Waquoit Bay NERR (WQB) Nutrient Metadata
(January 2003 to December 2003)
Latest Update January 6, 2012

I. Data Set and Research Descriptors

1) **Principal investigator(s) and contact persons** –

a) **Reserve Contact**

Jennifer DeAlteris
Research Assistant
Waquoit Bay NERR
149 Waquoit Hwy
East Falmouth, MA 02536
Phone: 508-457-0495 x124
Email: jennifer.dealteris@state.ma.us

b) **Laboratory Contact**

Gordon Wallace
Environmental, Coastal & Ocean Sciences
University of Massachusetts at Boston
100 Morrissey Blvd.
Boston, MA 02125
Phone: 617-287-7447
Email: gordon.wallace@umb.edu
Gordon's trace element lab is responsible for the nutrient analysis.

c) **Other Contacts and Programs**

Christopher R. Weidman
Research Coordinator
Waquoit Bay NERR
149 Waquoit Hwy
East Falmouth, MA 02536
Phone: 508-457-0495 x105
Email: chris.weidman@state.ma.us

2) **Research objectives**

The main purpose of the SWMP program is to aid Waquoit Bay NERR in one of its priority missions: to perform as a living laboratory and platform for coastal and estuarine research. The long term, continuous detailed monitoring of the estuary's basic hydrophysical, meteorological and chemical parameters are an essential tool and context for any research activities located here. Besides this overarching mission, there are also several specific research interests. One primary issue for the Waquoit Bay ecosystem is the influence of anthropogenic induced alterations by nitrogen enrichment. Waquoit Bay receives nitrogen from several sources, such as septic systems (their leachate percolates into groundwater which then enters the bay), run off from roads, run off containing domestic and agricultural fertilizer and animal waste, and atmospheric sources. This elevated nitrogen loading to the bay has resulted in enhanced eutrophication that has contributed to the alteration of the bay's habitats. For example, thick mats of seaweeds (macroalgae) now cover the bottom where eelgrass meadows thrived in the 1970's. Unfortunately, there are few definitive records of the bay's water quality conditions during that period, which makes it difficult to evaluate the rates of change. To facilitate future evaluation, long-term records from SWMP can be used to track water column conditions. Of obvious interest are measurements of dissolved nutrients in the bay's water column, as well as measurements of dissolved oxygen (DO), turbidity, and chlorophyll concentration. Such records will facilitate evaluation of changes which may come about from a continuation of watershed alteration that result from current development patterns (i.e., non-sewered residential areas served by private septic systems typically consisting of septic tanks and leach fields) as well as non-industrial commercial development, such as golf courses, cranberry bogs, and retail shopping outlets. The records will be useful for evaluating the efficacy of remediation efforts intended to reduce the nitrogen loading from these sources to Waquoit Bay.

Another focus of long-term research interest is the detection of climate change and the determination of its effects on the estuarine environment. Characterizing the variability of the various water column parameters, such as their scale, magnitude and frequency, is likely to be an important aspect of the estuarine ecosystem that may be sensitive to climate change. Related to this focus is an interest in the impact of storms (hurricanes and northeasters) and other extreme meteorological events on the estuary. For example, what temperature and wind field thresholds exist that might bring about or trigger certain conditions within the bay? The observations recorded by the SWMP will allow for these types of studies.

3) Research methods

a) Monthly Grab Sampling Program

Monthly grab samples are taken at the four principal SWMP data sonde stations in the Waquoit Bay watershed (Metoxit Point, Child's River, Menauhant and Sage Lot Pond). Grab samples are taken on the same day, collected between +3 hours before slack low-water and slack low-water. No distinction is made between neap and spring tide conditions. Efforts are made to collect samples at approximately monthly (30 day) intervals (roughly mid-month). Grab samples are reflective of the water mass sampled by the water quality data sonde, at depths approximately 0.5 m above the bottom. In 2003, during the second year of operation, grab samples were collected as replicates (two samples from a single water sample) only in the first month of January, after which we changed methods to be properly in accord with SWMP nutrient sampling protocols. No samples were taken in February due to severe winter conditions and ice over. For the remainder of the year (March-December) following SWMP protocol, two sequential grab samples (in immediate sequence – 1-3 minute interval between samples) were obtained at each site. This resulted in a total of eight grab samples from 4 sites. At the time of sample collection, water temperature, salinity, pH and dissolved oxygen were also measured with an YSI 650. All samples are collected in amber, wide-mouth, Nalgene 500mL sample bottles that were precleaned with 10% HCL and rinsed 3 times with distilled water. Samples are collected using a 1L van Doren sampler and rinsing the sample bottle 3 times with ambient water prior to collection of the sample. Samples are immediately returned to the lab (within one hour) to be filtered for nutrients and chlorophyll, and frozen (-20° C). In 2003, the frozen nutrient samples were delivered the to the trace element laboratory at UMass Boston within 1-7 days for analysis.

b) Diel Sampling Program

Diel grab samples are taken at the Child's River long-term SWMP water quality data sonde station. Diel sampling occurred during any tidal conditions (no distinction was made between neap and spring tide conditions). Twelve samples were collected over a lunar day (24hr: 45min) time period at 2.25 hour intervals using ISCO auto-samplers. Efforts were made to collect samples at approximately monthly (30 day) intervals (roughly mid-month) and within one day (usually overlapping) of grab sampling (described above). Sampling depth of the ISCO ranges between 0.5 to 1.2 meters depending on the tidal stage; it's height is fixed from the bottom at 0.4 meters, where the YSI data sonde sensors sample. Samples are collected in 1000mL clear polypropylene bottles (kept dark inside the ISCO until returning to the lab) that were precleaned with 10% HCl and rinsed 3 times with distilled water. Due to the use of ISCO auto samplers, ambient water rinses prior to sample collection is not possible. During the summer months ice is added inside the ISCO sampler in an effort to decrease sample alteration by providing cold storage. All samples are filtered for nutrients and chlorophyll once the ISCO has completed the sampling cycle. The frozen nutrient samples (-20° C) are delivered to the trace metal element lab at UMass Boston for analysis within 1-7 days.

4) **Site location and character**

a) General description of Waquoit Bay estuarine system:

The Waquoit Bay National Estuarine Research Reserve (WBNERR) is located in the northeastern United States on the southern coast of Cape Cod, Massachusetts. About 8,000 people maintain permanent residency in Waquoit Bay's drainage area, which covers parts of the towns of Falmouth, Mashpee, and Sandwich. During summer months, the population swells 2-3 times with the greatest housing concentrations immediate to the coastline (water views and frontage). In addition, the upper portions of the watershed include a military base, Otis Air Force Base and the Massachusetts Military Reservation, portions of which have been designated by the EPA as Superfund sites due to past practices of dumping jet fuel and other volatile groundwater contaminants.

WBNERR's estuaries are representative of shallow tidal lagoons that occur from Cape Cod to Sandy Hook, New Jersey. WBNERR is within the northern edge of the Virginian biogeographic province, on the transitional border (Cape Cod) with the Acadian biogeographic province to the north and east. Like many embayments located on glacial outwash plains, Waquoit Bay is shallow (< 5 m), fronted by prominent barrier beaches (i.e., those of South Cape Beach State Park and Washburn Island), and is backed by salt marshes and upland coastal forests of scrub pine and oak. Two narrow, navigable inlets, reinforced with granite jetties, pass through two barrier beaches to connect Waquoit Bay with Vineyard Sound to the south. A third shallow and generally un-navigable inlet opened through the Washburn Island barrier beach during Hurricane Bob in August 1991, finally closed up in February 2002.

b) The Metoxit Point station (MP) (41^{o} 34.131' N 070^{o} 31.294' W, 2.2 m deep) is located in the main basin of Waquoit Bay and was selected to be within or near the outer regions of the gyre (described above) and more or less represents "typical" water mass conditions and residence times for the bay. The location is at least a half mile from shore, well flushed by tides, and is in an area that is minimally disturbed by routine activities on the bay (e.g. boat traffic, shell fishing, etc.). Bottom sediments at the site are organic rich muds overlain by thick algal mats. Because of this site's fairly open exposure to south (greatest fetch over the bay), we have observed that when sustained southerly winds are greater than about 20 kts, the Metoxit Point site experiences increased turbidity (sediment suspension event). A mean tidal range of 0.46m (SD = 0.17) is calculated based on one month of data (May 2003), with a minimum of 0.13 m and a maximum of 0.91 m. Mean monthly salinity range for 2002 is 4.2 ppt from a mean monthly minimum of 27.8 ppt to 32.0 ppt.

c) The Menauhant station (MH) (41^{o} 33.156' N 070^{o} 32.912' W, 1.2 m deep) is located within the Eel Pond Inlet at the Menauhant Yacht Club dock. Eel Pond Inlet is the westernmost of the two main tidal inlets into the Waquoit Bay system. The site was chosen because it occupies one of the strategic locations for gauging the system's water mass characteristics. Entering waters represent the marine end-member while outflows represent the final product of estuarine water mass modification and export to shelf waters. The site also has easy walk-in access to a secure private pier that extends into the throat of the inlet. Also, because of the turbulent tidal flow within the inlet, conditions are vertically well mixed, and the site can be maintained year round even through ice-over conditions in the rest of the bay. Bottom sediments at this site are clean sands and gravels with almost no attached bottom vegetation. Since inception, we have noted that strong south to southeast (onshore) winds tend to produce turbidity events at this site from the wave induced suspension of fine sediments and organic material in the upstream near-shore zone. While we have found that these types of turbidity events are localized to windward near-shore areas in the bay, the transport of these sediments

at inlet mouths during such times is perhaps a dominant sedimentation process within the estuarine system. In other words while the choice of our location may be producing a localized signal in one of our measured parameters that signal may reflect key processes in the system at large. A mean tidal range of 0.48m (SD = 0.19) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.99 m. Mean monthly salinity range for 2002 is 3.9 ppt from a mean monthly minimum of 28.5 ppt to 32.4 ppt.

d) The Child's River station (CR) (41° 34.793' N 070° 31.854' W, 1.2 m deep) is located on a dock piling at Edwards Boat Yard, a commercial marina near the upper tidal reaches of Child's River— the second largest input of surface freshwater to the bay. It runs through densely developed residential areas. The Childs River sub-watershed receives the highest nitrogen loading and is the largest nitrogen contributor to the Waquoit Bay system of all the sub-watersheds. In the upper tidal portions of the river we have consistently recorded the highest chlorophyll levels and the lowest dissolved oxygen readings of any region in the bay and so this location represents an end-member for looking at anthropogenic inputs and impacts on the system. This location is very strongly stratified, characterized by a salt wedge with fresher river water overlying saline ocean water. Vertical salinity ranges can run from 0-10 ppm at the surface to more than 30 ppm just 1 m below. The sonde sensors are usually well within the salt wedge portion of the water column, nonetheless this location is also our freshest SWMP site, and is at the opposite end of Child's River from the seaward Menauhant station. Bottom sediments are fine organic rich muds. This location represents the most terrigenously and anthropogenically-impacted SWMP site. Monthly water quality, collected near this location for the past decade, shows very high chlorophyll concentrations during the warmer months and more recent dissolved nutrient records show very high nutrient-loads. Boat traffic at the marina likely leads to increased turbidity during the boating season as well. As this site is dockside at a private marina, general security is high along with easy access. The station is also serviceable year-round and usually not subject to seasonal shutdown due to ice over. A mean tidal range of 0.46 m (SD = 0.17) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.95 m. Mean monthly salinity range for 2002 is 14.7 ppt from a mean monthly minimum of 15.8 ppt to 30.5 ppt.

e) The Sage Lot station (SL) (41° 33.254' N 070° 30.612' W, 1.2 m deep) is located in deeper portion of Sage Lot Pond – a small sub-estuary of Waquoit Bay (20 ha) surrounded by salt marsh and barrier beach. Its small watershed is the least developed of all of Waquoit Bay's sub-watersheds and Sage Lot Pond is considered to be its least impacted and most pristine sub-estuary. Bottom sediments are organic rich muds. Sage Lot Pond possesses one of the few remaining eelgrass beds in the Waquoit Bay system. Indeed the Child's River and Sage Lot Pond sites are considered to represent opposite end-members of nutrient-loading and human-induced influence. Researchers often locate their experiments in these two locations to take advantage of this difference. However, Sage Lot Pond is hydrologically connected to an upstream brackish source -- Flat Pond – via a series of tidal creeks, drainage ditches and culverts. Flat Pond borders a country club and golf course and some concern exists for its impact on the water quality of Sage Lot Pond. A mean tidal range of 0.40m (SD = 0.14) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.67 m. Mean monthly salinity range for 2002 is 4.9 ppt from a mean monthly minimum of 27.2 ppt to 32.1 ppt.

5) **Code Variable Definitions**

Wqbcrnut – Waquoit Bay NERR Child's River nutrients
Wqbmhnut – Waquoit Bay NERR Menauhant Yacht Club nutrients
Wqbmpnut – Waquoit Bay NERR Metoxit Point nutrients
Wqbslnut – Waquoit Bay NERR Sage Lot Pond nutrients
1– grab sample (collected with van Doren sampler)
2 – diel sample (collected with ISCO)

6) **Data collection period**

Diel Sampling:

Site	Start Date	Start Time	End Date	End Time
CR	1/14/03	10:40	1/15/03	11:25
CR	3/11/03	9:42	3/12/03	10:27
CR	4/22/03	9:49	4/23/03	10:34
CR	5/20/03	9:09	5/21/03	9:54
CR	6/19/03	9:11	6/20/03	9:56
CR	7/15/03	8:44	7/16/03	9:29
CR	8/18/03	8:42	8/19/03	9:27
CR	9/16/03	8:48	9/17/03	9:33
CR	10/16/03	8:07	10/17/03	8:52
CR	11/17/03	9:58	11/18/03	10:43
CR	12/16/03	9:28	12/17/03	10:13

Grab Sampling:

Sage Lot Pond

Site	Start Date	Start Time	End Date	End Time
SL	4/23/03	8:40	4/23/03	8:45
SL	5/21/03	8:40	5/21/03	8:45
SL	6/20/03	9:00	6/20/03	9:05
SL	7/16/03	8:50	7/16/03	8:55
SL	8/19/03	9:30	8/19/03	9:35
SL	9/17/03	9:40	9/17/03	9:45
SL	10/17/03	9:40	10/17/03	9:45
SL	11/18/03	10:20	11/18/03	10:25

Metoxit Point

Site	Start Date	Start Time	End Date	End Time
MP	4/23/03	9:40	4/23/03	9:45
MP	5/21/03	9:40	5/21/03	9:45
MP	6/20/03	9:46	6/20/03	9:51
MP	7/16/03	9:53	7/16/03	9:58
MP	8/19/03	8:30	8/19/03	8:35
MP	9/17/03	8:30	9/17/03	8:35
MP	10/17/03	10:20	10/17/03	10:25
MP	11/18/03	9:25	11/18/03	9:30
MP	12/17/03	10:15	12/17/03	10:20

Child's River

Site	Start Date	Start Time	End Date	End Time
CR	1/15/03	12:56	1/15/03	13:01
CR	3/12/03	10:35	3/12/03	10:40
CR	4/23/03	10:25	4/23/03	10:30
CR	5/21/03	11:05	5/21/03	11:10

CR	6/20/03	10:50	6/20/03	10:55
CR	7/16/03	11:05	7/16/03	11:10
CR	8/19/03	10:30	8/19/03	10:35
CR	9/17/03	11:05	9/17/03	11:10
CR	10/17/03	11:10	10/17/03	11:15
CR	11/18/03	11:25	11/18/03	11:30
CR	12/17/03	11:12	12/17/03	11:17

Menauhant

Site	Start Date	Start Time	End Date	End Time
MH	1/15/03	11:36	1/15/03	11:41
MH	3/12/03	10:10	3/12/03	10:15
MH	4/23/03	10:10	4/23/03	10:15
MH	5/21/03	10:30	5/21/03	10:35
MH	6/20/03	10:30	6/20/03	10:35
MH	7/16/03	10:40	7/16/03	10:45
MH	8/19/03	10:15	8/19/03	10:20
MH	9/17/03	10:45	9/17/03	10:50
MH	10/17/03	10:50	10/17/03	10:55
MH	11/18/03	11:05	11/18/03	11:10
MH	12/17/03	10:56	12/17/03	11:01

7) **Associated researchers and projects**

a) SWMP Water Quality Monitoring data
In order to understand long-term changes in water quality, YSI 6600UPG data loggers are deployed. Measurements of dissolved oxygen, salinity, temperature, pH, depth and turbidity are taken every 30 minutes, continuously at each of the 4 sites. The data collected provides background data for other research about the ecology of these habitats. Visit http://cdmo.baruch.sc.edu/ if you are interested in the data.

b) Bay Watchers
Bay Watchers is a Citizen Water Quality Monitoring group based in Waquoit Bay. Volunteers measure for dissolved oxygen concentration, salinity, temperature (air and water), water clarity (using secchi depth), chlorophyll-a and nutrients at 7 sites throughout the Reserve. Visit http://www.waquoitbayreserve.org/baywatch.htm to view the data.

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.

9) **Entry verification** –

The nutrient data is imported directly from the instrument into an excel file. Therefore, it is not possible for human error to occur during data entry. The data is then checked over by Gordon Wallace at the UMASS lab before being sent to WQB as an excel spreadsheet. The data units are converted to mg/L from uM/L by WQB's lab technician Jennifer DeAlteris. She also checked the chlorophyll and field parameters 100% against the field notebooks and data sheets.

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
	Total Dissolved Nitrogen	TDN	mg/L as N
	Dissolved Organic Nitrogen	DON	mg/L as N
	Particulate Organic Nitrogen	PON	mg/L as N
	Total Nitrogen	TN	mg/L as N
Carbon:	Particulate Organic Carbon	POC	mg/L as C
Other Lab Parameters:			
	Chlorophyll a	CHLA	µg/L
	Phaeophytin	PHEA	µg/L
	Silicate	SiO4F	mg/L as Si
Field Parameters:			
	Dissolved Oxygen	DO_N	mg/L

%Dissolved Oxygen Saturation	DO_S_N	%
pH	PH_N	standard units
Salinity	SALT_N	ppt
Water Temperature	WTEM_N	°C

Notes:
1. Time is coded based on a 2400 hour clock and all times are changed to Eastern Standard Time (EST).
2. Waquoit Bay Reserve was measured NO2 until July 2003 after one year of monthly measurements, when it was determined that NO2 was usually an insignificant component of DIN. Since July 2003 NO23 and NH4 were the only measured DIN species.
3. PON/POC began to be measured in April 2003, allowing calculation of TN.

11) **Measured and Calculated Laboratory Parameters –**

i) **Variables Measured Directly**

Nitrogen species:	NO2F, NO23F, NH4F, TDN, PON
Carbon species:	POC
Phosphorus species:	PO4F
Other:	CHLA, PHAE, SiO4F

ii) **Computed Variables**

NO3:	NO23F-NO2F
DIN:	NO23F+NH4F
DON:	TDN-NH4F-NO23F
TN:	TDN+PON
DIP:	PO4F

12) **Limits of Detection**

Table 1. **Method Detection Limits** (MDL) for measured water quality parameters for each sample month's nutrient analysis

	NO2 F (mg/L)	NO23 F (mg/L)	NH4 F (mg/L)	PO4 F (mg/L)	TDN (mg/L)	PON / POC mg on filter
January 2003	0.006	0.001	0.003	0.006 (P flag) 0.003 (R flag)	0.059	NA
March 2003	0.006	0.005 0.001 (R flag)	0.002	0.001	0.059	NA
April 2003	0.002	0.000	0.003	0.007	0.059	Note B
May 2003	0.002	0.001	0.004	0.007	0.059	" "
June 2003	0.003	0.001		0.009	0.059	" "
July 2003		0.003	0.001	0.001	0.059	" "
August 2003		0.001	0.001	0.001	0.059	" "
September 2003		0.002	0.003	0.001	0.059	" "
October 2003		0.001	0.001	0.001	0.059	" "
November 2003		0.001 0.001 (R flag)	0.001	0.002 0.005 (R flag)	0.059	" "
December 2003		0.001	0.001	0.005	0.059	" "

Note A: At UMass Boston's Trace Element Facility, the limit of detection (LOD) for each run is determined as 3σ of the reagent blank or 3σ of the instrument noise, whichever is greater. Values below the LOD for any given run are identified in the data report as such.

Note B: For the POC and PON data, the Limit of Detection is expressed as mg of Nitrogen or Carbon on the filter which is calculated from 3*blank standard deviation. The blanks are from our lab, deionized water processed just as if it were a sample. The LOD for POC is 0.025mg and the LOD for PON is 0.010 mg. The LOD is the same for all the 2003 data because it is using all the 2003 blanks collected. Please contact Gordon Wallace for further explanation.

13) **Laboratory Methods**

i) **Parameter: NH4F**
UMass Boston Laboratory SOP # Nut_03
See Appendix A

ii) **Parameter: NO23F (and NO2F)**
UMass Boston Laboratory SOP # Nut_02
See Appendix B

iii) **Parameter: PO4F**
UMass Boston Laboratory SOP # Nut_04
See Appendix C

iv) **Parameter: TDN**
UMass Boston Laboratory
See Appendix D

v) **Parameter: POC/PON**
UMass Boston Laboratory
See Appendix E

vi) **Parameter: Silicate**
Waquoit Bay NERR Laboratory
See Appendix F

vii) **Parameter: Chlorophyll *a* and Phaeophytin**
Waquoit Bay NERR Laboratory
See Appendix G

14) **Reporting of Missing Data, Data with Concentrations Lower than Method Detection Limits *etc***

Missing Data:

There were quite a few samples that were lost after delivery to the lab. All samples that are coded "M" for missing are due to lost samples at the UMASS Laboratory.

January 2003:

No grab samples were collected from Sage Lot and Metoxit Point in January due complete ice over and removal of water quality instrumentation from these water access only sites.

February 2003:

No samples were collected this month due to severe winter conditions (heavy snow and extreme cold) and complete ice over of the estuary.

March 2003:

On 3/12 grab samples from Childs River were deleted due to high NO23 values. Parameters deleted were NO3, NO23, DIN, and DON.

No grab samples were collected from Sage Lot and Metoxit Point in March due ice over and removal of water quality instrumentation from these water access only sites. Ice broke up on the bay finally on March 21.

April 2003:

On 4/23 grab sample data were deleted from Childs River the lab suspected POC and PON values to be "bad". Parameters deleted were PON, TN and POC.

No NO23 data from wqbcrnut D#2 this month. Sample lost at UMASS analytical lab presumably.

May 2003:

No NO2 data from wqbcrnut D#2 and wqbcrnut grab A this month. Samples lost at UMASS analytical lab presumably.

July 2003:

NO2 analysis discontinued after one year of measurements. Determined to be insignificant component of DIN.

December 2003:

No grab samples were collected from Sage Lot in December due ice over in early December and removal of water quality instrumentation from this water access only site.

No TDN data from wqbcrnut D#2 this month. Sample lost at UMASS analytical lab presumably.

Missing and below MDL data:

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 –**

.

a) **Precision –**

i) **Field Variability** – WQBNERR collects two successive grab samples for the monthly grab sample program.

ii) **Laboratory Variability** – The UMass laboratory analyzed replicates on 14% of our samples.

iii) **Inter-organizational splits** – none.

b) **Accuracy –**

i) **Sample Spikes** – see lab protocols

ii) **Standard Reference Material Analysis –** see lab protocols

iii) **Cross Calibration Exercises** – September 2003-NERRs-wide inter-lab reference comparison.

16) **Other Remarks**

Date	Rainfall (mm):
January 2003	
1	12.446
2	9.144
3	26.416
4	22.606
6	.762
7	5.842
8	2.794
9	3.048
10	.508
30	2.794
31	.508
Monthly Total	86.9
February 2003	
1	14.224
2	.254
7	.254
8	.508
10	.254
11	.508
2	5.842
4	4.826
18	1.270
19	9.398
20	4.572
22	47.244
23	29.210
Monthly Total	118.4
March 2003	
2	35.052
3	.254
5	4.572
6	.254
7	2.286
8	2.286
14	11.430
15	3.302
16	.254
18	.254
21	32.258
22	.254
23	.254
27	2.032

29	1.016
30	90.170
31	7.112

Monthly Total 193.0

April 2003

1	.762
2	1.778
3	.254
4	5.080
22	12.192
24	.254
26	16.002
27	.508
29	1.270

Monthly Total 38.1

May 2003

1	.254
6	2.540
7	.254
8	2.286
12	1.270
13	.254
14	.254
15	.254
21	3.556
22	8.128
23	12.446
24	15.494
25	3.048
26	15.494
27	.508
31	6.858

Monthly Total 72.9

June 2003

1	58.674
4	16.256
5	18.796
6	.254
7	13.716
12	4.826
13	5.334
14	7.112
18	4.064
19	3.556
21	2.286

22	21.590
23	.508
24	.254

Monthly Total 157.2

July 2003

9	.762
11	.762
15	.254
18	.508
19	2.032
24	18.288
3	5.080

Monthly Total 27.7

August 2003

1	6.604
2	9.906
5	16.510
6	.254
7	34.544
8	7.620
9	7.874
10	1.270
11	9.398
12	.508
16	37.846
17	22.352

Monthly Total 154.7

September 2003

2	32.512
3	.254
4	30.734
5	3.556
7	.254
9	.254
10	.254
12	.254
16	2.794
21	.254
23	13.716
25	.254
27	.254
28	.254

Monthly Total 85.6

October 2003

1	.254
2	9.398
4	2.032
6	.254
10	.254
11	.254
12	23.114
13	.254
15	29.972
17	.254
18	5.080
19	9.144
20	.254
21	2.794
22	.762
27	21.844
28	5.080
29	27.178

Monthly Total 138.2

However, owing to large gaps in data for these two months, precipitation data reported below are taken from a nearby Precipitation station several kilometers west of the Reserve at Long Pond Reservoir maintained by the Town of Falmouth

November 2003

4	.25
5	18.80
6	7.11
11	4.06
12	3.56
19	7.11
20	18.80
24	3.81
28	9.40

Monthly Total 72.88

December 2003

6	132.08
7	19.05
11	10.92
14	51.56
17	8.64
28	8.64

Monthly Total 230.83