APPENDICES

APPENDIX A

Lake Attitash 2011 Sampling

&

Analysis Plan

Title and Approval Page

Sampling and Analysis Plan (SAP)
for
Lake Attitash - Merrimac/Amesbury, MA

February 8, 2011

U.S. ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND REGIONAL LABORATORY
OFFICE OF ENVIRONMENTAL MEASUREMENT & EVALUATION
11 TECHNOLOGY DRIVE
NORTH CHELMSFORD, MASSACHUSETTS 01863

Title and Approval Page:

______________________________ Date: 2/8/2011
Hilary Snook, EMT Project Manager

______________________________ Date: 2/9/2011
Diane Switzer, EMT Team Leader

______________________________ Date: 2/10/2011
Dan Boudreau, OEME Chemistry Laboratory

1. Introduction

This site specific Sample Analysis Plan (SAP) was written in conjunction with the EMT Generic Quality Assurance Project Plan (QAPP), 5/10. The general project goals, procedures, and quality control criteria for this SAP are included in the generic QAPP. This SAP includes any additional site specific information not included in the generic QAPP along with a site map, sample locations, the number and type of samples to be collected including the quality control samples, the project manager and sampling team members, and any other pertinent information related to this project.

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2. Background

Lake Attitash is a 360 acre "great pond" located equally within the towns of Amesbury and Merrimac, Massachusetts. The pond is less than a mile across at its longest point, has a maximum depth of thirty-two feet and an average depth of ten feet. Bottom composition is predominantly organic muck overlain by submergent, emergent, and floating aquatic plants and underlain by coarse sands and gravel. Surrounding land use is comprised of dense residential along most of the shoreline on a topography that is dominated by very steep hilly terrain, with the exception of the Southwest and Northwest quadrants of the lake. Non-residential use directly adjacent to the lake consists of a boy's camp on the South side of the lake, the town of Merrimac municipal drinking water filtration plant, located in the Southwest quadrant of the lake, and an agricultural composting facility in the northwest quadrant located directly adjacent to the main inlet tributary to the lake. The western half of the lake is a mixed land use of residential development dominated by elevated sandy shore lands and two significant wetland areas.

The only substantial surface inflow to lake Attitash is a small feeder stream called the Back River, located in the Northwest section of the lake. A small wetland in the Southwest corner of the lake provides some minor inflow into the lake and another small wetland on the eastern side of the lake provides minor inflow via drainage pipe connections from the wetland to the lake. This is believed to be during spring and wet weather periods only. Other sources of water to the lake are through groundwater fed springs, and stormwater surface runoff from the landscape.

Outflow from the lake is through the Birches Dam, constructed in 1712 to regulate and hold back flows for mill operations at the time. The dam has raised the water level three feet from its natural level. From the Birches Dam, water flows through a broad and shallow intentionally ponded meadow area known as meadow brook. From the outlet of Meadow Brook water flows into Tuxbury Pond, where it is joined by the Powow River from the North. Water flows through the pond to an outlet control structure in the Southeast corner of Tuxbury pond, held back for public water supply and flood control, and from there continues through the town of Amesbury where it meets its confluence with the Merrimack River. The Amesbury public drinking water supply intake is just downstream of Tuxbury Pond and is a surface raw water intake prior to filtration and treatment. The lake is subject to high residential pressure from year-round and seasonal residences and the related extensive impervious paved surfaces surrounding the majority of the lake perimeter. Numerous storm drains are located around the lake with direct discharges into the water body. This infrastructure is located in areas of dense urban development in conjunction with extremely hilly terrain, providing likely sources of high pollutant and nutrient rich urban runoff. In the early 1980's residential septic systems were discontinued and all residences were connected to town sewer systems. Agricultural activities directly adjacent to the lake's main tributary inlet stream are potentially subjecting the lake to excessive nutrient loading due to runoff from agricultural activities. The farm has several subsurface tile drains which are used to drain the fields and these directly discharge into the main tributary stream feeding the lake. The farm operates partly as a composting facility and stockpiles windrows of composting material within close proximity of the inlet stream to the lake. Data from previous studies in 1977-78 and 1994-98 reported elevated levels of phosphorous and nitrogen from sites located downstream of this facility. High recreational pressure comes from the use of the lake for boating, water skiing, fishing and swimming. The Town of Amesbury operates a swimming beach on the eastern shore of the lake. A summer camp is also operated on the southeastern shore with an emphasis on water skiing, sailing and swimming. Public access to the lake is provided by a single lane paved boat ramp with parking for approximately twenty vehicles with trailers. The town of Merrimac has a public water supply well field and small green sand filtration plant adjacent to a small wetland that links to the lake via a small inlet in the southwest section of the lake. A town sewer line also crosses through this wetland area to service residents along this section of the lake. Previous monitoring efforts have revealed intermittent highly elevated phosphorus loads coming in to the lake from this inlet.

Lake Attitash has undergone a transformation typical for most urban lakes. Historically, the lake shoreline was sparsely settled and dwellings were predominantly used as a vacation and summer getaways. The infrastructure was comprised of groundwater wells or direct lake withdrawals, and waste was handled through on site septic systems. Residences around the lake went from seasonal use to permanent year round dwellings. In the early 1980's all residences around the lake were finally hooked into town sewer systems and most residences hooked into public water supply distribution lines. Lake Attitash has become a eutrophic lake and experiences seasonally hyper-eutrophic conditions. This lake has experienced a steady decline in water quality from the 1970's, classified as mesotrophic after the first water quality study, and declining since with regard to benchmark parameters of secchi disk transparency, chlorophyll-a, and phosphorous concentrations. In the summer months heavy macrophyte cover occurs to nuisance levels and has been documented and mapped in all areas of the lake. Invasive plant species of Water Chestnut and Eurasian Milfoil have been observed in several locations at density levels of concern. The State put in a public boat launch and parking facility significantly adding to the public use of the lake and increasing the risk of exotic and nuisance plant proliferation. Public use pressure is high, Lake Attitash being one of the only publically accessible water bodies in the Northeast corner of Massachusetts. The lake receives year round use from fishing, sailing, swimming, and water skiing in the summer to ice fishing, snowmobiling and ice boating in the winter. The lake is also known as a depositional mercury "hotspot" from local and regional industrial sources. Fish tissue surveys conducted in the past by Massachusetts Department of Environmental Protection (MADEP) had revealed mercury tissue concentrations above state and federal advisory levels.

The first known water quality report on the lake was completed by the Massachusetts Department of Environmental Protection (MADEP) in 1977. Findings listed the lake as a mesotrophic system with good water quality and reasonably good clarity. Subsequent studies were done in 1994 by the Lake Attitash Association (LAA), concluding that water quality appeared to be declining since the 1977

MADEP report. This report identified potential sources of elevated nutrients emanating from the Back River area and the wetland located in the Southwest quadrant of the lake. A watershed management plan was developed by Camp Dresser and McKee (CDM) in 1999, adding to the conclusions and recommendations from the earlier LAA water quality report. In 2002, a grant was given to the Town of Amesbury by the Massachusetts Department of Conservation and Recreation (DCR) Lakes & Ponds Program to implement some recommendations from the CDM Lake Attitash Watershed Management Plan. Implementation measures included:

- Grass lined swale installation with sediment forebay
- Siltation curtain barrier for the Back River sediment control
- Install new storm drain infrastructure
- Install culvert flap gates and implement wetland restoration
- Install stormwater wetlands, remove phragmites
- Develop QAPP and implement water quality monitoring
- Replace catch basins
- Prepare quarterly progress reports and final report

Many of the above action items have been implemented, with the exception of wetlands restoration, phragmites removal, and a focused water quality monitoring effort. The Lake Attitash Association has been routinely monitoring water quality of the lake in order to track trends and provide educational outreach to the lake shore community as the resource dollars are available. General perceptions based on monitoring efforts indicate that the water quality is getting worse.

Problem statement

Lake Attitash is a surface water body that is presently becoming increasingly nutrient enriched and declining in water quality. Water quality sampling in areas perceived to be contributing pollutants to the lake have sporadically revealed elevated nutrient concentrations, but most sampling efforts did not point to a single or consistent source of nutrient loading to the lake. A local farm adjacent to the single tributary stream to the lake is perceived as a large pollutant source to the lake, but this has never been verified through consistent and temporally targeted sampling efforts. Historical sampling above and below the farm has not revealed any large nutrient influxes to the system. The farm presently has a tile drainage system that drains its fields through several laterals connecting to a main pipe that discharges through a three foot culvert directly into the tributary stream/wetland to the lake. This wetland has been historically trenched to dewater the wetland and is trenched all the way to the open water of the lake. Although sampling around the farm has not revealed many highly elevated nutrient loadings, it is highly suspect that the timing of the sampling effort may have been off and missed the pulse of nutrients coming off the landscape into the lake. Tile drain nutrient fluxes are extremely temporal, based on literature and work done on agricultural tile drain fields in Ohio and southern Ontario.

A small wetland adjacent to the lake in the southwest end has shown elevated phosphorus loading to the lake in the past. This has usually been coincidental with high rain events and it is suspect that a local sewer line which runs through/adjacent to the wetland may be a contributing nutrient source via sewer line exfiltration during wet weather events. Adjacent to the same wetland complex is a public water supply that filters water via green sand filtration. It is questioned that this may also be a potential source for nutrients if the filtration process backflushes into the adjacent wetland which is connected to the lake.

The southeast and northeast shores of Lake Attitash are surrounded by hilly terrain and are densely populated. The dense residential land use provides a considerable percentage of impervious surfaces for snow melt and rainfall runoff to collect nutrients which are transferred via the storm drain system to the lake. Catch basins surround the lake and provide capture of coarse particulates, but soluble nutrients are directly imported to the lake system via catch basin outlets piped directly to the lake and are readily available to nuisance aquatic plants and algae. The nutrient loading to the lake through the storm drain network has not been quantified and is a perceived as a primary source of loading to the lake.

Lake Attitash is a relatively shallow lake that has one primary inlet stream, the Back River, and one outlet, the Birches Dam. The Back River and the Birches Dam are in very close proximity to one another and it is perceived that flow from the inlet stream may not flow through the major portion of the lake. If this is indeed the case, deep water within the lake may remain stagnant with development of an anoxic layer that releases phosphorus and other nutrients from the sediments during the warmer summer months, creating large and potentially dangerous algal blooms.

Anticipated Project Actions

1. Dye study to determine flow patterns in the lake.
2. Temp transects to determine spring influxes into Lake Attitash.
3. SRP at major inlets, Sargent's farm, catch basins, and SE inlet
4. Sediment samples to look at TP levels through sediment core
5. Soil phosphorus and soil nitrogen adjacent to the Back River and composting windrows.

3. Project Description/Objective

Despite good faith sampling efforts by many parties, the identification and quantification of sources of impairment within and outside Lake Attitash has been elusive. Sampling events have either been too infrequent due to budget constraints, or have not been targeted temporally or spatially to capture the suspected sources during periods when they are contributing (i.e. spring thaws, storm events). The primary objective of this effort is to quantify the in lake and watershed nutrient contributions causing impairment and degradation, determine their sources, loading and frequency, and establish a nutrient budget for the lake and recommend appropriate best management practices to mitigate the sources. This objective will entail the collection of water samples during spring runoff, wet weather events and background dry weather periods. A small number of soil and lake sediment samples will be taken and flow measurements at significant lake tributaries and the outlet dam will be conducted. Dye tracer studies will be implemented to track and understand the water flow through the system.

The target compounds to be sampled through this effort are nutrients, principally phosphorus and nitrogen in its various forms. Phosphorus is well known as the limiting nutrient in lakes and small influxes beyond natural background level contributions can significantly impair lake water quality. Highly elevated levels can result in blue green algal blooms that can harbor toxic cyanobacteria. The Amesbury public water supply could potentially be at risk from cyanobacteria from Lake Attitash. Cyanobacteria toxins are not affected or filtered out by conventional water treatment methods. These potent toxins present a human and animal health risk from direct and indirect exposures. Certain strains are potent neuro and hepato-toxins and have been responsible for hundreds of deaths among people and animals worldwide. In the summer of 2009, Lake Attitash had a nine week recreational advisory imposed against physical contact between humans/pets from the Massachusetts Department of Public Health (MADPH). This advisory was issued after detection of cyanobacteria in the lake water was in excess of 300,000 cells/ml. The MADPH utilizes the World Health Organization's risk threshold of 70,000 cells/ml as a trigger point for issuing advisories.

The objectives of this project are to determine and quantify the major sources of nutrient inputs into Lake Attitash and determine the flow of nutrients within the lake. This information will be used to formulate a watershed management plan which will include a nutrient budget for the lake that accounts for internal and external sources of nutrient loading. This monitoring information will be utilized to make decisions on the most appropriate best management practices for the water body. A rating curve will be developed from flow monitoring of the Birches Dam outlet. This flow data will be used to determine the flushing rate of the lake and the ability of the lake to either sequester nutrients in the sediment, or allow nutrients to pass through the lake into Tuxbury Pond and eventually the Powwow River. Of particular concern is the farming operation adjacent to the major tributary to the lake, non-point storm water sources, the small inlet in the southwest section of the lake, and the lake sediments.

Total phosphorus (TP) concentrations in lake water above 10ug/L can lead to increased algal growth, and concentrations from 25ug/l and above can lead to nuisance algal blooms, degraded water quality conditions, and potential Harmful Algal Blooms (HABS) of cyanobacteria. Total phosphorus is used to measure lake water quality rather than other phosphorus species primarily for practical reasons. Phosphorus cycles between living and non living forms and dissolved and particulate fractions depending on time of year and location within the lake system. Any concentrations of total phosphorus entering the water body above 15ug/L would be cause for concern. Soil phosphorus levels will also be important to quantify in order to determine if phosphorus is in excess of what plants can effectively uptake, leaving the remainder to potentially runoff and contribute to nutrient enrichment of the lake.

An important species of phosphorus for Lake Attitash in addition to total phosphorus is Soluble Reactive Phosphorus (SRP), also commonly labeled ortho-phosphate (oP). SRP is an important analytical parameter as it represents a labile form that is readily accessible for plant uptake and can easily be transported off of the terrestrial landscape via surface runoff or subsurface flow. In many agricultural practices, application of phosphorus to crop soils builds up within the soil matrix to levels far beyond crop needs. Soil phosphorus levels critical for plant growth is usually an order of magnitude greater than concentration levels that will accelerate eutrophication in lakes and other surface water bodies. This is an important concern based on the agricultural practices taking place adjacent to the main tributary stream to Lake Attitash. Values above 15ug/L could be a cause for concern.

Nitrogen is another important nutrient effecting lake water quality and plant growth. Total Kjeldahl Nitrogen (TKN) is a measure of the organic nitrogen and inorganic components such as nitrite and nitrate, and summed to get a calculated value for total nitrogen. Spring values above 300 ug/L of TKN can support summer algae blooms. Ratios of nitrogen to phosphorus less than 10:1 (N:P) will cause algal growth if nitrogen inputs enter the lake (nitrogen limited), N:P ratios of 15:1 will cause algal growth when phosphorus enters the waterbody (phosphorus limited). Excessive nitrogen inputs are often linked to agricultural practices, lawn fertilizers, septic systems, and spring runoff events. These are all practices currently taking place within the lake's watershed.

In order to determine the watershed nutrient loading to Lake Attitash, flow measurements must be made in order to convert nutrient concentrations to pounds per year or other loading conventions and make estimates on internal and external loading rates. It is anticipated that measurements will be made at key input locations around the lake, catch basin discharge locations into the lake during wet weather, and at the outlet dam from the lake.

Summary of Project's Objectives

Recognized Environmental Concern (REC)	Contaminant of Concern (COC)	Laboratory's Reporting Level (RL)	Project's Action Level	Comments
Lake Surface Water/Storm Drain Water	Total Phosphorus	5 ug/L	5 ug/L	Nutrient Input
Lake Surface Water/Storm Drain Water	Soluble Reactive Phosphorus (Orthophosphate)	5 ug/l	5 ug/L	Nutrient Input
Lake Surface Water/Storm Drain Water	Nitrate/Nitrite	50 ug/L	50 ug/L	Nutrient Input
Lake Surface Water/Storm Drain Water	Total Kjeldahl Nitrogen	20 ug/L	300 ug/L	Nutrient Input
Agricultural Soil Phosphorus	Total Phosphorus	25 mg/kg	40 mg/kg	Soil Nutrient Level
Lake Sediment	Total Phosphorus	25 mg/kg	40 mg/kg	Nutrient Content/Potential for release

4. Sampling Design

This sampling effort is designed to capture quantitative measurements of the principal perceived nutrient inputs coming into the lake system off of the watershed. Water quality sampling will take place in the major inlet to Lake Attitash at points upstream and downstream of where the farming operation composting windrows and adjacent fields are located. This includes inputs from impervious paved surfaces via stormwater catchments or other conveyances, wetland inflows, and agricultural runoff. The sampling is also designed to capture and quantify internal loading contributions to lake problems, such as release of phosphorus from anoxic sediments into the water column as the lake thermally stratifies during the summer months. Temporal design is as critical as spatial design in this effort, as many inputs to the system may only occur a couple times through the course of the year, but may contribute the majority of external nutrient loading to the system. The following bullets summarize those key areas where efforts will be focused.

- Collect and analyze water samples for total phosphorus, soluble reactive phosphorus (orthophosphate), nitrate/nitrate, and Total Kjeldahl Nitrogen (TKN). The following sampling locations will be targeted: Back River upstream/downstream from agricultural activity with potential for enforcement, tile drain outfall from agricultural activity with potential for enforcement, southwestern inlet from wetland area adjacent to Town water supply, Birches Dam outflow and the deepest point within the lake. These samples will be collected predominantly during critical periods when their impacts are most likely to occur. This time period will most likely be during spring runoff events, early summer and wet weather events, and thaw periods during winter months.

- Collect and analyze storm drain water samples from around the lake for total phosphorus, soluble reactive phosphorus (orthophosphate), nitrate/nitrate and Total Kjeldahl Nitrogen during two rain storm events. These wet weather surveys should be preceded by a minimum of seven days antecedent weather conditions followed by a storm of approximately one half inch or greater rainfall and having duration of no less than four hours.
- Collect and analyze lake sediment samples for Total Phosphorus from tile drain outlet and deepest point of the lake. Potentially collect soil samples from cropland overlying the tile drainage system.
- Perform separate dye studies to determine flow patterns from Back River inlet and Southwestern wetland inlet
- Perform flow measurements at outlet from Lake Attitash to create a rating curve for Lake Attitash, and from tributary streams and storm outfalls into the lake if possible.
- Collect rainfall and evaporation data during the course of the project to quantify watershed precipitation and lake evaporation.
- Record daily boat launch traffic to help determine recreational carrying capacity.

SAMPLE DESIGN MATRIX TABLE

Sample Number	Sample Locations	Number of Samples	Chemical Analyses	Rationale
Site #1	Deep spot	Minimum of four per month	TP, oP, TKN,NO2, NO3	Nutrient levels of epilimnetic and hypolimnetic water to determine in lake nutrient contributions
Site #6	Back River	Minimum of four per month, dependent on weather conditions and seasonality	TP, oP, TKN,NO2, NO3, flow measurement	Nutrient levels of surface water upstream of drain to determine background concentrations. A storm runoff event may warrant multiple samples to be collected over a 48 hour period at this site to determine storm loading rates.
Site #10	Upstream of Tile drain	Minimum of four per month, dependent on weather conditions and seasonality	TP, oP, TKN,NO2, NO3, flow measurement	Determine loading for upstream areas. A storm runoff event may warrant multiple samples to be collected over a 48 hour period at this site to determine storm loading rates.
Site #8	Tributary streams	Minimum of four per month, dependent on weather conditions and seasonality	TP, oP, TKN,NO2, NO3, flow measurement	Determine loading for surrounding areas. A storm runoff event may warrant multiple samples to be collected over a 48 hour period at this site to determine storm loading rates.
Site #7 Approximate	Downstream of Tile drain	Minimum of four per month, dependent on weather conditions and seasonality	TP, oP, TKN,NO2, NO3, flow measurement	Determine loading for combined sources. A storm runoff event may warrant multiple samples to be collected over a 48 hour period at this site to determine storm loading rates.
Site A Approximate	Tile Drain Outflow	Minimum of four per month, dependent on weather conditions and seasonality	TP, oP, TKN,NO2, NO3, flow measurement	Determine loading for agricultural source. A storm runoff event may warrant multiple samples to be collected over a 48 hour period at this site to determine storm loading rates.

Sample Number	Sample Locations	Number of Samples	Chemical Analyses	Rationale
Sites #3 & #4	Storm Drains-Surrounding lake	Minimum of 12, assuming a 24 hour storm event	TP, oP, TKN,NO2, NO3, flow measurement	Nutrient levels entering storm water catchment system. A storm runoff event may warrant multiple samples to be collected over a 48 hour period at this site to determine storm loading rates.
Site #1	Deep spot	Minimum of 12, dependent on weather conditions and seasonality	TP	Sediment Chemistry-Potential for nutrient release via internal loading.
Site A Approximate	Tile Drain Outflow	Minimum of 12, dependent on weather conditions and seasonality	TP	Sediment Chemistry-Potential for subsurface soil nutrient release from agricultural practices. A storm runoff event may warrant multiple samples to be collected over a 48 hour period at this site to determine storm loading rates.
Site #2	Birches Dam Outlet	Minimum of four per month, dependent on weather conditions and seasonality	oP, flow measurement, stage readings	Used to determine lake nutrient budget Flow measurement A storm runoff event may warrant multiple samples to be collected over a 48 hour period at this site to determine storm loading rates.

Sampling and Analytical Summary Table

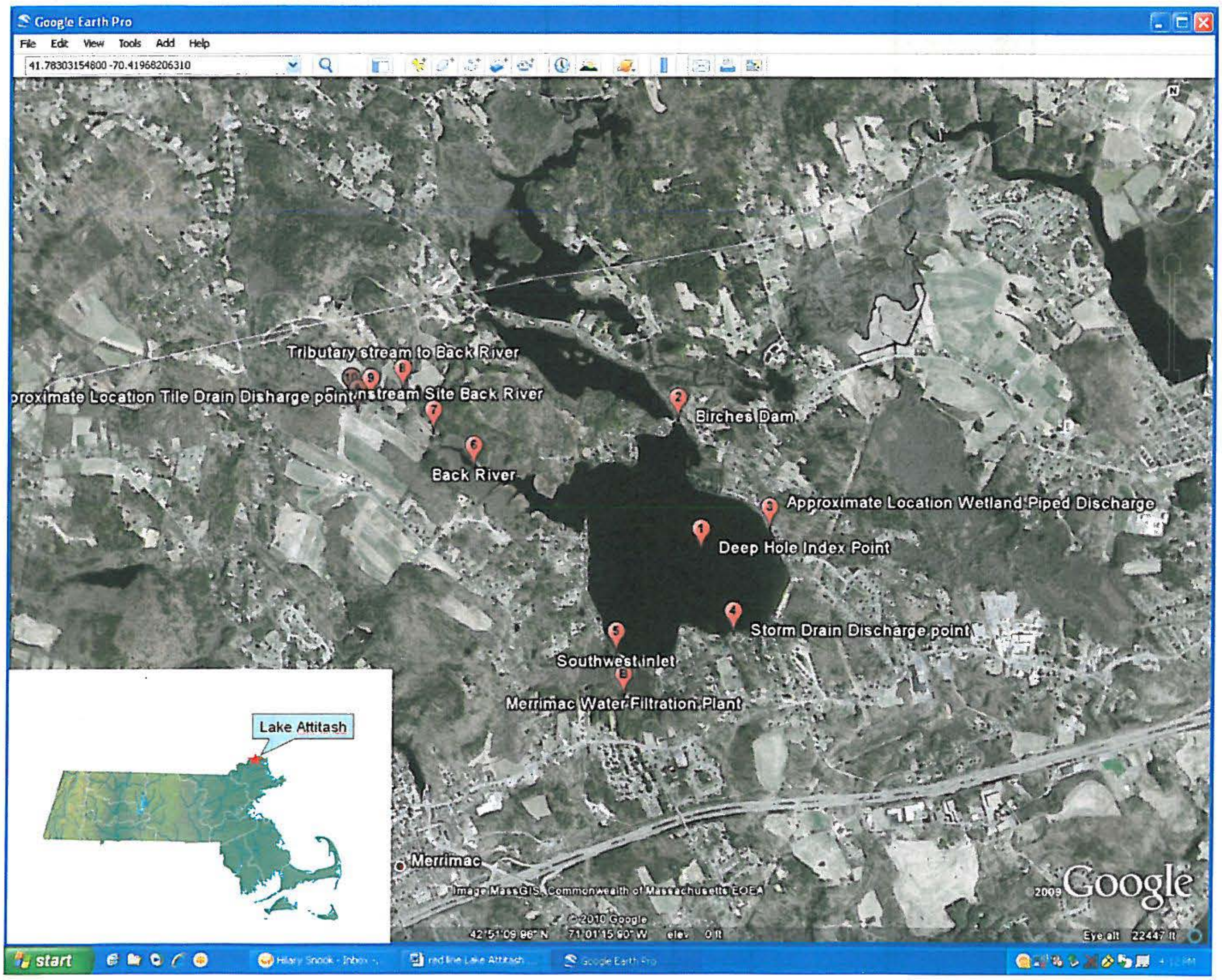
Parameter	Matrix	Sample # (field QC)	Name of Analytical Laboratory	Analytical Methods	Sampling SOPs	Container	Preservation	Maximum Holding Time
Total Phosphorus	Water	28/mo (3)	OEME Lab	EIASOP-INGTP8	ECASOP-Ambient Water Sampling2	250 mL HDPE	1-6 C	28 days
Total Phosphorus	Sediment	4 (1)	OEME Lab	EIASOP-INGTP8	EIASOP-Soil, Sed, Soil2	250 mL HDPE	1-6 C	28 days
Ortho-phosphate	Water	28/mo (3)	OEME Lab	EIASOP-INGTP8	ECASOP-Ambient Water Sampling2	250 mL HDPE	1-6 C	48 hrs
Nitrite/ Nitrate	Water	28/mo (3)	OEME Lab	EIASOP-INGIC11	ECASOP-Ambient Water Sampling2	250 mL HDPE	1-6 C	48 hrs
Total Kjeldahl Nitrogen	Water	28/mo (3)	Resource Labs,LLC	Contracted out	ECASOP-Ambient Water Sampling2	250 mL HDPE	1-6 C, Sulfuric Acid pH<2.0	28 days

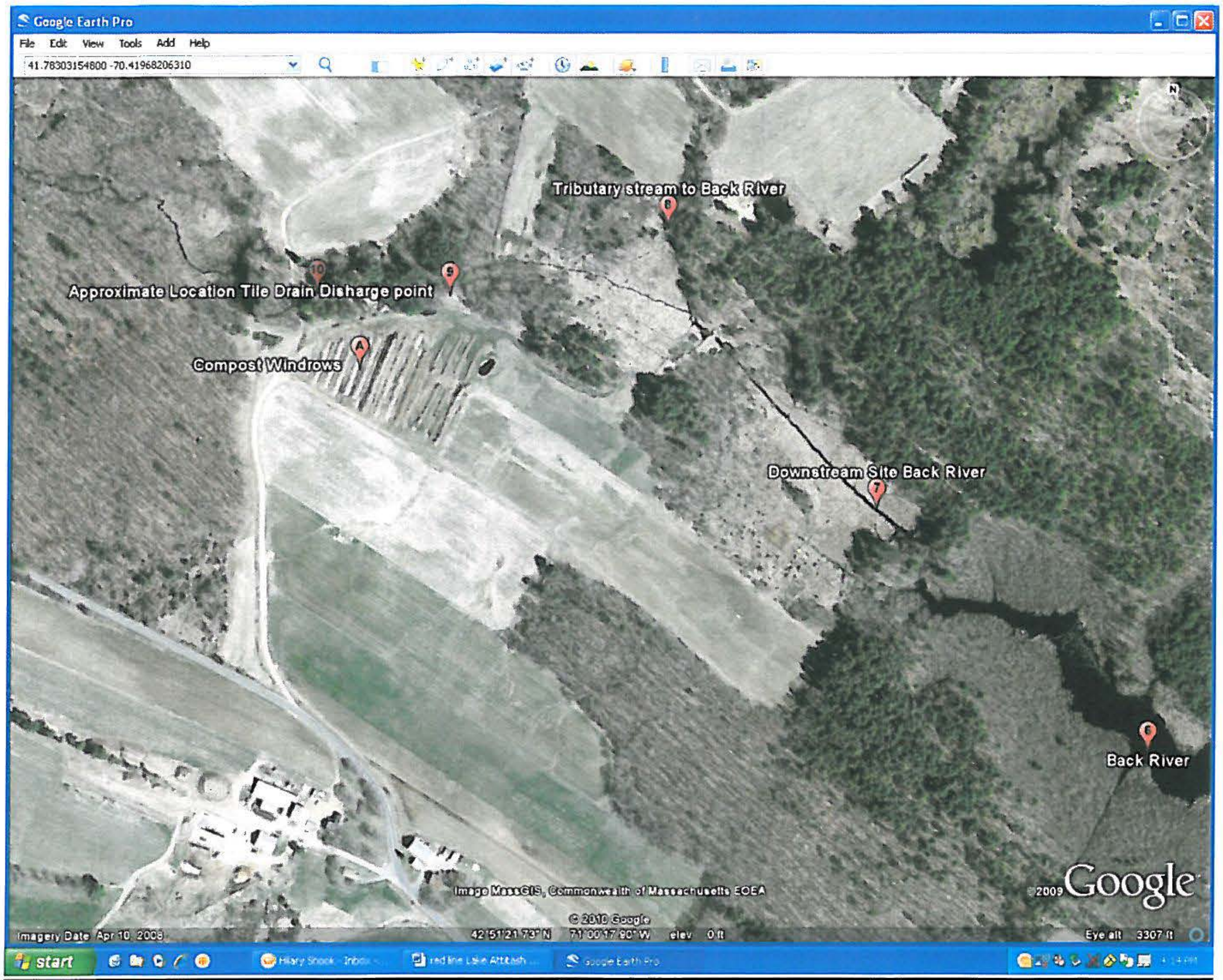
Note: Separate samples will be collected for TP, TKN and oP, nitrite, nitrate.

5.0 Site Specific Issues

- The Back River Area has limited accessibility by boat. Sampling in this area may require the use of waders and walking through the stream/overland through underbrush to these areas. Footing could be potentially slippery and uneven. Underbrush may be thick and difficult to navigate through.

6.0 Site Maps




Google Earth Pro
File Edit View Tools Add Help
41.78303154800 -70.41968206310
Tributary stream to Back River
Approximate Location Tile Drain Disharge point
Compost Windrows
Downstream Site Back River
Back River
Image MassGIS, Commonwealth of Massachusetts EOEA
© 2010 Google
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Imagery Date Apr 10, 2008
Eye alt 3307 ft
start

APPENDIX B

Annual Climatological Summary

1931-2012

National Data Center
Federal Building
151 Patton Ave
Asheville, North Carolina 28801

Station Name NEWBURYPORT 3 WNW, MA US
Station ID GHCND:USC00195285
From NOAA Climate Data Center

	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
MONTH	**1931**	**1932**	**1933**	**1934**	**1935**	**1936**	**1937**	**1938**	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**
JAN	2.98	5.83	2.59	2.63	6.48	7.34	4.49	3.96	1.99	2.43	2.94	4.01	2.23	2.94
FEB	2.81	2.08	3.11	2.76	3.15	2.28	2.1	2.39	3.27	3.54	2.04	3.8	1.61	2.12
MAR		5.08	6.15	4.86	1.57	7.06	4.35	2.51	4.54	4.53	2.24	6.97	3.32	4
APR	2.52	2.56	7.75	2.74	4.8	3.61	5	3.39	4.71	5.3	1.04	1.53	3.03	3.39
MAY	3.86	0.91	2.93	2.17	1.48	2.21	2.8	3.52	2.02		3.22	2.61	4.71	1.13
JUN	6.39	2.06	1.44	4.3	6.29	2.38	4.63	6.72	3.85	2.58	1.72	2.92	2.08	4.93
JUL	3.04	2.69	3.93	2.35	3.44	4.79	0.49	12.49	1.28	3.15	4.89	7.82	5.78	3.2
AUG	4.82	3.32	2.55	0.57	1.5	3.01	3.38	1.99	2.77	1.45	2.37	1.61	2.34	1.16
SEP		5.42	8.42	6.83	4.83	1.91	4.22	8.28	1.57	3.99	0.51	1.53	1.08	10.76
OCT	2.14	7.36	4.49	4.06	0.94	2.95	3.1	2.67	4.08	0.56	2.65	2.81	5.98	2.92
NOV		4.18	1.68	2.71	5.55	1.03	5.25	2.61	0.72	6.35	2.53	4.72	5.07	6.09
DEC		1.34	3.41	2.43	1.33	8.01	4.56	3.9	3.45	4.07	4.61	5.74	0.96	3.56
Total Annual Precipitation (inches)	28.56	42.83	48.45	38.41	41.36	46.58	44.37	54.43	34.25	37.95	30.76	46.07	38.19	46.2

Annual Mean Precipitation (inches)	45.18

Annual Climatological Summary

National Data Center
Federal Building
151 Patton Ave
Asheville, North Carolina 28801

	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
MONTH	**1945**	**1946**	**1947**	**1948**	**1949**	**1950**	**1951**	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**
JAN	2.56	4.12	2.74	5.63	3.41	4.15	2.41	4.33	5.01	2.59	0.8	3.91	2.45	11.38
FEB	4.96	2.8	1.16	2.23	2.97	2.63	4.29	3.79	2.88	2.76	3.69	4.75	1.12	2.61
MAR	1.96	1.49	3.68	2.38	1.07	3.49	4.48	2.89	7.56	2.87	3.93	6.15	2.09	5.18
APR	3.17	2.86	3.8	3.1	5.62	1.95	3.24	4.73	5.15	4.98	3.52	3.28	1.9	5.58
MAY	5.34	6.52	3.69	5.03	3.32	1.21	4.23	4.84	3.28	12.27	1.49	1.7	3.59	3.49
JUN	5.71	2.37	3.4	4.95	0.65	1.96	1.91	3.1	0.84	2.49	2.91	1.95	1.23	1.74
JUL	4.25	1.53	5.42	3.74	1.17	3.37	5.27	1.15	2.46	1.77	0.45	2.95	1.24	4.89
AUG	2.68	10.31	1.39	1.01	0.96	3.94	3.15	6	3.04	5.72	7.92	1.15	1.47	2.7
SEP	1.43	2.36	3.68	0.53	7.11	2.23		2.97	1.49	10.64	2.07	4.31	1.03	3.93
OCT	2.73	0.6	0.07	2.39		4.98	2.25	1.05	3.6	2.37	6.82	4.77	3.47	4.37
NOV	6.93	1.07	6.43	5.83		6.06	7.24	2.25	5.69	5.66	5.76	4.53	4.68	3.7
DEC	6.55	4.29	4.55	1.14		3.69	4.25	4.2	3.5	4.95	1.37	4.25	5.39	1.64
Total Annual Precipitation (inches)	48.27	40.32	40.01	37.96	26.28	39.66	42.72	41.3	44.5	59.07	40.73	43.7	29.66	51.21

	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
MONTH	**1959**	**1960**	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**	**1967**	**1968**	**1969**	**1970**	**1971**	**1972**
JAN	3.24	2.99	2.36	2.76	3.5	4.58	1.77	4.82	2.39	4.09	3.45	0.7	1.83	1.59
FEB	2.76	5.11	3.51	3.74	3.06	4.61	4.97	3.7	3.64	0.78	6.83	4.55	4.58	5.92
MAR	4.78	3.1	3.76	3.64	4.64	3.53	2.06	2.59	3.95	6.34	2.54	3.68	2.87	6.58
APR	3.12	4	7.1	4.37	1.39	4.37	2.63	1.06	5.05	2.01	3.29	3.58	2.77	3.47
MAY	1.72	4.44	3.3	2.42	3.91	1	1.46	3.03	7	3.93	1.65	3.76	4.16	4.37
JUN	5.85	1.12	1.97	4.62	1.15	1.47	3.45	1.97	3.84	6.27	2.61	3.57	3.17	8.91
JUL	5.87	5.11	6.08	2.23	2.95	3.61	2.05	3.55	3.39	1.29	4.17	2.21	3.26	4.36
AUG	4.66	1.56	3.35	4.82	3.17	2.17	2.77	1.57	3.3	1.77	1.81	3.88	3.32	1.39
SEP	2.47	5.39	6.76	4.93	4.58	1.68	2.61	4.85	3.24	1.41	4.51	3.36	2.07	4.78
OCT	4.19	2.43	2.21	12.58	2.4	3.35	2.5	3.18	1.21	2.81	1.53	4.33	2.78	3.38
NOV	4.63	3.13	4.67	4.5	10.17	3.09	2.94	4.62	4.2	7.84	7.69	3.85	6.27	8.54
DEC	5.03	3.77	4.31	6.35	2.53	4.28	2.29	3.05	5.65	6.73	9.75	5.45	3.93	5.97
Total Annual Precipitation (inches)	48.32	42.15	49.38	56.96	43.45	37.74	31.5	37.99	46.86	45.27	49.83	42.92	41.01	59.26

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	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
MONTH	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**
JAN	3.12	3.41	5.06	4.6	7.13	8.36	11.41	0.48	0.67	4.52	4.97	2.46	1.15	3.86
FEB	2.08	2.18	3.17	3.01	2.29	1.96	3.28	0.9	7.99	3.1	5.61	7.35	1.74	2.99
MAR	2.62	3.74	3.31	3.12	5.98	2.6	2.96	4.55	1	2.33	11.05	6.01	3.44	4.05
APR	9.97	3.28	2.46	2.44	3.67	3.44	3.9	5.3	3.7	3.82	7.1	5.44	1.32	3.13
MAY	5.11	5.01	1.34	3.23	2.77	5.47	3.93	1.82	1.06	2.38	4.81	7.68	3.17	1.09
JUN	4.62	2.73	3.45	0.24	3.18	4.69	1.27	3.15	3.71	10.72	2.22	4.6	3.63	7.71
JUL	3.56	0.78	2.87	5.03	2.33	1.52	2.98	4.4	4.73	3.55	2.21	5.58	3.21	5.58
AUG	3.6	2.01	6.7	4.86	2.26	3.9	5.98	2.22	1.46	3.26	2.57	1.99	5.73	1.67
SEP	1.52	8.07	5.37	2.62	4.86	0.86	3.67	1.54	3.59	2.15	1.83	0.94	5.72	2.75
OCT	3.01	2.48	5.42	4.37	5.88	3.61	4.79	5.05	4.66	3.6	4.09	4.61	3.24	2.28
NOV	2.23	3.32	5.98	0.75	6.41	2.23	3.7	3.55	2.95	4	12.3	3.59	6.44	5.82
DEC	7.5	4.47	6.93	3.26	6.51	4.03	1.59	0.94	6.41	0.78	6.9	3.7	1.28	7.93
Total Annual Precipitation (inches)	48.94	41.48	52.06	37.53	53.27	42.67	49.46	33.9	41.93	44.21	65.66	53.95	40.07	48.86

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	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
MONTH	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
JAN	8.27	2.53	0.32	4	3.13	3.02	1.93	4.88	4.7	5.68	2.79	5.67	7.78	3.15
FEB	0.29	3	2.73	3.28	1.96	2.2	4.89	1.83	2.45	2.9	1.82	5.65	3.6	4.45
MAR	3.14	3.07	2.94	1.44	3.24	3.24	7.53	6.5	2.37	3.24	4.38	4.54	5.6	4.4
APR	14.82	2.9	4.21	4.9	3.73	2.86	5.29X	2.56	1.93	5.96	7.13	2.63	0.65	6.84
MAY	1.76	5.87	3.7	7.1	3.41	1.46	0.7	5.19	2.73	3.12	3.45	4.7	4.36	3
JUN	2.62	1.43	4.15	1.1	3.26	5.49	2.38	1.25	1.36	1.72	2.73	10.51	0.55	4.61
JUL	1.5	6.88	5.44	1.9	3.2	3.92	1.35	1.25	3.67	7.31	2.25	3.04	3.93	5.83
AUG	2	4.55	3.22	5.44	7.9	3.83	0.64	4.17	1.18	1.76	3.51	3.04	1.55	2.46
SEP	7.49	2.79	4.39	1.53	6.78	3.18	5.54	8.37	3.13	7.24	2.16	2.72	9.31	3.14
OCT	3.1	2.83	4.9	10.63	1.68	2.38	3.5	0.3	5.8	15.54	1.31	5.95	4.21	3.3
NOV	2.34	6.35	5.78	2.49	3.89	4.71	2.89	3.19	7.48	2.32	5.91	1.73	2.48	5.57
DEC	3.23	1.08	1.1	3.67	3.54	4.51	5.54	5.6	2.93	6.14	4.04	1.51	1.98	5.45
Total Annual Precipitation (inches)	50.56	43.28	42.88	47.48	45.72	40.8	36.89	45.09	39.73	62.93	41.48	51.69	46	52.2

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	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total		
MONTH	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**		
JAN	2.46X	2.87	3.54		3.99	4.43	3.17	3.19	4.71	3.53	4.95	3.41		
FEB	3.04	2.74	4.22	1.51		1.8	2.6	8.96	3.14	5.52	3.63	1.12		
MAR	11.66	3.7	4.46	2.34	5.23	0.85	5.94	6.35	3.56	17.64	3.59	2.98		
APR	1.18	4.36	4.19	11.95	4.97	3.44	9.15	3.68	4.77	2.49	5.09	4.11		
MAY	1.55	4.55	4.43	5.06	8.5	20.32	4.64	1.72	3.99	3.49	4.48	4.17		
JUN	4.93	4.48			3.64	9.47	4.49	4.92	6.35	1.79	6.19			
JUL	1.5	1.19		3.74	3.39	4.63	5.27	7.25	8.29	1.93	3.25			
AUG	2.23	1.93	6.11	6.99	1.27	3.49	1.15	4.36	6.82	6.25	7.54			
SEP	2.58	3.31	4.56	5.96	1.8	3.23	2	8.99	1.56	1.66	3.9			
OCT	1.67	4.73	5.73	2.8	14.83	5.89	4.22	2.74	5.66	5.5	10.85			
NOV	1.5	5.91	2.57	3.82	3.09	6.96	3.65	3.8	4.94	4.52	3			
DEC	3.21	6.44	5.39	5.3	4.75	3.16	5.64	7.25	5.44	3.5	3.71			
Total Annual Precipitation (inches)	35.05	46.21	45.2	49.47	55.46	67.67	51.92	63.21	59.23	57.82	60.18	15.79		

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	25 percentile	75 percentile	Mean	Max	Minimum
MONTH					
JAN	2.58	4.63	3.82	11.41	0.32
FEB	2.20	3.79	3.26	8.96	0.29
MAR	2.87	4.84	4.21	17.64	0.85
APR	2.77	4.97	4.10	14.82	0.65
MAY	2.17	4.55	3.78	20.32	0.70
JUN	1.96	4.62	3.58	10.72	0.24
JUL	2.21	4.82	3.62	12.49	0.45
AUG	1.76	3.94	3.28	10.31	0.57
SEP	1.96	5.04	3.91	10.76	0.51
OCT	2.47	4.78	4.03	15.54	0.07
NOV	2.95	5.85	4.49	12.30	0.72
DEC	3.19	5.47	4.21	9.75	0.78
Total Annual Precipitation (inches)			3.86		
		Sum of means	**46.27**		

APPENDIX C

Massachusetts Dept. of Public Health
Lake Attitash Cyanobacteria
Monitoring Data
2009-2012

Lake Attitash Cyanobacteria Monitoring by Massachussetts Dept. of Public Health

Site Name	Date of Collection	Time of Collection	Total Phosphorus (mg/L)	Chlorophyll a (ug/L)	pH	Water Temp (degrees C)	Total Cell Count	Toxin Test Performed	Toxin Found	Toxin Level	Toxin Tested For	Comments
Old Merrimac Beach on Bisson Ln	06-Aug-09	10:30 AM	0.042	318		26.9	54680	Yes	No	<1	Microcystins	
State Boat Ramp	06-Aug-09	4:50 PM	0.017	333		26.4	60200	Yes	No	<1	Microcystins	Green flecks visible on water's surface.
State Boat Ramp	12-Aug-09	10:45 AM				25.2	80000	Yes	No	<1	Microcystins	Fishy odor. Dead fish - 4 total, 2 in the water. Sample exceeded 24h hold time for cell count.
State Boat Ramp	18-Aug-09	12:25 PM	0.018	700	9.1	29.88	55300	Yes	No	<1	Microcystins	3 dead fish spotted in water measuring 3-7'' in length. 4-5 dead fish on dry portion of boat ramp. Briefly talked with EPA and local boys camp director. EPA said this lake has been bad all summer and they have seen many dead fish these past days. The loca
Camp Bauercrest - left of dock	25-Aug-09	11:40 AM		1112		28.5	350000	Yes	No	<1	Microcystins	Dead fish.
Camp Bauercrest - right of dock	25-Aug-09	11:49 AM		1000		28.6	62000	Yes	No	<1	Microcystins	Odor, dead fish.
Dam	25-Aug-09	9:55 AM		456		29.3	0	Yes	No	<1	Microcystins	Dead fish, odor.
Old Merrimac Beach on Bisson Ln	25-Aug-09	10:23 AM		668			171000	Yes	No	<1	Microcystins	
State Boat Ramp	25-Aug-09	9:22 AM	0.037	222		27.9	63000	Yes	No	<1	Microcystins	Odor, dead fish.
Camp Bauercrest	01-Sep-09	7:40 AM		1668	7.8	22.33	43364	Yes	No	<1	Microcystins	Small area of algal scum at surface around dock of campground. Dead fish observed (1 catfish).
Old Merrimac Beach on Bisson Ln	01-Sep-09	7:38 AM		1444	7.8	22.04	30900	Yes	No	<1	Microcystins	
State Boat Ramp	01-Sep-09	10:00 AM	0.054	1556	7.8	21.36	42200	Yes	No	<1	Microcystins	Dead fish present at boat ramp (3 fish).
State Boat Ramp	08-Sep-09	11:00 AM				20.8	66300	Yes	No	<1	Microcystins	Scum observed near shore. Secchi disk depth - 1 meter at 1 meter depth, 4 inches near shore.
State Boat Ramp	15-Sep-09	12:36 PM				20.2	46200	No	No			
State Boat Ramp	23-Sep-09	11:15 AM				18.6	49000	No				
State Boat Ramp	15-Jun-10	3:12 PM	0.018	2.1	8.3	24.1	27440	Yes	No	<1	Microcystins	Very Windy
State Boat Ramp	21-Jun-10	12:00 PM	0.02	0.16	8.6	25.46	32800	Yes	No	<1	Microcystins	
State Boat Ramp	28-Jun-10	12:00 PM	0.011	10.7	8.8	26.28	39380	Yes	No	<1	Microcystins	Other Cyanophyaceae: Chrococcus 1900, Gloethece 1900, Gloecapsa 380. Non-Cyanophyceae: Diatomaceae, Rotifera, Chlorophyceae, Protozoa. Dead animal odor noted during sampling event.
State Boat Ramp	06-Jul-10	12:00 PM	0.021	16	8.5	29.36	41120	Yes	No	<1	Microcystins	Non-Cyanophyceae: Diatomaceae, Chlorophyceae, Protozoa
State Boat Ramp	12-Jul-10	12:00 PM	0.024	1.1	8.8	28.8	28800	Yes	No	<1	Microcystins	Non-Cyanophyceae: Diatomaceae, Chlorophyceae, Protozoa, Rotifera

State Boat Ramp	19-Jul-10	1:09 PM	0.03	16	9.3	28.2	45204	Yes	No	<1	Microcystins	Non-Cyanophyceae: Rotifera
State Boat Ramp	26-Jul-10	12:15 PM	0.028	7.5	8.8	26.18	22500	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Camp Bauercrest Swim Dock	04-Aug-10	1:30 PM					70000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	04-Aug-10	1:45 PM	0.035	21	8.7	26.53	75000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Camp Bauercrest Swim Dock	09-Aug-10	12:00 PM					48000	Yes	No	<0.15	Microcystins	Non-Cyanophyceae: None. Fish Kill observed during site visit. Abraxis 520022 results for Microcystins: <1 ppb
State Boat Ramp	09-Aug-10	12:15 PM	0.02	16	9	25.81	46400	Yes	No	<0.15	Microcystins	Non-Cyanophyceae: None. Abraxis 520022 results for Microcystins: <1 ppb
Camp Bauercrest Swim Dock	16-Aug-10	1:48 PM					85200	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Site Name	**Date of Collection**	**Time of Collection**	**Total Phosphorus (mg/L)**	**Chlorophyll a (ug/L)**	**pH**	**Water Temp (degrees C)**	**Total Cell Count**	**Toxin Test Performed**	**Toxin Found**	**Toxin Level**	**Toxin Tested For**	**Comments**
State Boat Ramp	16-Aug-10	1:03 PM	0.025	9.6	7.7	24.05	43000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Camp Bauercrest Swim Dock	23-Aug-10	11:54 AM					87600	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	23-Aug-10	11:30 AM	0.017	34	9.5	21.98	106700	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Camp Bauercrest Swim Dock	30-Aug-10	12:00 PM					19200	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	30-Aug-10	12:15 PM	0.296	<1.1	9.1	25.86	37800	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Camp Bauercrest Swim Dock	07-Sep-10	12:15 PM					147600	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	07-Sep-10	12:00 PM	0.031	20	9	22.79	97000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Camp Bauercrest Swim Dock	13-Sep-10	12:00 PM					86000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	13-Sep-10	12:15 PM	0.026	43	9	20.33	97600	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Camp Bauercrest Swim Dock	20-Sep-10	11:45 AM					37500	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	20-Sep-10	12:15 PM	0.048	33	9.6	20.37	45400	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Phycocyanin readings. Routine site(6")=16,523 cells/ml. Routine site(12")=21,243 cells/ml. Routine site(18")=24,381 cells/ml. Routine site(24")=25,896 cells/ml. Grab Sample=25,797 cells/ml.
Camp Bauercrest Swim Dock	29-Sep-10	12:05 PM					12100	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Composite Sample	29-Sep-10	12:35 PM					54300	Yes	No	<1	Microcystins	Non-Cyanophyceae = None. Phycocyanin readings. Dam at northern end of lake on Birchmeadow Rd. = 5,313 cells/ml. Camp Bauercrest = 5,411 cells/ml. Routine site = 5,435 cells/ml. Old Merrimac town beach at end of Bisson Ln. = 5,389 cells/ml. Composite sample = 6,646 cells/ml.

State Boat Ramp	29-Sep-10	12:15 PM	0.046	17	7.8	20.61	43800	Yes	No	<1	Microcystins	Non-Cyanophyceae = None. Phycocyanin reading. Grab sample = 6,227 cell/ml.
State Boat Ramp	04-Oct-10	12:30 PM	0.037	1.1	9	16.85	64600	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	22-Oct-10	12:20 PM			8.1	10.38	55100	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Very windy during sampling event.
21 Lakeshore Drive	01-Jun-11	11:30 AM			7.6	22.4	305000	Yes	No	<0.15	Microcystins	Non-Cyanophyceae: Tabellaria. Fish Kill - 3 dead fish on beach. Abraxis 520022 test kit results: 1 ppb. Sample collected in 24" of water due to shallow bottom gradient and observation of near-shore scum.
State Boat Ramp	01-Jun-11	10:45 AM			7.9	22.6	0	Yes	No	<1	Microcystins	Non-Cyanophyceae: Synedra, Tabellaria, Ceratium
21 Lakeshore Drive	08-Jun-11	11:30 AM			8.5	23.7	281600	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Fish Kill - dead fish on beach and in water appeared to have been there for a long time. Odor of decaying fish was noted. Sample collected in 24" of water due to shallow bottom gradient and observation of near-shore scum.
21 Lakeshore Drive	13-Jun-11	12:15 PM			7.9	20.2	42000	Yes	No	<1	Microcystins	Non-Cyanophyceae: Tabellaria, Volvox. Fish Kill - 1 dead fish on shore. Outfall observed approx. 50' south of sample location; moderate flow discharging to lake. Sample collected in 24" of water due to shallow bottom gradient and observation of near-shore scum.
State Boat Ramp	13-Jun-11	11:45 AM	0.017		7.9	20.4	32000	Yes	No	<1	Microcystins	Non-Cyanophyceae: Tabellaria, Ceratium. Fish Kill - 3 dead fish observed at boat ramp
21 Lakeshore Drive	20-Jun-11	11:15 AM			7	23.3	40320	Yes	No	<1	Microcystins	Non-Cyanophyceae: Diatoma, Fragilaria
State Boat Ramp	20-Jun-11	11:40 AM	0.044		7	23.2	88000	Yes	No	<1	Microcystins	Non-Cyanophyceae: Diatoma, Ceratium. Fish Kill - 2 Fish
State Boat Ramp	27-Jun-11	1:00 PM	0.017		8.4	22.8	15600	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Fish Kill - 1 Fish

Site Name	Date of Collection	Time of Collection	Total Phosphorus (mg/L)	Chlorophyll a (ug/L)	pH	Water Temp (degrees C)	Total Cell Count	Toxin Test Performed	Toxin Found	Toxin Level	Toxin Tested For	Comments
State Boat Ramp	05-Jul-11	1:10 PM	0.022		8.9	26.7	46800	Yes	No	<1	Microcystins	Non-Cyanophyceae: Staurastrum, Ceratium
State Boat Ramp	11-Jul-11	11:10 AM	0.029		7	26.7	31100	Yes	No	<1	Microcystin	Non-Cyanophyceae: None
State Boat Ramp	18-Jul-11	11:00 AM	0.04		7.8	26.7	26800	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	25-Jul-11	10:50 AM	0.025		7.6	28.4	32900	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	01-Aug-11	10:30 AM	<0.01		8.8	27.5	39900	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Suspended algae visible near shore
State Boat Ramp	08-Aug-11	10:42 AM	0.017		8.5	25.8	48900	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Water level low
State Boat Ramp	15-Aug-11	12:00 PM	0.037		8.4	23.8	22900	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	25-Aug-11	10:55 AM	0.016		8.7	23.9	26700	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Total Phosphorus sample collected on August 22. Live fish seen.
State Boat Ramp	30-Aug-11	11:10 AM	0.024		7.6	24.2	35000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None

6 Strathmere Club Dock	21-Sep-11	1:55 PM			7.6	21.02	28400	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
Camp Bauercrest	30-Apr-12	1:19 AM					0	Yes	No	ND	Microcystins, anatoxin-a, cylindrospermposin, and paralytic shellfish toxins (saxitoxins)	Tiny green dots at 1m depth. YSI battery dead. All toxins tested for were not detected above the detection limit.
State Boat Ramp	07-May-12	12:21 PM					140400	Yes	No	<1	Microcystin	Non-Cyanophyceae: Asterionella, Fragilaria, Tabellaria. YSI, Secchi, turbidity not recorded. Tiny green dots.
State Boat Ramp	14-May-12	12:15 PM			12	17.3	73000	Yes	No	<1	Microcystins	Non-Cyanophyceae: Tabellaria, Dinobryon
State Boat Ramp	23-May-12	12:00 AM			8	19.2	200400	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	29-May-12	11:59 AM			11	22.5	71500	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	05-Jun-12	11:15 AM			10	17.2	56000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. A few dead snails and fish but prob. from fishing.
State Boat Ramp	11-Jun-12	11:35 AM			9.8	21.3	27000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	18-Jun-12	11:15 AM			9.6	21.2	25200	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Odor present. Live fish.
State Boat Ramp	27-Jun-12	10:58 AM			9.6	23	54200	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	05-Jul-12	11:12 AM			9.5	26.5	84900	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Septic odor noted.
State Boat Ramp	11-Jul-12	11:13 AM			9.1	27.4	50000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Clarity 2 at sample depth. Green scum near shore on ramp.
State Boat Ramp	18-Jul-12	11:22 AM			9.1	28.7	29700	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	25-Jul-12	11:30 AM			7.3	25.6	64800	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Dead fish on boat ramp
State Boat Ramp	30-Jul-12	10:54 AM			9.2	25.8	44800	Yes	No	<1	Microcystins	Non-Cyanophyceae: None. Seven dead fish.
State Boat Ramp	06-Aug-12	10:51 AM			8.9	27.6	58000	Yes	No	<1	Microcystins	Non-Cyanophyceae: None
State Boat Ramp	13-Aug-12	12:17 PM			7.6	27.26	58100	Yes	No	<1	Microcystins	Non-Cyanophyceae: None Detected. Musky.
State Boat Ramp	20-Aug-12	3:30 PM			8.6	25.85	20700	Yes	No	<1	Microcystins	Non-Cyanophyceae: None Detected
State Boat Ramp	27-Aug-12	12:05 PM			9.5	25.4	84500	Yes	No	<1	Microcystins	Non-Cyanophyceae: None Dectected
Boat ramp	04-Sep-12	12:06 PM			7	22.26	21400	Yes	No	<1	Microcystins	Non-Cyanophyceae: None Detected
Boat ramp	11-Sep-12	11:17 AM					82800	Yes	No	<1	Microcystins	Non-Cyanophyceae: None Detected
Boat Ramp	18-Sep-12	11:08 AM			8.3	21.2	63700	Yes	No	<1	Microcystins	Non-Cyanophyceae: None Detected. Live fish observed.
Boat ramp	25-Sep-12	11:09 AM					50200	Yes	No	<1	Microcystins	Non-Cyanophyceae: None Detected

Toxin analysis and ID completed by Northeast laboratories - Abraxis Test 520022

Samples collected six inches below surface from shoreline area

APPENDIX D

Lake Attitash 2005 Phytoplankton Assemblage

PHYTOPLANKTON DENSITY (CELLS/ML)

	Attitash	Attitash	Attitash	Attitash	Attitash	Attitash	Attitash	Attitash	Attitash
	1	2	3	4	5	21	35	36	Dup F
TAXON	10/19/05	10/19/05	10/19/05	10/20/05	10/19/05	10/20/05	10/19/05	10/19/05	10/20/05
BACILLARIOPHYTA									
Centric Diatoms									
Aulacoseira	3910	4160	0	2850	0	0	3600	3900	0
Stephanodiscus	17	16	0	15	0	15	30	15	10
Araphid Pennate Diatoms									
Asterionella	17	16	0	15	0	0	15	0	0
Fragilaria/related taxa	68	48	68	0	0	30	0	0	10
Meridion	0	0	34	0	15	15	0	0	10
Synedra	0	16	17	0	0	0	0	0	0
Tabellaria	238	96	0	0	0	0	60	15	0
Monoraphid Pennate Diatoms									
Achnanthidium/related taxa	0	16	17	0	0	0	0	0	0
Biraphid Pennate Diatoms									
Amphora	0	0	0	0	0	0	0	0	0
Cymbella/related taxa	0	0	0	0	0	0	0	0	0
Epithemia	17	0	0	0	0	0	0	0	0
Eunotia	17	16	17	0	0	15	0	0	10
Gomphonema/related taxa	17	16	0	15	0	15	15	0	10
Gyrosigma	0	0	0	0	0	0	0	0	0
Navicula/related taxa	17	0	34	0	0	0	15	15	0
Nitzschia	0	0	0	0	15	0	0	0	0
Pinnularia	0	0	0	0	0	0	0	0	0
CHLOROPHYTA									
Flagellated Chlorophytes									
Carteria	0	0	0	0	0	0	0	0	0
Chlamydomonas	0	0	0	0	180	0	0	0	0
Coccomonas	0	0	0	0	0	0	0	0	0
Eudorina	0	0	0	0	0	0	0	0	0
Pandorina	0	0	0	0	0	0	0	0	0
Other Flagellated Greens	0	0	0	0	0	0	0	0	0
Coccoid/Colonial Chlorophytes									
Ankistrodesmus	0	0	0	15	0	0	0	0	0
Botryococcus	0	0	0	0	0	0	0	0	0
Coelastrum	0	0	0	0	0	0	0	0	0
Crucigenia	0	0	0	0	0	0	0	0	0
Elakatothrix	34	0	0	30	0	30	0	30	0
Kirchneriella	0	64	0	30	0	0	0	0	0
Oocystis	0	64	0	30	0	60	0	60	20
Paulschulzia	0	0	0	0	0	0	0	0	0
Quadrigula	0	0	0	0	0	0	0	0	0
Scenedesmus	0	64	68	60	0	60	0	0	20
Schroederia	0	0	0	0	0	0	0	0	0
Sphaerocystis	136	64	0	120	0	0	0	0	0
Other Coccoid Green Cells	0	0	0	0	60	0	0	0	0
Filamentous Chlorophytes									
Desmids									
Cosmarium	0	0	0	0	0	0	0	0	0
Staurastrum	0	0	0	0	0	0	0	0	0
Staurodesmus	0	0	0	0	0	0	0	0	0
Teilingia/related taxa	0	0	0	0	0	0	0	0	0
CHRYSOPHYTA									
Flagellated Classic Chrysophytes									
Dinobryon	17	16	0	15	0	0	15	0	0
Synura	17	0	0	0	0	0	0	0	0
Other Flagellated Goldens	0	0	0	0	90	45	0	0	60
Non-Motile Classic Chrysophytes									
Bitrichia	0	0	0	0	0	0	0	0	0
Haptophytes									
Tribophytes/Eustigmatophytes									
Ophiocytium	0	0	0	0	0	0	0	0	0
Raphidophytes									
CRYPTOPHYTA									
Cryptomonas	34	64	17	300	30	135	75	75	180

CYANOPHYTA	1	2	3	4	5	21	35	36	Dup F
Unicellular and Colonial Forms									
Aphanocapsa	850	800	0	750	600	0	900	750	0
Chroococcus	340	128	0	0	0	0	0	0	0
Coelosphaerium	0	0	0	0	0	0	0	0	0
Dactylococcopsis	0	0	0	0	0	0	0	0	0
Merismopedia	0	0	0	0	0	0	0	0	0
Microcystis	3400	640	0	0	0	0	375	2400	0
Synechococcus/Cyanobium	850	1120	0	0	0	0	0	0	0
Filamentous Nitrogen Fixers									
Anabaena	3060	7200	0	4500	0	0	3150	4500	0
Aphanizomenon	0	0	0	0	0	0	0	0	0
Filamentous Non-Nitrogen Fixers									
Oscillatoria	0	0	340	0	1200	0	0	0	0
Pseudanabaena	0	0	680	0	900	0	0	0	50
EUGLENOPHYTA									
Euglena	0	0	17	0	0	15	0	0	0
Lepocinclis	0	0	0	0	0	0	0	0	0
Phacus	0	0	17	0	0	0	0	0	0
Trachelomonas	34	112	17	60	15	15	105	75	10
Strombomonas	0	0	0	0	0	0	0	0	0
PYRRHOPHYTA									
Ceratium	0	0	0	0	0	0	0	0	0
Gymnodinium	0	0	0	0	0	0	0	0	0
Peridinium	0	0	0	0	0	0	0	0	0
DENSITY (CELLS/ML) SUMMARY									
BACILLARIOPHYTA	**4318**	**4400**	**187**	**2895**	**30**	**90**	**3735**	**3945**	**50**
Centric Diatoms	3927	4176	0	2865	0	15	3630	3915	10
Araphid Pennate Diatoms	323	176	119	15	15	45	75	15	20
Monoraphid Pennate Diatoms	0	16	17	0	0	0	0	0	0
Biraphid Pennate Diatoms	68	32	51	15	15	30	30	15	20
CHLOROPHYTA	**170**	**256**	**68**	**285**	**240**	**150**	**0**	**90**	**40**
Flagellated Chlorophytes	0	0	0	0	180	0	0	0	0
Coccoid/Colonial Chlorophytes	170	256	68	285	60	150	0	90	40
Filamentous Chlorophytes	0	0	0	0	0	0	0	0	0
Desmids	0	0	0	0	0	0	0	0	0
CHRYSOPHYTA	**34**	**16**	**0**	**15**	**90**	**45**	**15**	**0**	**60**
Flagellated Classic Chrysophytes	34	16	0	15	90	45	15	0	60
Non-Motile Classic Chrysophytes	0	0	0	0	0	0	0	0	0
Haptophytes	0	0	0	0	0	0	0	0	0
Tribophytes/Eustigmatophytes	0	0	0	0	0	0	0	0	0
Raphidophytes	0	0	0	0	0	0	0	0	0
CRYPTOPHYTA	**34**	**64**	**17**	**300**	**30**	**135**	**75**	**75**	**180**
CYANOPHYTA	**8500**	**9888**	**1020**	**5250**	**2700**	**0**	**4425**	**7650**	**50**
Unicellular and Colonial Forms	5440	2688	0	750	600	0	1275	3150	0
Filamentous Nitrogen Fixers	3060	7200	0	4500	0	0	3150	4500	0
Filamentous Non-Nitrogen Fixers	0	0	1020	0	2100	0	0	0	50
EUGLENOPHYTA	**34**	**112**	**51**	**60**	**15**	**30**	**105**	**75**	**10**
PYRRHOPHYTA	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**13090**	**14736**	**1343**	**8805**	**3105**	**450**	**8355**	**11835**	**390**
CELL DIVERSITY	**0.77**	**0.65**	**0.68**	**0.55**	**0.66**	**0.94**	**0.57**	**0.59**	**0.77**
CELL EVENNESS	**0.59**	**0.49**	**0.61**	**0.47**	**0.66**	**0.87**	**0.53**	**0.57**	**0.74**
NUMBER OF TAXA									
BACILLARIOPHYTA	**9**	**9**	**6**	**4**	**2**	**5**	**6**	**4**	**5**
Centric Diatoms	2	2	0	2	0	1	2	2	1
Araphid Pennate Diatoms	3	4	3	1	1	2	2	1	2
Monoraphid Pennate Diatoms	0	1	1	0	0	0	0	0	0
Biraphid Pennate Diatoms	4	2	2	1	1	2	2	1	2
CHLOROPHYTA	**2**	**4**	**1**	**6**	**2**	**3**	**0**	**2**	**2**
Flagellated Chlorophytes	0	0	0	0	1	0	0	0	0
Coccoid/Colonial Chlorophytes	2	4	1	6	1	3	0	2	2
Filamentous Chlorophytes	0	0	0	0	0	0	0	0	0
Desmids	0	0	0	0	0	0	0	0	0
CHRYSOPHYTA	**2**	**1**	**0**	**1**	**1**	**1**	**1**	**0**	**1**
Flagellated Classic Chrysophytes	2	1	0	1	1	1	1	0	1
Non-Motile Classic Chrysophytes	0	0	0	0	0	0	0	0	0
Haptophytes	0	0	0	0	0	0	0	0	0
Tribophytes/Eustigmatophytes	0	0	0	0	0	0	0	0	0
Raphidophytes	0	0	0	0	0	0	0	0	0
CRYPTOPHYTA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
CYANOPHYTA	**5**	**5**	**2**	**2**	**3**	**0**	**3**	**3**	**1**
Unicellular and Colonial Forms	4	4	0	1	1	0	2	2	0
Filamentous Nitrogen Fixers	1	1	0	1	0	0	1	1	0
Filamentous Non-Nitrogen Fixers	0	0	2	0	2	0	0	0	1
EUGLENOPHYTA	**1**	**1**	**3**	**1**	**1**	**2**	**1**	**1**	**1**
PYRRHOPHYTA	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**20**	**21**	**13**	**15**	**10**	**12**	**12**	**11**	**11**

PHYTOPLANKTON BIOMASS (UG/L)									
	Attitash	Attitash	Attitash	Attitash	Attitash	Attitash	Attitash	Attitash	Attitash
	1	2	3	4	5	21	35	36	Dup F
TAXON	10/19/05	10/19/05	10/19/05	10/20/05	10/19/05	10/20/05	10/19/05	10/19/05	10/20/05
BACILLARIOPHYTA									
Centric Diatoms									
Aulacoseira	1173.0	1248.0	0.0	855.0	0.0	0.0	1080.0	1170.0	0.0
Stephanodiscus	42.5	40.0	0.0	37.5	0.0	37.5	75.0	37.5	25.0
Araphid Pennate Diatoms									
Asterionella	3.4	3.2	0.0	3.0	0.0	0.0	3.0	0.0	0.0
Fragilaria/related taxa	20.4	14.4	20.4	0.0	0.0	9.0	0.0	0.0	3.0
Meridion	0.0	0.0	10.2	0.0	4.5	4.5	0.0	0.0	3.0
Synedra	0.0	128.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0
Tabellaria	190.4	76.8	0.0	0.0	0.0	0.0	48.0	12.0	0.0
Monoraphid Pennate Diatoms									
Achnanthidium/related taxa	0.0	1.6	1.7	0.0	0.0	0.0	0.0	0.0	0.0
Biraphid Pennate Diatoms									
Amphora	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymbella/related taxa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epithemia	81.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eunotia	17.0	16.0	17.0	0.0	0.0	15.0	0.0	0.0	10.0
Gomphonema/related taxa	17.0	16.0	0.0	15.0	0.0	15.0	15.0	0.0	10.0
Gyrosigma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula/related taxa	8.5	0.0	17.0	0.0	0.0	0.0	7.5	7.5	0.0
Nitzschia	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0
Pinnularia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHLOROPHYTA									
Flagellated Chlorophytes									
Carteria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlamydomonas	0.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0	0.0
Coccomonas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eudorina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pandorina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Flagellated Greens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coccoid/Colonial Chlorophytes									
Ankistrodesmus	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0
Botryococcus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coelastrum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crucigenia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Elakatothrix	3.4	0.0	0.0	3.0	0.0	3.0	0.0	3.0	0.0
Kirchneriella	0.0	6.4	0.0	3.0	0.0	0.0	0.0	0.0	0.0
Oocystis	0.0	25.6	0.0	12.0	0.0	24.0	0.0	24.0	8.0
Paulschulzia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quadrigula	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scenedesmus	0.0	6.4	6.8	6.0	0.0	6.0	0.0	0.0	2.0
Schroederia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaerocystis	27.2	12.8	0.0	24.0	0.0	0.0	0.0	0.0	0.0
Other Coccoid Green Cells	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0
Filamentous Chlorophytes									
Desmids									
Cosmarium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Staurastrum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Staurodesmus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Teilingia/related taxa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRYSOPHYTA									
Flagellated Classic Chrysophytes									
Dinobryon	51.0	48.0	0.0	45.0	0.0	0.0	45.0	0.0	0.0
Synura	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Flagellated Goldens	0.0	0.0	0.0	0.0	4.5	2.3	0.0	0.0	3.0
Non-Motile Classic Chrysophytes									
Bitrichia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haptophytes									
Tribophytes/Eustigmatophytes									
Ophiocytium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raphidophytes									
CRYPTOPHYTA									
Cryptomonas	30.6	201.6	3.4	165.0	27.0	48.0	57.0	78.0	64.0

CYANOPHYTA	1	2	3	4	5	21	35	36	Dup F
Unicellular and Colonial Forms									
Aphanocapsa	8.5	8.0	0.0	7.5	6.0	0.0	9.0	7.5	0.0
Chroococcus	136.0	51.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coelosphaerium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dactylococcopsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Merismopedia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microcystis	102.0	19.2	0.0	0.0	0.0	0.0	11.3	72.0	0.0
Synechococcus/Cyanobium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Filamentous Nitrogen Fixers									
Anabaena	612.0	1440.0	0.0	900.0	0.0	0.0	630.0	900.0	0.0
Aphanizomenon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Filamentous Non-Nitrogen Fixers									
Oscillatoria	0.0	0.0	3.4	0.0	12.0	0.0	0.0	0.0	0.0
Pseudanabaena	0.0	0.0	6.8	0.0	9.0	0.0	0.0	0.0	0.5
EUGLENOPHYTA									
Euglena	0.0	0.0	425.0	0.0	0.0	7.5	0.0	0.0	0.0
Lepocinclis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phacus	0.0	0.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0
Trachelomonas	107.1	180.8	17.0	60.0	15.0	15.0	105.0	204.0	10.0
Strombomonas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PYRRHOPHYTA									
Ceratium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gymnodinium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peridinium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BIOMASS (UG/ML) SUMMARY									
BACILLARIOPHYTA	**1553.8**	**1544.0**	**79.9**	**910.5**	**16.5**	**81.0**	**1228.5**	**1227.0**	**51.0**
Centric Diatoms	1215.5	1288.0	0.0	892.5	0.0	37.5	1155.0	1207.5	25.0
Araphid Pennate Diatoms	214.2	222.4	44.2	3.0	4.5	13.5	51.0	12.0	6.0
Monoraphid Pennate Diatoms	0.0	1.6	1.7	0.0	0.0	0.0	0.0	0.0	0.0
Biraphid Pennate Diatoms	124.1	32.0	34.0	15.0	12.0	30.0	22.5	7.5	20.0
CHLOROPHYTA	**30.6**	**51.2**	**6.8**	**55.5**	**30.0**	**33.0**	**0.0**	**27.0**	**10.0**
Flagellated Chlorophytes	0.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0	0.0
Coccoid/Colonial Chlorophytes	30.6	51.2	6.8	55.5	12.0	33.0	0.0	27.0	10.0
Filamentous Chlorophytes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desmids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRYSOPHYTA	**64.6**	**48.0**	**0.0**	**45.0**	**4.5**	**2.3**	**45.0**	**0.0**	**3.0**
Flagellated Classic Chrysophytes	64.6	48.0	0.0	45.0	4.5	2.3	45.0	0.0	3.0
Non-Motile Classic Chrysophytes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haptophytes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tribophytes/Eustigmatophytes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raphidophytes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRYPTOPHYTA	**30.6**	**201.6**	**3.4**	**165.0**	**27.0**	**48.0**	**57.0**	**78.0**	**64.0**
CYANOPHYTA	**867.0**	**1529.6**	**10.2**	**907.5**	**27.0**	**0.0**	**650.3**	**979.5**	**0.5**
Unicellular and Colonial Forms	255.0	89.6	0.0	7.5	6.0	0.0	20.3	79.5	0.0
Filamentous Nitrogen Fixers	612.0	1440.0	0.0	900.0	0.0	0.0	630.0	900.0	0.0
Filamentous Non-Nitrogen Fixers	0.0	0.0	10.2	0.0	21.0	0.0	0.0	0.0	0.5
EUGLENOPHYTA	**107.1**	**180.8**	**447.1**	**60.0**	**15.0**	**22.5**	**105.0**	**204.0**	**10.0**
PYRRHOPHYTA	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
TOTAL	**2653.7**	**3555.2**	**547.4**	**2143.5**	**120.0**	**186.8**	**2085.8**	**2515.5**	**138.5**
BIOMASS DIVERSITY	**0.80**	**0.71**	**0.45**	**0.60**	**0.94**	**0.93**	**0.59**	**0.57**	**0.75**
BIOMASS EVENNESS	**0.62**	**0.54**	**0.41**	**0.51**	**0.94**	**0.86**	**0.55**	**0.55**	**0.72**