/20 | 0600 |
| job09nut | 9/17 | 0800 | 9/18 | 0600 |
| job09nut | 10/15 | 0830 | 10/16 | 0630 |
| job09nut | 11/20 | 0830 | 11/21 | 0630 |
| job09nut | 12/12 | 0830 | 12/13 | 0630 |

**Grab Sampling**

| Station, Date, Time | | |
|---|---|---|
| job09nut | 07/24/2002 | 08:00 |
| job09nut | 08/20/2002 | 08:44 |
| job09nut | 09/18/2002 | 08:15 |
| job09nut | 10/16/2002 | 08:19 |
| job09nut | 11/21/2002 | 08:32 |
| job09nut | 12/13/2002 | 08:30 |
| job10nut | 07/24/2002 | 08:20 |
| job10nut | 08/20/2002 | 08:11 |
| job10nut | 09/18/2002 | 08:36 |
| job10nut | 10/16/2002 | 08:03 |
| job10nut | 11/21/2002 | 08:53 |
| job10nut | 12/13/2002 | 08:45 |
| job19nut | 07/24/2002 | 09:10 |
| job19nut | 08/20/2002 | 07:57 |
| job19nut | 09/18/2002 | 07:56 |
| job19nut | 10/16/2002 | 07:51 |
| job19nut | 11/21/2002 | 08:20 |
| job19nut | 12/13/2002 | 08:00 |
| job20nut | 07/24/2002 | 09:35 |
| job20nut | 08/20/2002 | 07:48 |
| job20nut | 09/18/2002 | 07:52 |
| job20nut | 10/16/2002 | 07:45 |
| job20nut | 11/21/2002 | 08:15 |
| job20nut | 12/13/2002 | 08:10 |

7) **Associated researchers and projects**

A water quality monitoring using YSI 6000 data loggers started in December, 1995 to determine pH, salinity, turbidity, temperature, specific conductance, depth, dissolved oxygen saturation and concentration.

In April of 2003, an expanded nutrient and chlorophyll monitoring program was established. This one year program will assess nitrogen and chlorophyll loading in a broader geographical area of the Bay. Nine additional stations are being monitored.

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 Service, 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 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.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual 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 the 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**

After the results of nutrients sampling arrives from VIMS laboratory to Jobos Bay NERR the data was verified before being sent to the CDMO to be archived into the permanent database. The person responsible of this task is the research coordinator of the reserve Iris L. Tirado.

10) **Parameter Titles and Variable Names by Data 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: | Orthophosphate | PO4F | mg/l as P |
| Nitrogen: | 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 as N |

Other Lab Parameters:

| | | |
|---|---|---|
| Chlorophyll a | CHLA_N | µg/l |
| Phaeophytin | PHEA | µg/l |

11) **Measured and Calculated Laboratory Parameters**

a) **Variables Measured Directly**

| | |
|---|---|
| Nitrogen species: | $NO_2$ F, $NO_{23}$ F, $NH_4$ F |
| Phosphorus species: | $PO_4$F |
| Chlorophyll a | CHLA_N |
| Phaeophytin | PHEA |

b) **Computed Variables**

| | |
|---|---|
| $NO_3$ F: | $NO_{23}$ F -$NO_2$ F |
| DIN: | $NO_{23}$ F +$NH_4$ F |

Notes:

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

12) **Limits of Detection**

The VIMS Nutrient Analytical Laboratory has established Method Detection Limits (MDL), the lowest concentration of a parameter that an analytical procedure can reliably detect. The MDL is determined as 3 times the standard deviation of a minimum of 7 replicates of a single low concentration sample. Table 1 presents the current MDL's; these values are reviewed and revised periodically.

Table 1. Method Detection Limits (MDL) for measured water quality parameters.

| Parameter | Variable | Mean Conc. mg/l as N or P | Std. Dev. | MDL mg/l as N or P | Dates in use |
|---|---|---|---|---|---|
| Ammonium | $NH_4$F | .2499 | .169 | 0.0015 | Jul – Dec 2002 |
| Nitrite | $NO_2$ F | .0021 | .0014 | 0.0002 | Jul – Dec 2002 |
| Nitrite + Nitrate | NO23 F | .0129 | .0091 | 0.0010 | Jul – Dec 2002 |
| Orthophosphate | $PO_4$F | .0369 | .0326 | 0.0006 | Jul – Dec 2002 |
| Chlorophyll | CHLA_N | .26 | .086 | 0.25 | Jul – Dec 2002 |
| Pheophytin | PHEA | .28 | .247 | 0.25 | Jul – Dec 2002 |

13) **Laboratory Methods**

i) **Parameter: NH4F**
VIMS Laboratory Method:
EPA or other Reference Method:
Method Reference: US.EPA 1974. Methods for Chemical Analysis of Water and Wastes pp.168-174
Method Descriptor: Samples were filtered with a 0.45 μm membrane filter.
Preservation Method: Samples are stored at 4°C up to 24 hours.

**Summary of Method:**
Automated Continuous flow, segmented stream, no bubble gating. Dual wavelength detection and matrix correction.
Chemistry:
Alkaline phenol and hypo chlorite react with ammonia to form indophenols blue that is proportional to the ammonia concentration. The blue color formed is intensified with sodium nitroprusside. Reaction is heat catalyzed at 37˚C. The range is 0.001-2.0 mg/L.
Interferences:
Alkalinity over 500mg/L
Acidity over 100 mg/L
Ca and Mg ions will precipitate unless complexed
Color intensity is pH dependent

ii) **Parameter: $NO_2F$**

VIMS Laboratory Method:
EPA or other Reference Method: 353.4
Method Reference: US.EPA 1994. USEPA 600/R-97/072. Method 353.4
Method Descriptor: Samples were filtered with a 0.45 μm membrane filter.
Preservation Method: Samples are stored at 4°C up to 24 hours.

**Summary of Method:**
Automated continuous flow, segmented stream, no bubble gating. Dual wavelength detection and matrix correction.
Chemistry:
An adaptation of the diazotization method. Under acidic conditions, nitrite ion reacts with sulfanilamide to yield a diazole compound, which couples with N-1 napthylenediamine dihydrochloride to form a soluble dye, which is measured colorimetrically. The range is 0.001 to 0.050 mg/L.
Interferences:
$NCl_3$ false positive
These metal ions cause precipitation at high concentrations:
$Sb^{+3}$, $Au^{+3}$, $Bi^{+3}$, $Fe^{+3}$, $Pb^{+2}$, $Hg^{+2}$, $Ag^{+}$, $PtCl_6^{-2}$, $VO_3^{-2}$
Cupric ion may catalyze decomposition of diazole compound.

iii) **Parameter: $NO_x$ F**
VIMS Laboratory Method:
EPA or other Reference Method: 353.4
Method Reference: US.EPA 1994. USEPA 600/R-97/072. Method 353.4
Method Descriptor: Samples were filtered with a 0.45 μm membrane filter.
Preservation Method: Samples are stored at 4°C up to 24 hours.

**Summary of Method:**
Automated continuous flow, segmented stream, no bubble gating. Dual wavelength detection and matrix correction.
Chemistry:
Nitrate is reduced to nitrite by a copper/cadmium reductor column. The nitrite ion then reacts with sulfanilamide to form diazole compound. This compound then couples with n-1-napthylenediamine dihydrochloride to form a reddish/purple azo dye. The color development chemistry is the same as that used in nitrite, Method #5. Range is 0-1.2 mg/L.
Interferences:
High concentrations of Fe, Cu (>10 mg/L)
Oil and Grease will coat Cd column
Residual Chlorine oxidizes Cd column
Sulfates will consume Cd column in the formation of $S^{-2}$

iv) **Parameter: $PO_4F$**
VIMS Laboratory Method:
EPA or other Reference Method: 365.5
Method Reference: US.EPA 1994. USEPA 600/R-97/072. Method 365.5
Method Descriptor: Samples were filtered with a 0.45 μm membrane filter.
Preservation Method: Samples are stored at 4°C up to 24 hours.

**Summary of Method:**
Automated continuous flow, segmented stream, no bubble gating. Dual wavelength detection and matrix correction.
Chemistry:
Ammonium molybdate and antimony potassium tartrate react in a sulfuric acid environment to form an antimony-phospho-molybdo complex, which is reduced to a blue colored complex by ascorbic acid. Reaction is heat catalyzed at 40 °C. Range is 1-50 ppb.
Interferences:
$Fe^{+3}$ at concentrations greater than 50 mg/L
$SiO_2$ at conc.>10mg/L positive interference- not naturally present
Hydrogen sulfide
Mercuric Chloride (used as preservative by some)

v) **Parameter: CHLA_N and PHA**
VIMS Laboratory Method:
EPA or other Reference Method: 445.0

Method Reference: US.EPA 1997. USEPA 600/R-97/072. Method 445.0
Method Descriptor: Samples were filtered with a 0.47 µm membrane filter and subjected to 10% Acetone
Preservation Method: Samples are stored at 4°C up to 24 hours.

**Summary of Method:**
The two methods for determining Chlorophyll a given here are with 1) a scanning spectrophotometer and 2) a Turner Design fluorometer. The method used requires filtering a known quantity of water through a glass fiber filter. This filter is later ground with a tissue grinder made of teflon/glass. Approximately 2-3 mL's of 90% acetone are added to the filter before grinding. Acetone is also used to wash the filter in to 17 x 150 test tube with tight fitting cap. The sample is steeped at leased 2 hours and not exceeding 24 hours at 4 °C, in the dark. The samples are centrifuged and read on spectrophotometer or fluorometer. If the samples cannot be read within that time period, storage in the freezer at –20 °C for a few days is acceptable. If pheaophytin measurements are desired, the sample is acidified and read again.

14) **Reporting of Missing Data and Data with Concentrations 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 –**

From July to December 2002 we do not have QA/QC Program

16) **Other Remarks**

**On 07/22/2025 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.

| | | Historic | |
|---|---|---|---|
| **Flag/code** | ***If also C*** | **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 | | N | Negative calculated value |
| (CRE) or F_Record {CRE} | | P | Significant precipitation (reserve defined, see metadata for further details) |
| <0> (CUS) | | U | Lab analysis from unpreserved sample |
| <1> (CSM) | | S | Data suspect, see metadata for further details |

All chlorophyll *a* and phaeophytin data prior to May 2007 were removed from the dataset (or rejected for 2007 data) on 10/22/2018 (07/2002-04/2007). These measured values were all very low with little to no fluctuation. A dramatic change is noticed in the May 2007 onward measured values, which exhibit results that align with expected pigment levels. It was ultimately discovered that the pre-May 2007 filters had been stored in 10% acetone prior to analysis, resulting in damaged samples and inaccurate measurements. Users of this data were notified of the update.

For 2002 we have an average precipitation of 641.37 mm at the JBNERR area. The highest precipitation was reported during June of 117.6 mm.

Rain Events:

January

| Date | RainAmount (mm) |
|---|---|
| 6 | .254 |
| 13 | .254 |
| 14 | .254 |
| 16 | .254 |
| 18 | .254 |
| 22 | 1.016 |
| 23 | .508 |
| 25 | 1.778 |
| 27 | .508 |
| 28 | 3.810 |
| 31 | .254 |

"Monthly Total" 9.1

February

| Date | RainAmount (mm) |
|---|---|
| 1 | 1.016 |
| 3 | 2.540 |
| 19 | .762 |
| 24 | 1.270 |

"Monthly Total" 5.6

March

| Date | RainAmount (mm) |
|---|---|
| 1 | 1.016 |
| 8 | .508 |
| 13 | .508 |
| 18 | .254 |
| 23 | 1.016 |
| 27 | 3.048 |
| 28 | 10.922 |
| 29 | 1.778 |
| 30 | 1.524 |

"Monthly Total" 20.6

April

| Date | RainAmount (mm) |
|---|---|
| 3 | 4.318 |
| 4 | 4.064 |
| 6 | 9.652 |
| 7 | 13.208 |
| 15 | 1.778 |
| 16 | 1.778 |
| 20 | 48.006 |
| 21 | 17.780 |

"Monthly Total" 100.6

May

| Date | RainAmount (mm) |
|---|---|
| 18 | 1.016 |
| 22 | .762 |
| 23 | .254 |
| 27 | 8.890 |
| 28 | 1.270 |
| 29 | 39.624 |
| 30 | 10.414 |
| 31 | 6.604 |

"Monthly Total" 68.8

June

| Date | RainAmount (mm) |
|---|---|
| 2 | 2.794 |
| 3 | 6.858 |
| 4 | 28.702 |
| 5 | 14.732 |
| 8 | .508 |
| 9 | .508 |
| 11 | 9.906 |
| 13 | 3.302 |
| 14 | .254 |
| 17 | 8.128 |
| 18 | 28.194 |
| 21 | 9.144 |
| 27 | 4.572 |

"Monthly Total" 117.6

July

| Date | RainAmount (mm) |
|---|---|
| 2 | .762 |
| 7 | 11.684 |
| 8 | .254 |
| 14 | 14.986 |
| 17 | .254 |
| 28 | .762 |
| 29 | .254 |

"Monthly Total" 29.0

August

| Date | Rainamount (mm) |
|---|---|
| 6 | 3.048 |
| 7 | .508 |
| 8 | 2.286 |
| 10 | .254 |
| 11 | 14.732 |
| 14 | .762 |
| 16 | 5.842 |
| 18 | .508 |
| 29 | 6.350 |
| 30 | 8.890 |
| 31 | 9.652 |

"Monthly Total" 52.8

September

| Date | RainAmount (mm) |
|---|---|
| 1 | 5.334 |
| 7 | 3.048 |
| 10 | .508 |
| 14 | .254 |
| 15 | 49.530 |
| 16 | 5.588 |
| 24 | 5.334 |
| 25 | 26.162 |
| 26 | .762 |
| 28 | .762 |
| 29 | 1.016 |
| 30 | 4.318 |

"Monthly Total" 102.6

October

| Date | Rainamount (mm) |
|---|---|
| 2 | 1.778 |
| 4 | 1.016 |
| 8 | 2.286 |
| 10 | 26.162 |
| 11 | 7.112 |
| 12 | .254 |
| 15 | .508 |
| 16 | .762 |
| 24 | 7.366 |
| 25 | .254 |
| 26 | 2.286 |
| 27 | .254 |
| 30 | .508 |
| 31 | 1.524 |

"Monthly Total" 52.1

November

| Date | Rainamount (mm) |
|---|---|
| 8 | .508 |
| 10 | 2.286 |
| 11 | 16.002 |
| 13 | 1.270 |
| 17 | 5.588 |
| 18 | .254 |
| 19 | .508 |
| 21 | .508 |
| 22 | 1.016 |
| 23 | 3.556 |
| 26 | .762 |

"Monthly Total" 32.3

December

| Date | RainAmount (mm) |
|---|---|
| 1 | 1.270 |
| 2 | 3.048 |
| 4 | .762 |
| 5 | 3.556 |

| | |
|---|---|
| 6 | .254 |
| 9 | 1.778 |
| 10 | 4.572 |
| 11 | 3.810 |
| 12 | 5.588 |
| 13 | .254 |
| 14 | .254 |
| 15 | 4.064 |
| 16 | 13.970 |
| 18 | 4.826 |
| 20 | .254 |
| 21 | .508 |
| 24 | 1.016 |
| 25 | .508 |

| | |
|---|---|
| "Monthly Total" | 50.3 |