Martha’s Vineyard Coastal Pond Water Quality Survey-
Summer 2005

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Martha’s Vineyard Commission

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Project # 2005-01/604

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Figure numbers on the station maps in Appendix 1may be different than those used in the text.

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Executive Summary:
The primary goal of this project was to continue to build our water quality database for eight coastal ponds and to further prepare them for entry into the Commonwealth's Massachusetts Estuaries Project. The Ponds included in 2005 are: Sengekontacket Pond, Farm Pond, Tashmoo Pond, Cape Poge Pond, Pocha Pond, Oyster Pond, Katama Bay and James Pond. In the discussion that follows, reduced water quality means that most parameters at most stations are at unacceptable levels during much of the growing season. Somewhat reduced water quality means that at some stations, parameters are at acceptable levels at some times and unacceptable at others. Average means that the parameters are generally at or better than the unacceptable levels. Good water quality means that the system is most always better than the unacceptable levels by a substantial margin. These labels are for public outreach purposes and not meant to be precise descriptions of the systems and it should be kept in mind that these parameters will vary from year to year. More detailed guidance for interpreting the data is provided in the text on page 10 and a system for understanding the Buzzard's Bay rating scores is found on page 39.

Pond System Descriptions:
Sengekontacket Pond is vigorously circulated by the tides. However, it has substantial sources of wastewater in its watershed that lead to higher total organic nitrogen (TON) concentrations particularly in those areas removed from the inlets and into the recesses of the Pond. These locations include Major's Cove (SKT3 and 4) and the southern end of the Pond off the Boulevard (SKT8). At these more restricted circulation stations where large sources of nitrogen also exist, the 2003-TON values ranged between 0.5 and 1.0 ppm, well above desired levels. During 2004, the TON improved to 0.28 to 0.4 ppm, at or better than the target of 0.38 ppm for eelgrass health (Howes, B. personal communication; Costa, 2000). Chlorophyll concentration was less than 5 micrograms per liter (parts per billion). The highest values were found in Major's Cove and off the Boulevard mooring field.

During 2005, the average TON improved to 0.26 to 0.35 ppm. The chlorophyll content still averaged below 5 micrograms per liter (parts per billion). Dissolved oxygen saturation was at acceptable levels in the deeper water during the study. The water quality in the system was generally good in our rating system throughout the Pond in 2005.

Inorganic nitrogen to phosphorus ratios were generally less than 3 indicating that growth of phytoplankton was strongly limited by the availability of nitrogen throughout the summer. The Trapp's Pond outflow and samples acquired from the channel between the two Trapp's Ponds were higher (5 to 17) indicating nitrogen sources in these sub-watersheds. Water quality in Trapp's Pond was generally undesirable.

Farm Pond has restricted tidal flow due to the insufficient size of the culvert under Beach Road. Despite the flow restriction the Pond has extensive eelgrass beds. In 2003, the TON levels were higher than desirable, being between 0.5 and 0.9 ppm. Chlorophyll pigment concentrations reached higher than desirable levels in late August. Dissolved oxygen saturation also reached low levels (around 40%) late in August. Overall water quality during 2003 was somewhat reduced.

In 2004, total organic nitrogen concentrations ranged between 0.5 and 0.6 milligrams per liter (ppm). Chlorophyll pigment concentrations ranged from 6 to 7.7 micrograms per liter (ppb). Both these parameters approached the poor water quality value established by the Buzzard's Bay Program for tidal waters. Salinity averaged around 30 parts per thousand.

During 2005, total organic nitrogen concentrations improved further to average between 0.29 and 0.35 ppm, meeting the target of 0.38 ppm for eelgrass health. Chlorophyll pigment concentrations also improved to average between 4.25 and 5.6 parts per billion. The nitrogen to phosphorus ratios indicate that the system is strongly limited by the availability of nitrogen. Water quality was average in Farm Pond during 2006.

Tashmoo Pond had TON levels that were acceptable during 2003, being similar to Vineyard Sound values near the inlet and increasing somewhat the further into the system the sampling stations were located. Chlorophyll pigment concentrations followed a similar pattern, increasing into the pond but were acceptable during the study period on average. Dissolved oxygen saturation in the deeper water was at acceptable levels during the study period but declined in August and indicates the need for some continuous overnight data. Overall, water quality in Tashmoo during 2003 was average.

In 2004, the TON pattern continued toward increasing concentrations proceeding south into the Pond. The concentrations exceeded the undesirable water quality rating in the area around mid-Pond. The outlet from the upper, freshwater pond is a source of high TON levels. Chlorophyll concentrations followed a similar pattern with the concentrations near the inlet being similar to those found in Vineyard Sound and the values toward the southern half of the Pond exceeding the undesirable water quality rating. Dissolved inorganic nitrogen concentrations were low throughout the Pond with the Upper Pond outlet being a clear source of nitrogen at concentrations averaging about 0.17 milligrams per liter.

During 2005, TON ranged between 0.23 and 0.36 ppm exceeding the goal for eelgrass health. The same pattern of increasing further into the Pond was displayed. Chlorophyll concentration also displays the same pattern, increasing at stations that are further into the system. While meeting the goal for average water quality near the inlet, at mid-pond and points further south, the concentrations were higher than desired and the water quality rating is undesirable. SMAST personnel collected these samples and, at one station, samples were collected at the surface (S label in data spreadsheet), mid-depth (M) and bottom (B).

Cape Poge Pond is also vigorously circulated by the tides. In 2003, Total Organic Nitrogen increased toward the outlet from Pocha Pond that drains into Cape Poge but was generally below 0.4 ppm during the study at most stations. Chlorophyll pigment levels were below 5 parts per billion throughout the study. Inorganic nitrogen was elevated at the outlet from Pocha Pond and in the more isolated embayment known as Shear Pen Pond. Dissolved oxygen saturation in the deeper water was good throughout the study. Water quality varied from good at some stations to average at others.

In 2004, TON concentrations in Cape Pogue varied around 0.4 ppm, being higher toward the outlet of Pocha Pond. These were somewhat higher than those found in 2003. An anomalous value at POG2 in the north basin raises the average value considerably above the earlier concentrations. Chlorophyll concentrations were typically below 5 ppb throughout the summer. Inorganic nitrogen concentrations were low.

During 2005, TON ranged from 0.29 to 0.32 ppm, well below the 0.38 ppm goal for eelgrass health. On average, chlorophyll pigment levels were below 3.6 parts per billion, well below the goal of 6 ppb. Water quality was good throughout the system in 2005.

Pocha Pond drains into Cape Poge by way of a long channel called the Lagoon. Total Organic Nitrogen concentration was found to be elevated beyond desirable levels the further into the system the station was located. Despite this increase, pigment concentrations were less than 5 parts per billion throughout the study possibly indicating that the organic matter is derived from non-chlorophyll organisms. Inorganic nitrogen generally increased the further into the system the station was located. Dissolved oxygen was at acceptable levels throughout the study period. Water quality in the system was near the undesirable rating at some stations and average at others.

In 2004, TON values were above desirable levels approaching the undesirable water quality rating. Chlorophyll concentrations varied around 5 ppb. Dissolved inorganic nitrogen concentrations increased proceeding into the Pond and away from the outlet to Cape Pogue.

In the samples from 2005 the TON averaged between 0.31 and 0.38 ppm at or below the goal for eelgrass health. This represented a substantial improvement over the water quality in 2004. Chlorophyll pigments averaged less than 4.2 parts per billion. Inorganic nitrogen again displayed a clear trend toward increasing value proceeding further into the pond system. Water quality was somewhat undesirable during 2005.

Oyster Pond:
Oyster Pond is a 200-acre south shore pond. It is only tidal for relatively short periods of time following a cut through the barrier beach. During the drain down period the pond drops 4 feet or more before becoming tidal for a period ranging from less than one week up to a month. When it drains down, the water near the north end of the system becomes very fresh from groundwater discharge that is focused at the head of the pond. This can set up a strong horizontal salinity gradient and, under the right wind conditions, vertical stratification can become well established.

During 2005, the total organic nitrogen concentration averaged between 0.42 and 0.46 parts per million, above the desired target for eelgrass health of 0.38 ppm. Chlorophyll pigments were also elevated above the desired goal, varying from 7.2 to 7.5 parts per billion in the southern half of the system and up to 16.2 ppm at the northernmost station. Dissolved inorganic nitrogen showed a similar pattern, ranging from 0.6 to 1.3 micromoles per liter at the south end up to 3.2 at the northern station. The ratio of inorganic nitrogen to phosphorus shows a nitrogen limitation in the southern half of the system at all times, whether open to the ocean or not. The stations at the northern half of the system are variable, being phosphorus limited when that end of the pond is fresh and nitrogen limited when it is more saline. Water quality during 2005 was near the undesirable rating depending on station location and timing relative to the inlet to the ocean closing.

James Pond:
James Pond is a 41-acre north shore pond that is breached to the ocean periodically during the year. Flow from the system is sufficiently sluggish and the pond level remains high enough above the Sound that the tides in the system are diurnal. The system is shoaled by an extensive flood tidal delta and overwash deposits at the north end. The channel has been redirected by sand overwash so that it follows a long route and discharges into the pond across the tidal flat in a diffuse manner. James Pond receives small freshwater discharges from two streams and from the groundwater.

During 2005, total organic nitrogen concentration averaged between 0.7 and 1.0 parts per million, well above the threshold for eelgrass health. Chlorophyll pigments varied between 14.0 and 32.5 parts per billion. At the stations nearest the inlet, productivity was nitrogen limited over the course of the sampling period. Those stations further south varied from being nitrogen limited to being phosphorus limited. Water quality throughout the system rated an undesirable rating during 2005.

Katama Bay:
Katama Bay is a 1700-acre tidal system that includes Edgartown Harbor, a large mooring field, a number of oyster aquaculture operations and receives drainage from Caleb's Pond, a 39-acre tidal pond. The system is separated from the Atlantic Ocean by a barrier beach that has periodically breached in the past creating times when the system has very strong tides. This barrier has remained mostly intact in recent years. Along the north side of the barrier beach, significant flood tidal deltas from past breaches have created an extensive system of tidal flats and channels that create a complex, variable-depth habitat that has been a rich

source of soft-shelled clams and quahogs. The system has had eelgrass in the past, but it is believed that there is none today.

During 2005, total organic nitrogen concentration averaged between 0.27 to 0.36 parts per million, below the goal for eelgrass health. The concentration increases into Mattakeset Bay that receives fresh drainage from Herring Creek. Lower values were found in the Harbor near Chappaquiddick Point and just outside of the system. Similarly, the chlorophyll pigments were at acceptable levels in the system and even lower just outside the system. The inorganic nitrogen to phosphorus ratio indicates that the system is strongly limited by the availability of nitrogen with the exception of the station in Mattakeset Bay where phosphorus was limiting at times. The sample station near the Herring Creek discharge indicates that most of the time, that portion of the Bay was limited by the availability of phosphorus. Water quality in the system varied from good to near undesirable depending on distance from the tidal outlet.

<u>Methodology</u>:
The samples were collected, handled and processed under a Sampling and Analysis Plan that was drawn up as the first task under this project (MVC, 2005 see Appendix B). Samples were collected from a water depth of 8 to 12 inches unless otherwise noted. Field parameters measured with an YSI-85 meter included dissolved oxygen saturation, specific conductivity, temperature and salinity. These parameters were collected at regular intervals of 0.5 or 1.0 meter depending on depth to the bottom. The deep reading was typically collected at approximately 0.5 meters above the sediment surface. A depth-sounding device was used to determine total depth before data collection with the YSI meter to avoid inadvertent contact with the sediment stirring up a silt and organic-matter cloud. Water column transparency was measured with a standard 8-inch diameter Secchi disk with black and white quadrants. Extinction depth was measured over the shaded side of the boat both on the way down and on the return. Station locations were fixed with a Trimble Pathfinder GPS unit and by means of landmarks (often distinctive houses or piers) on shore and distance estimates to the shore.

Samples were collected in 1-liter dark HDPE bottles and placed in a cooler on ice. Upon returning from the sampling round, samples were filtered for particulate organic matter and chlorophyll pigment analyses following methods outlined in the SMAST QA Plan. They were typically shipped out the same day by MV Fast Ferry or transferred directly to the SMAST boat that was sampling on the Vineyard for the return trip to the lab. Sample collection, handling and processing and field data collection are more fully described in Appendix 2.

Lab and field data was evaluated for five parameters considered to provide insights into pond water quality. These include dissolved oxygen saturation, Secchi depth, Dissolved Inorganic Nitrogen (DIN), Total Organic Nitrogen (TON) and total pigment concentration (chlorophyll and phaeopigment).

Sample station locations are shown in Figures 1 through 8 attached in Appendix 1.
<u>Water Quality Framework</u>:
The term "eutrophication" carries a wide range of meaning. It is generally associated with an increase in productivity (the cycling of carbon into living matter) and high concentrations of

nutrients (Wetzel, 1983). The term was devised to indicate the extreme end of a range of conditions in lakes from clear and unproductive to excessively productive on the eutrophic end. Eutrophication in marine waters is characterized by a number of conditions that are undesirable from the human use perspective. These include excess microscopic phytoplankton, sometimes abundant larger aquatic plants, low oxygen levels in the water sometimes to the point of causing a die off of animals, a reduction in the number of species living in the system with a shift from filter feeders (scallops and clams) to detritus feeders like snails and, under extreme conditions, burrowing worms. The eutrophic state can develop under natural conditions where nutrients released from the surrounding uplands enter the pond in quantities that are not flushed out quickly enough and stimulate excessive productivity. The process is hastened by man made nutrients that are released in concentrations far in excess of the natural processes. These nutrients are released from development in the watershed by runoff of stormwater, erosion of soil from farmland, disposal of sewage by septic systems or by treatment facilities and by fertilizers applied to farmland and landscaping. The nutrients are also added from outside the watershed by acid rain that is contaminated through the stack emissions of power plants, manufacturing processes and auto exhaust.

One nutrient that all of these activities release and which is required for plant growth is nitrogen. The other major nutrients required for growth of phytoplankton and algae include phosphorus, carbon, hydrogen and oxygen. Generally, the last three are sufficiently available in coastal waters so that they do not hinder growth of these aquatic plants. In phytoplankton, nitrogen and phosphorus are required in the approximate ratio of 16 to 1 (Redfield, 1963). While other less important nutrients may also affect growth rates, these two are of primary importance and, by their availability alone, usually determine the amount of growth of biomass in the system. In ocean waters, it is generally agreed that nitrogen is the deficient nutrient and phosphorus is usually present in sufficient quantities for growth of phytoplankton (Valiela, 1995). For this reason, marine waters are often described as being nitrogen limited. This means if nitrogen is added to the water, phytoplankton can reproduce to take advantage of the supply and the amount of organisms in the water column can increase until once again limited by availability of nitrogen or another necessary nutrient.

While some increase in the phytoplankton population is not necessarily a problem, with enough nutrients the population can explode. High populations of phytoplankton (often called an algae bloom) cloud the water reducing light transmission. In large numbers, overnight oxygen uptake by these living organisms or the die off and decay of phytoplankton can reduce oxygen levels to the point where other organisms are stressed or killed. This may have occurred in Edgartown Great Pond in 1993, when the oyster population died out following a late summer algae bloom.

Reduced light penetration limits the vigor of eelgrass that requires sunlight, as does any green plant. Eelgrass is an important component of the ecosystem providing cover for bait fish, scallops, tautog, blue crabs and eels as well as food and a substrate for the growth of a myriad of aquatic plants and animals. It also acts as a sediment stabilizer through its dense root system.

While the available light level limits the potential success of eelgrass, both phytoplankton and large macro-algae (wrack algae) are typically limited by the availability of nutrients rather than light (Valiela, 1995). In more marine waters, common wrack algae include *Ulva*, *Enteromorpha* and *Cladophora*. The differing growth limitations set up a situation where, as nutrients are added to the system, phytoplankton and wrack algae increase, reduce the light penetrating to the bottom and cause a decline of eelgrass which may eventually be replaced entirely by macro-algae. The wrack algae however do not fill the role that eelgrass plays as a key component of the shallow, marine habitats. The macro-algae also tend to break loose late in the season or after a storm and gather into large mats which may smother desirable, filter feeding shellfish such as clams, scallops and oysters, encourage detritus (debris) feeders such as snails and, in severe cases, cause anoxia (lack of dissolved oxygen), aquatic animal die off and odors.

Nutrient stimulation of phytoplankton blooms also reduces available light to the eelgrass beds at the bottom particularly where the water depth is 2 or more meters. Nutrients also increase the growth of single cell and chain algae (e. g. diatoms) that grow on the surface of the eelgrass blades further blocking the sun light. Reduced light may stress the eelgrass making it more susceptible to wasting disease or may just reduce its vigor and lead to thinning of the eelgrass and eventual loss of entire beds over time.

Numerous studies of coastal ponds by researchers have concluded that nitrogen loading from shoreline development may have adverse impacts on these waters. Waquoit Bay, Cape Cod, has been thoroughly studied over 30 years (Valiela et al 1990). It is a coastal pond with a fixed inlet through a barrier beach. As residential land use increased in the recharge area, the pond has steadily lost formerly extensive eelgrass beds. The loss was attributed to nutrient loading from septic systems in the watershed (Kennish, 1996).

It seems clear that addition of nitrogen to our coastal ponds will lead to undesirable consequences if it exceeds a threshold known as the loading limit. Interim loading limits have been determined by the MV Commission but establishing final limits is the goal of the Massachusetts Estuaries Project. We should be very concerned at what the future nitrogen loading of the recharge area may do to our ponds. Once the recharge area is built out, it will take about 20 years for the system to reach equilibrium and for the full effect of the nitrogen loading to appear in the pond to which the recharge area contributes groundwater. If the "effect" on the pond is undesirable, changes made to reduce nitrogen loading further back in the recharge area will take another 20 years to reach the pond and reverse the negative impacts. For this reason we need to make every effort to anticipate possible impacts with a conservative limit on nitrogen loading within the recharge area.

Water Column Parameters:

There are key chemical and physical measures that are indicators of the condition of a water body under study. When collected over time, these measures can identify the trophic state of the system. The trophic state of a coastal pond is a descriptive term that indicates the amount of biomass production in the system. The most familiar trophic state is the eutrophic condition that indicates excessive biomass production.

The measures discussed here include chlorophyll pigment(s) that are an indicator of the microscopic algae population in the water column. The depth at which the Secchi disk can no longer be seen is the extinction depth and indicates the amount of light penetration through the water column. The amount of dissolved oxygen is a fundamental necessity for the animals living in a pond. It is affected by the algae population but also by the amount of organic matter that is decaying in the pond. The amount of nitrogen in the water column in all forms indicates whether a system is over- productive and if the nitrogen input from the watershed is excessive.

Although there are many other approaches to characterizing the condition of a pond including population studies of the benthic organisms, distribution and amount of aquatic plants and fish population, these parameters have not yet been evaluated. In examining the data presented for each pond, the rating system devised by the Buzzard's Bay Program (Costa et al, 1996) is helpful. The ratings are summarized in Table 1.

The lab analyses data is included in spreadsheet form in Appendix A.

Table 1: Buzzard's Bay Eutrophication Index (Costa et al, 1996)

Parameter	Zero Score	Perfect Score
Oxygen Saturation (lowest 1/3 observed)	40% saturation or less	90% saturation or more
Transparency (Secchi disk)	0.6 meters or less	3 meters or more
Phytoplankton pigments	10 parts per billion or more	3 ppb or less
Dissolved inorganic nitrogen (DIN)	10 micromolar (0.14 ppm) or more	1 micromolar or less
Total organic nitrogen (TON)	0.6 ppm or more	0.28 ppm or less

In reviewing the charts, we suggest that you apply a *desirable* goal for these water bodies as follows:

- Maintain ratings that are above 60% of the perfect score value for Dissolved Oxygen saturation (i.e. over 54%) and Secchi depth (over 1.8 meters) and
- Less than 60% of the zero score value for pigments, DIN (less than 6 micromoles/liter) and TON (0.38 parts per million) for the growing season.

The application of any rating system to such a diverse group of ponds is prone to misinterpretation. The caveat to the text that follows is that these ratings will change as the amount of specific information we have increases. The ratings may also change from year to year depending on weather, the temperature of the offshore water and other factors not known at this time. The rating system will be refined specifically for each pond during the Massachusetts Estuaries Project study of these systems.

Discussion of 2005 Data:
Figures 1 through 8, showing the sample station locations for each pond, are included in Appendix 1. The data in the tables in Appendix 1 also contains results for ponds that were not part of this grant program. In most cases, sample station maps can be found in documents posted at the Commission's website (mvcommission.org) in the 2003 or 2004 data reports. Data found in Appendix 1 includes lab analyses and field data. SMAST personnel collected multiple samples at some stations including in Lagoon (LGP), Oak Bluffs Harbor (OBH), Vineyard Sound and Tashmoo (TSH). Sampling depths are indicated in the column labeled "sample depth" in the spreadsheet. S indicates surface, M is mid-water column and D is deep. Lab data from this project except for Tashmoo were from samples collected at surface.

Sengekontacket Pond:
Sample station locations are shown in Figure 1. The watershed of Sengekontacket Pond is 4472 acres in the Towns of Oak Bluffs, West Tisbury and Edgartown. This is the area that contributes groundwater to the Pond.
The watershed contains:

- Approximately 1395 residences as of 2003.
- Just over 200 acres of paved roadways.
- Portions of two golf courses.
- 7 acres of green industry.
- About 1700 acres of open space

There could be as many as 2164 residences in the watershed at buildout producing a 55% increase in wastewater discharged into the watershed. Construction of guesthouses could substantially increase this number.
Sengekontacket Pond Physical Character:
Sengekontacket Pond is a shallow, 700-acre coastal salt pond and is connected by a culvert to Trapp's Pond a 44-acre tidal water body. Sengekontacket is vigorously circulated by the tides that average 2 feet in range and produce a flushing rate of about 2.33 days for removal of 95% of the old pond water to the Sound.

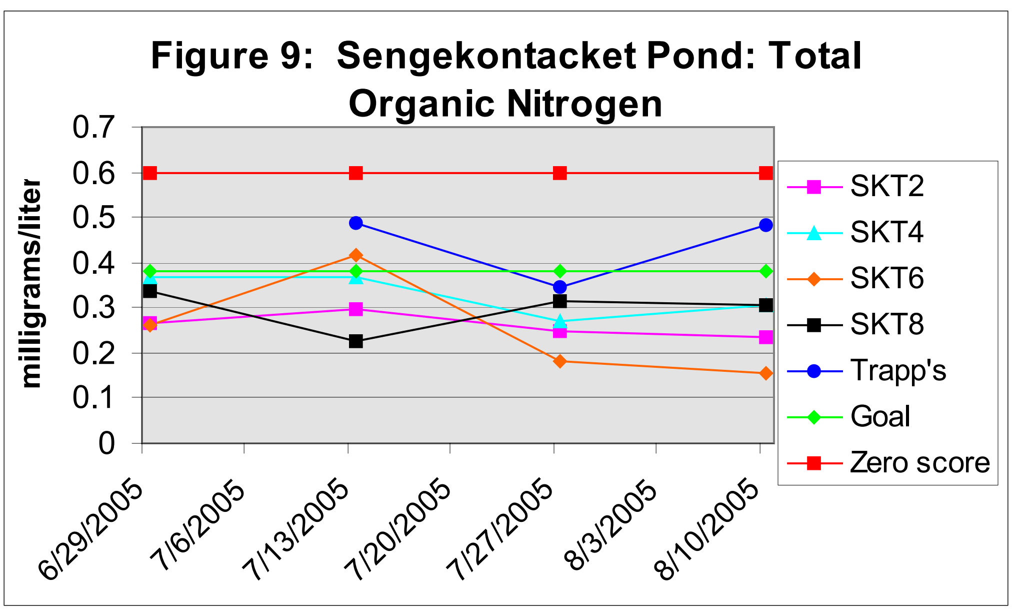
The Pond is marked by an extensive system of relict flood tidal deltas that form a large shoal area that runs from the southern inlet to the north past the mouth of Major's Cove causing the average depth of the Pond to be 0.9 meters or 3 feet (Gaines, 1995). While this area is an important source of soft-shelled clams and quahogs, it is also an obstruction to tidal flow with uncertain consequences. At the southern inlet, the flood tidal delta is bisected by the channel forming Sarson's Island to the north and a subsurface shoal area to the south that was largely dredged and used to nourish the beach in the 1990's. The west side of the Pond is marked by deeper water basins including Major's Cove and three more continuing to the south from there.

The Pond is flushed through two armored inlets. The southern inlet drains about 2/3 of the Pond, drawing water from the area to its south and to the north up to Major's Cove. The northern inlet is a smaller, armored inlet that is prone to sand deposition reducing the effective flow and requiring frequent dredging. Gaines (1995) identified possible "conveyor belt" type water transport into and out of Major's Cove. A shoal area near the mouth of the Cove was identified as a possible obstruction to exchange.

Trapp's Pond drains into the southern end of Sengekontacket by an undersized corrugated metal pipe. From tidal elevation data collected in 2001 (Wilcox, 2002) it is apparent that the culvert beneath Beach Road is inadequate to pass the tidal prism that is available at the Sengekontacket Pond gauge through to the Trapp's Pond side. On the Sengekontacket side, the tide range averages nearly 4 times that on the Trapp's Pond side. Increased tidal exchange should be available by increasing the size of the culvert to permit passage of a larger volume of water during the 6 to 7 hours of each tide. Greater flushing will remove nutrients entering Trapp's Pond more rapidly which should reduce the impacts associated with nutrient excess such as epiphytic slime growth on eelgrass and decline of eelgrass health. The eastern pond has a large watershed containing some significant wastewater flows that have been recently sewered (Dripps & Wilcox, 1999). The eelgrass in this shallow pond is very heavily coated with epiphytes but apparently survives because the water is shallow and the sunlight can penetrate to the eelgrass blades.

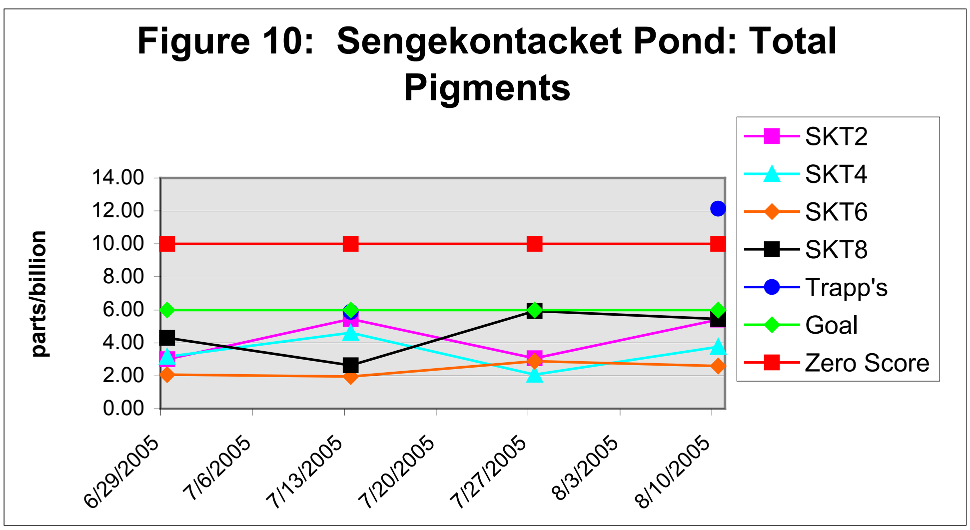
Nearly all eelgrass was lost from Sengekontacket Pond in the late 1980's from an unknown cause. Hempy and Wilcox (1998) speculated that the pattern of the remaining eelgrass, restricted to Trapp's Pond and parts of Major's Cove, implied that wasting disease may have been the cause. The Pond is important habitat for the bay scallop, quahog, soft-shell clam, blue claw crab and eel as well as a nursery for food chain fish important to the sport fishery.

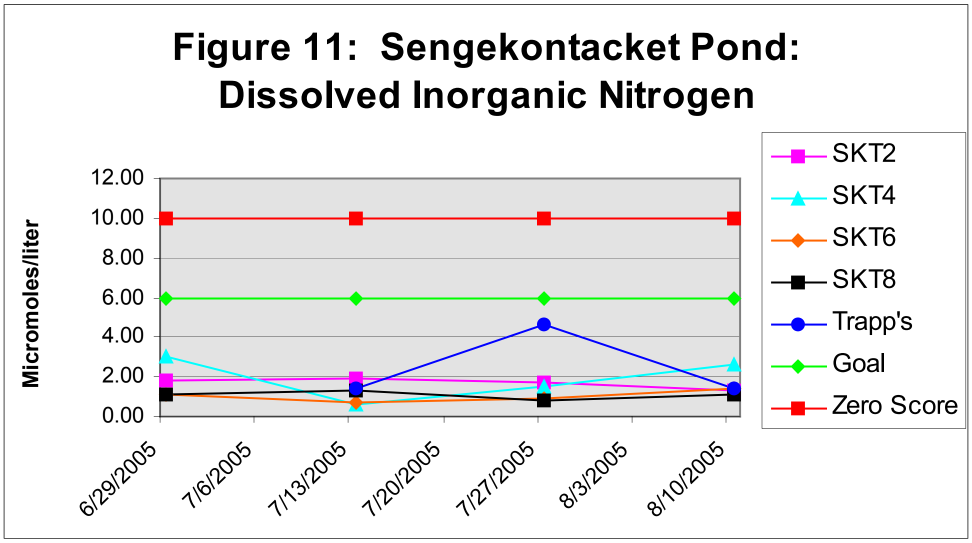
As Sengekontacket is a vigorously circulated tidal Pond, salinity concentrations of about 30 parts per thousand are typically uniform through the system and are not plotted. Total organic nitrogen concentrations are plotted in Figure 9.



The TON concentration for good eelgrass health is below 0.38 ppm (milligrams/liter). During 2005, the concentrations found were mostly below this threshold. Station SKT2 at the north end of the Pond is consistently at a good concentration. Stations SKT4 at the inner end of Major's Cove and SKT 6 in the cove directly opposite the large inlet are variable, approaching or exceeding the limit for good eelgrass health during some portions of the sampling period. On the 0-to-100 scale of the Buzzard's Bay Program, the 2005 ratings varied from the mid-80's in Majors Cove to over 90 throughout the rest of the system (good to excellent water quality). Trapp's Pond had the highest TON values, exceeding the limit for good eelgrass health (rating score of 50- undesirable water quality). Despite the high TON concentration, the innermost pond has a large eelgrass bed that possibly persists due to the very shallow water (less than 1 meter) that allows adequate light.

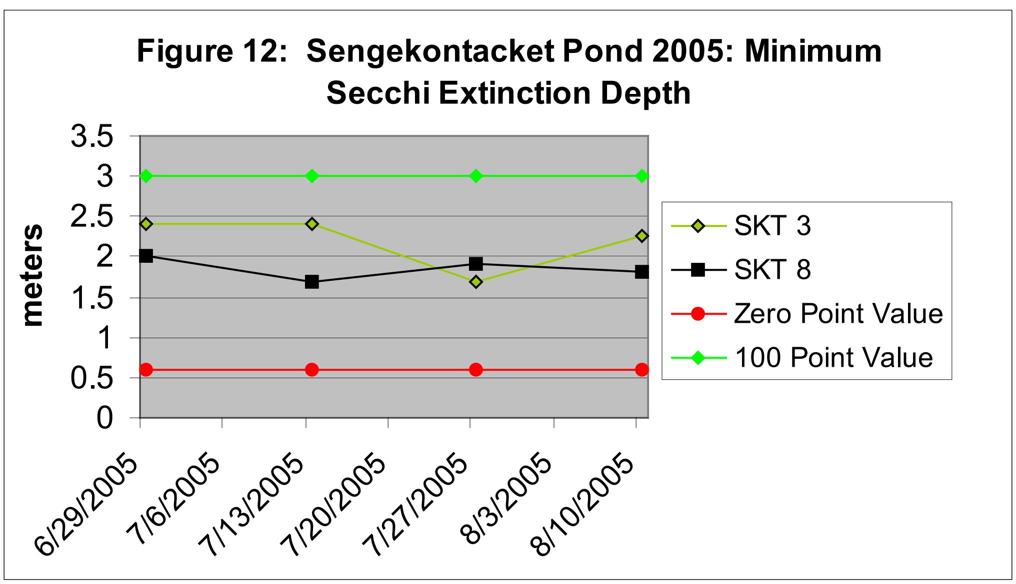
The sum of pigments found in the water indicates the amount of growth at the base of the food chain. The values measured in 2005 were well below (on the good side) the goal for system health. Ratings ranged from a low score of 67 in outer Major's Cove to 100 in the embayments on the west side of the Pond. The exceptions are Trapp's Pond (score of 14) that exceeded the threshold and station SKT8 (off the Boulevard) that was at the limit during August. The mooring area at the Boulevard scored a 77. From observation of the system, it appears that much of the growth driven by the supply of nitrogen in Sengekontacket is focused on large drift algae that grow and accumulate at the bottom in the vicinity of stations SKT2, 3, 6, 7 and 8 rather than on growth of phytoplankton. Drift or wrack algae cause problems by drifting into eelgrass and smothering the plants and by removing oxygen from the water column overnight.



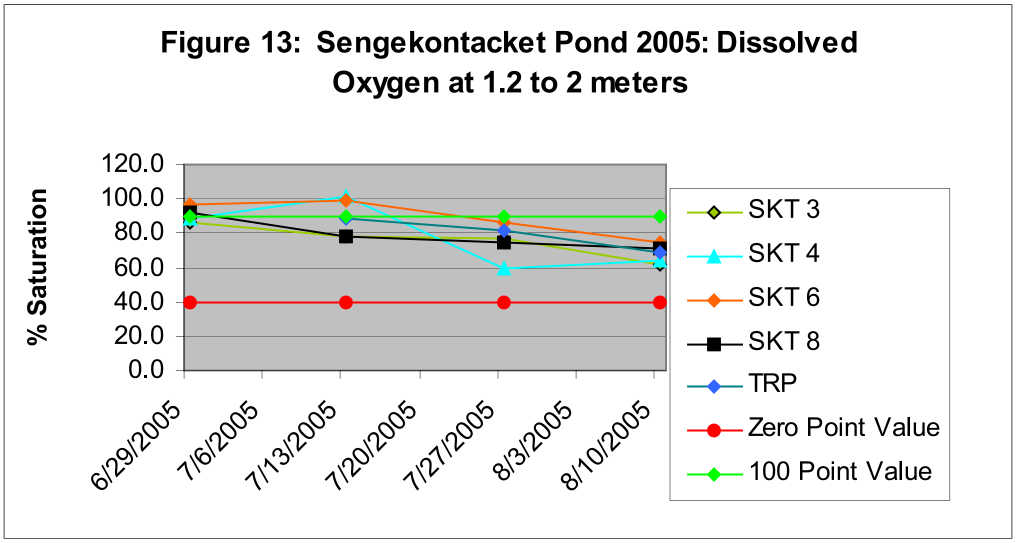


Dissolved inorganic nitrogen is low throughout the Pond. This is to be expected in a Pond that rapidly converts this scarce nutrient into plant biomass. Values are higher at SKT2, at the north end of the Pond, SKT4 in Majors Cove and Trapp's Pond. Ratings varied from 84 (Trapp's) to 100 all in the good to excellent water quality range.

The Secchi depths plotted in Figure 12 are **minimum values** because the disk could be seen on the bottom throughout the sampling period. All we can say is that scores were over 37 throughout the system. The light penetration is believed to be good and correlates with low levels of chlorophyll described in the previous discussion.



Dissolved oxygen in the deeper water remained above 60% saturation that is the minimum desirable value. There is a trend toward lower saturation into August, and, it is possible that the values would have gone below the minimum later in the month and into September. Buzzard's Bay Eutrophication Index ratings varied from a low of 71 at SKT3 in Major's Cove to a score of 100 at SKT5 and SKT7 (acceptable to excellent water quality).



Farm Pond:
Sample station locations are shown in Figure 2 In Appendix 1. Farm Pond is a 33-acre tidal pond that is connected to Nantucket Sound by a culvert under Beach Road. The watershed is approximately 450 to 500 acres in extent and includes a portion of the Farm Neck Golf Club, a portion of the now-capped Oak Bluffs Landfill, the grammar school and a densely developed residential area around Waban Park.

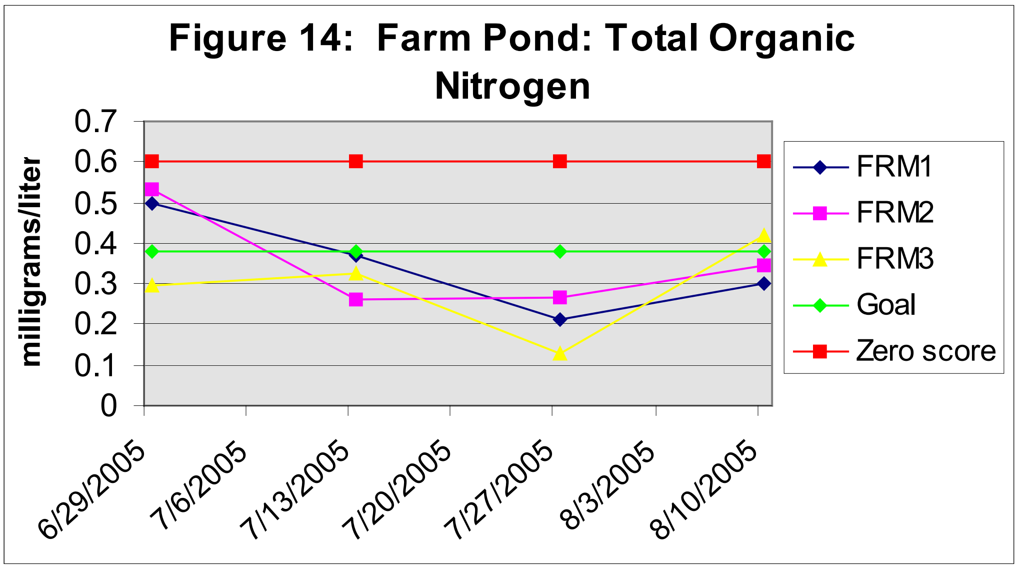
Farm Pond Physical Character:
The tidal signal is severely reduced in transit through the 4-foot diameter culvert beneath Beach Road. An approximate 2-foot tide range in Nantucket Sound is reduced to 0.5 feet within the Pond (Kelley, Applied Coastal Engineering, 2006). The volume of the Pond at mid-tide was determined to be 5.167 million cubic feet and the tidal prism to be 0.738 million cubic feet producing an estimated time for 50% tidal exchange of 3.6 days (Kelley, 2006). Enlarging the culvert to 16 feet or 24 feet would result in an increase in tide range to 1.1 feet and reduce the residence time to between 1.2 and 1.4 days.

In 1998, the Pond contained a significant eelgrass bed in the southern two thirds. No eelgrass was found north of Wood Island. Eelgrass was noted at the northern end in 2004 indicating some improvement in water quality condition in the six-year period. The eelgrass is heavily coated with epiphytes and was considered to be at some risk (Hempy and Wilcox, 1998). During late summer 2006, eelgrass was found throughout the system although very sparse in the center of the Pond (Wilcox, personal observation). It probably continues to thrive mainly because the Pond is so shallow that sunlight remains adequate despite the heavy fouling (most is less than 4 feet deep).

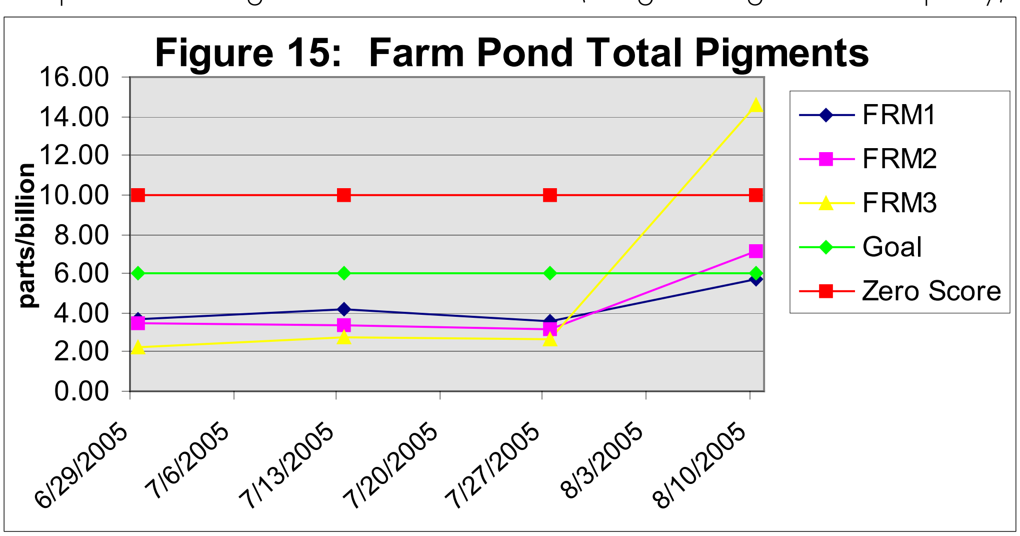
In 2000, a large, direct stormwater discharge was eliminated by infiltrating the runoff further up in the watershed. Data collected before and after revealed that, for the storm studied, the infiltration capacity reduced the discharge to zero (Wilcox, 2002). A portion of the watershed was sewered in 2002. The treated wastewater is now infiltrated in Ocean Park.

The infiltration of treated wastewater in Ocean Park was predicted to increase the watershed area at the north end of the Pond to a limited degree (Horsley and Witten, 1998). At this time the net effect in terms of nitrogen loading is not clear as part of the service area is within the watershed and part of the added watershed is not sewered.

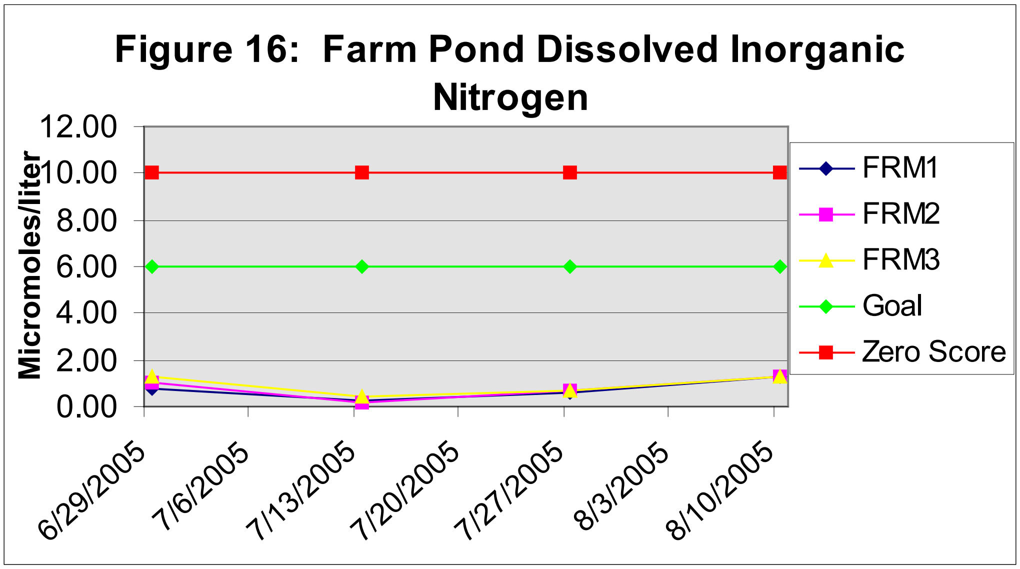
Total organic nitrogen concentrations are higher than desirable in late June but remained below the threshold of the undesirable water quality rating during the remainder July and early August. The Buzzard's Bay eutrophication score ranged from 78 to 97 (acceptable to excellent). This is a significant improvement over 2004 and 2003.



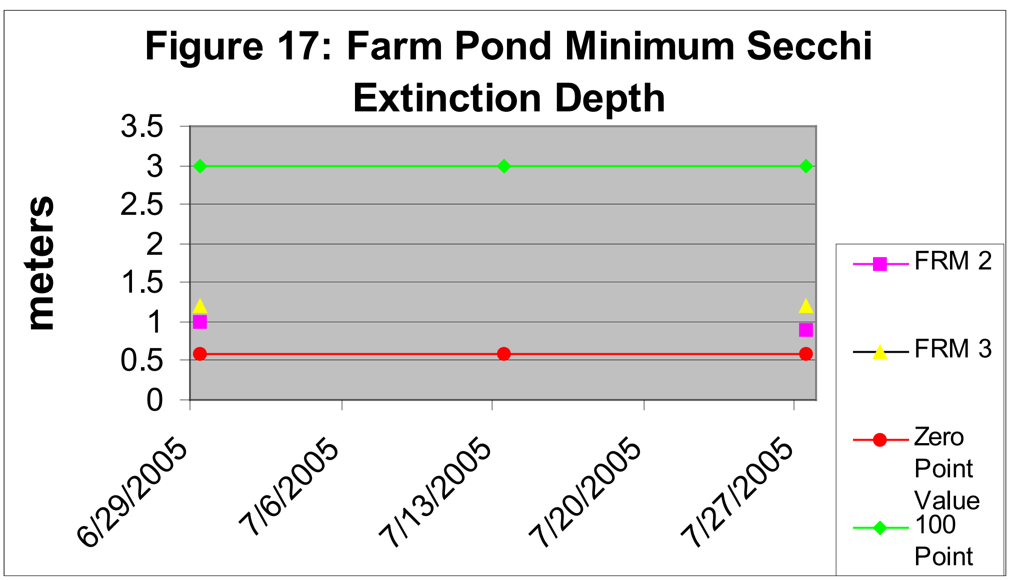
Chlorophyll pigment concentrations are acceptable through July but higher than desirable during the late June and early August sampling rounds. It is possible and even likely that the pigment content of the water column would have continued to exceed the desirable concentration if sampled later in August and into September. Eutrophication ratings varied from 63 to 82 (marginal to good water quality).



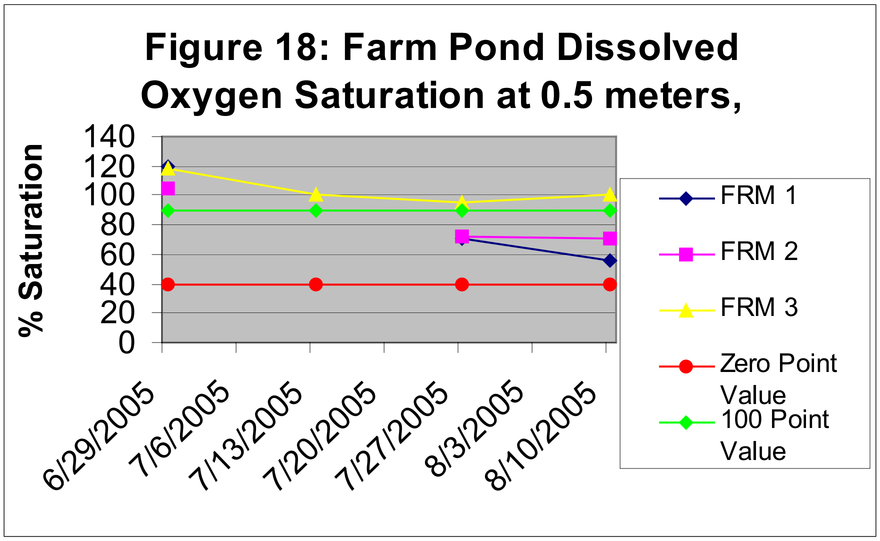
Dissolved inorganic nitrogen concentrations were low during 2005. This is in part a reflection of the rapid uptake and conversion of this nutrient to organic nitrogen and phytoplankton that is plotted in Figures 14 and 15. The ratings for the DIN values are 100 at all stations.



Secchi disk extinction depth readings could not be collected because the disk was visible on the bottom throughout the study period in the deepest areas of the Pond. The minimum Secchi values are plotted in Figure 17.



Dissolved oxygen saturation was well above the 60% minimum acceptable value throughout the study period at FRM3 at the south end of the Pond possibly reflecting the release of oxygen from extensive eelgrass beds found there. The saturation values at the other stations are near the minimum desirable target during August. The Eutrophication ratings ranged from 84 to 100 (good to excellent water quality).



Tashmoo:

Sample station locations are shown in Figure 3. Tashmoo Pond is a 270-acre tidal pond situated on the north shore of Martha's Vineyard. It has a mean depth of 1.3 meters (4.25 feet) but reaches maximum depth in excess of 4 meters (12 feet) below mean sea level. The tide range is 0.61 meters (2.0 feet) (MVC, 2003). The Pond is flushed through a man-made channel to Vineyard Sound that is stabilized by stone groins but requires regularly dredging. Approximately 3.2 days are required to exchange 95% of the water in the system with Vineyard Sound.

Fresh water enters the pond at its southern end from a 0.5-acre fresh pond connected to the main body of the pond by a herring run as well as springs. This pond is filled by significant groundwater fed springs. The discharge from the herring run out of this freshwater system is 0.27 million gallons per day (Samimy, 2004).

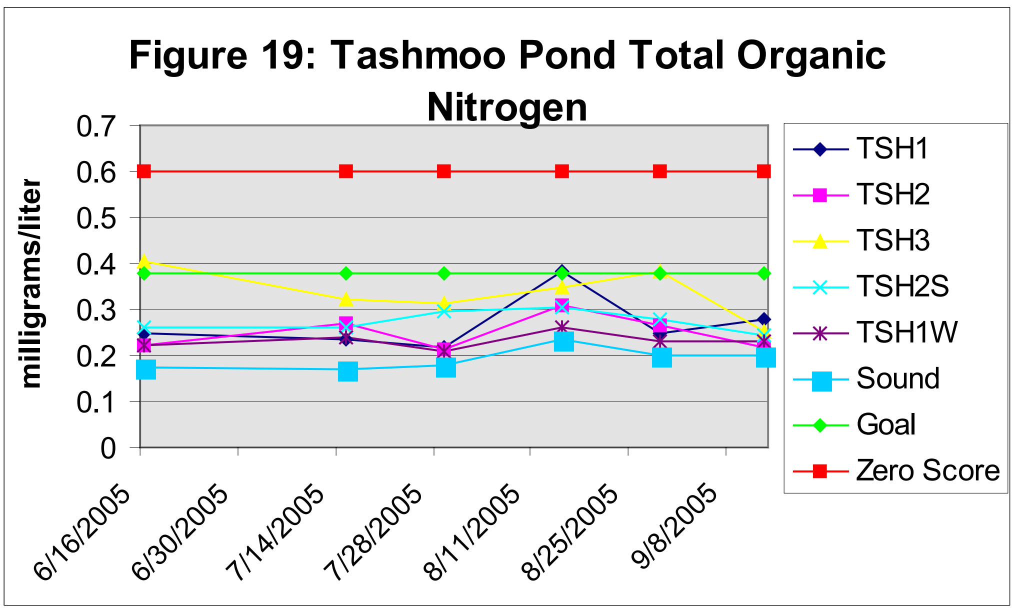
Primarily seasonal residences surround the pond on lots ranging from over 3 acres on the west side to under ¼ acre on the east side. There are two small farms on the west side, limited portions of which extend to the pond shore. The watershed also includes year round residential as well as commercial uses.

Various algae such as Fucus (rockweed), Codium, and numerous red, green, and brown filamentous algae grow on rocks at the edges of the pond, in the shallows on various substrates, and as epiphytes on the eelgrass. The area of eelgrass beds in the system has declined by 42 % between the 1995 and 2001 mapping projects carried out by the Department of Environmental Protection (Costello, 2005). The Pond is a potential source of bay scallops but has not been commercially productive recently. Some soft-shelled clams and quahogs are produced from the system. A herring run to the Upper Tashmoo Pond was restored and enhanced in 2004.

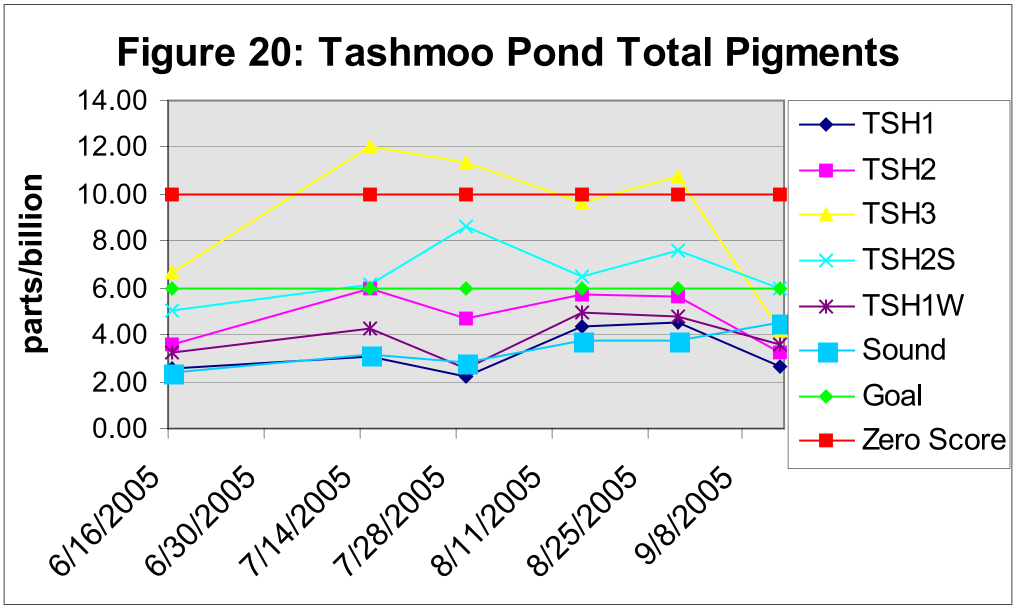
The Pond is marked by a large flood tidal delta at the north end that is bisected by the channel. To the east and west of this shoal, there are additional shoals created by wave overwash and/or relict flood tidal deposits. The Pond deepens dramatically toward the mid point in the north-south direction where there is a large mooring field. The pond harbors over 130 boats in the summer, and is host to hundreds of resident geese, ducks, cormorants and waterfowl.

Total organic nitrogen concentrations are plotted in Figure 19. A station located in Vineyard Sound is included in this dataset that was collected by SMAST personnel. The Vineyard Sound sample is a good indicator of the background concentration for the parameters reported here from Tashmoo and is a good measuring stick for the data reported in the other ponds.

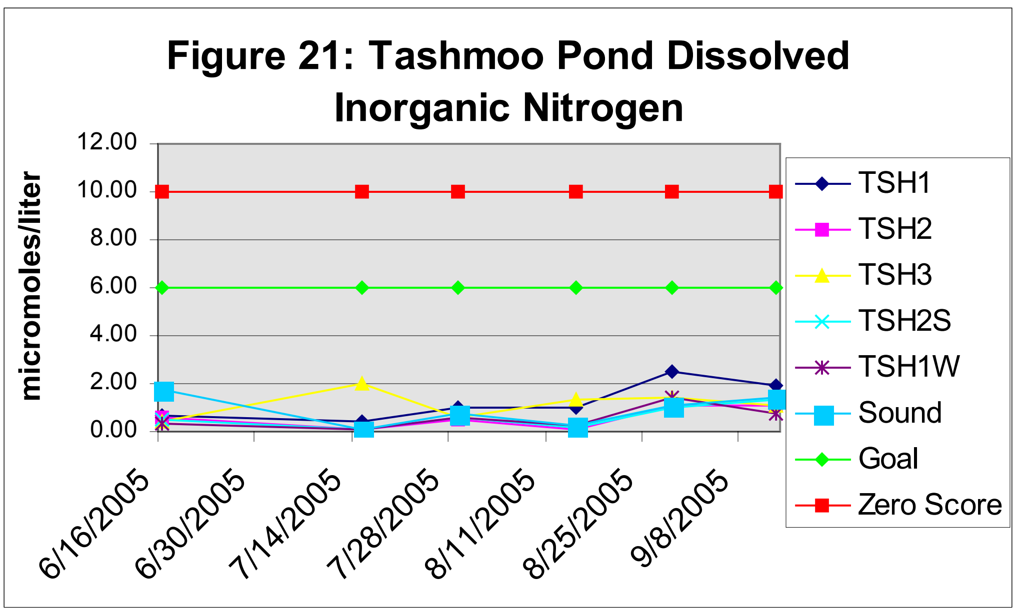
The TON levels were mostly in the desirable range during 2005 in Tashmoo and only approached the limit for eelgrass health at times. There is a clear pattern to the TON concentrations. Station TSH3, furthest into the Pond, had the highest concentration during the sampling period. Station TSH1 and TSH1W had TON values only slightly above that found in the Sound. Eutrophication ratings were dramatically improved over 2003 and 2004 with all stations except TSH3 scoring a 100. The 81 score for TSH3 is a good one for this location.



The concentration of chlorophyll as indicated by the total pigments plot is high and exceeds the poor water quality threshold at two stations over the course of the summer. The data indicates a significant increase in phytoplankton over the Vineyard Sound level. The same pattern of higher values further into the Pond system found with TON is clearly seen with the pigments. The Eutrophication rating score was 13 at station TSH3 but improved to 74 at station TSH2 (acceptable water quality). The wide variation in water quality demonstrated by the huge difference in the scores underlines the system's dramatic change in water quality from points north of TSH3 and those south of TSH3.



Dissolved inorganic nitrogen concentrations in the main body of the Pond are very similar to those found in Vineyard Sound as a result of rapid uptake and conversion into organic matter (TON and pigment values are high). These concentrations score over 90 (excellent water quality) on the Eutrophication Index scale.



Secchi extinction readings and dissolved oxygen data were not available from SMAST.

<u>Cape Poge Pond</u>:
Sample station locations are shown in Figure 4. Cape Poge Pond is a 1520-acre tidal pond that is a highly productive source of bay scallops for the Town of Edgartown. The Pond has extensive eelgrass beds in those areas where sunlight penetration is good. It also produces

soft-shelled clams and quahogs. It is connected to Pocha Pond by way of a 95-acre water body called the Lagoon (Gaines, 1998).

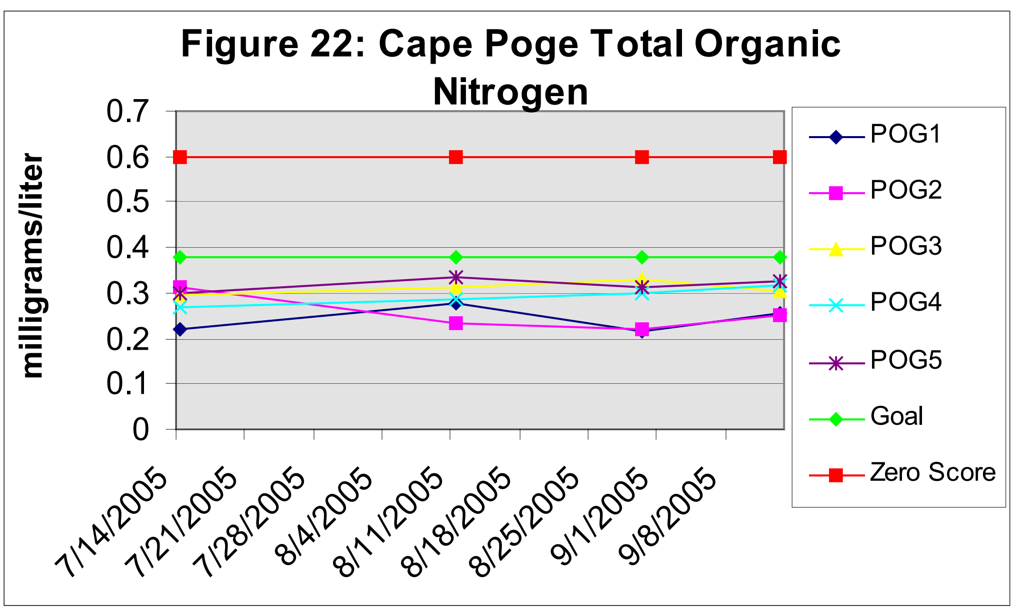
Prior to 1992, the Pond produced over 10,000 bushels of bay scallops annually. From 1993 through 1998, the yield was 4,000 or less. The harvest has picked up somewhat since then with yields of 7500 or more bushels in 1999, 2001, 2002 and 2003.

The Pond has a tide range of about 2 to 2.25 feet (Wilcox, 2000, unpublished data). Gaines (1998) reports that about 1/3 of the pond is over 2 meters in depth and 2/3 less than 2 meters.

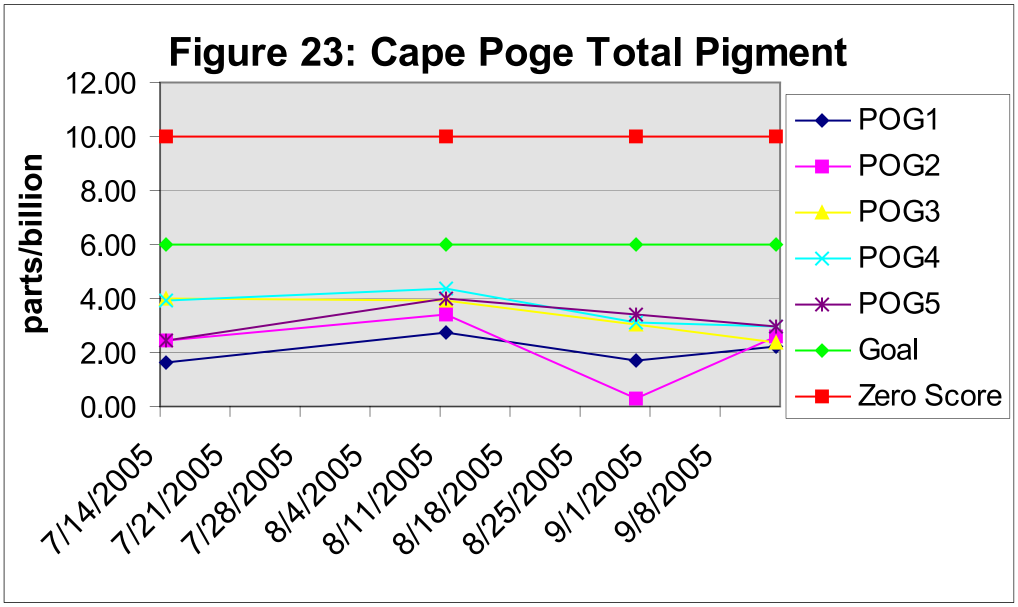
The watershed for the system as a whole (including the Lagoon and Pocha Pond is about 1480 acres of upland, 350 acres of barrier beach and 468 acres of salt marsh (Gaines, 1998) and includes low and moderate density residential development.

The Pond is divided into two main basins by Oliver Point, a low sand bar that extends about half way across the Pond. Both areas have deep water in excess of 5 meters (15 feet). There are a limited number of seasonal moorings in the Pond. Shear Pen Pond is located along the northeastern portion of the Pond. It is a circular shaped pond, possibly a kettle hole that is surrounded by barrier beach and marsh and separated from Cape Poge by a shallow bar. Water depth in Shear Pen is also over 5 meters (15 feet).

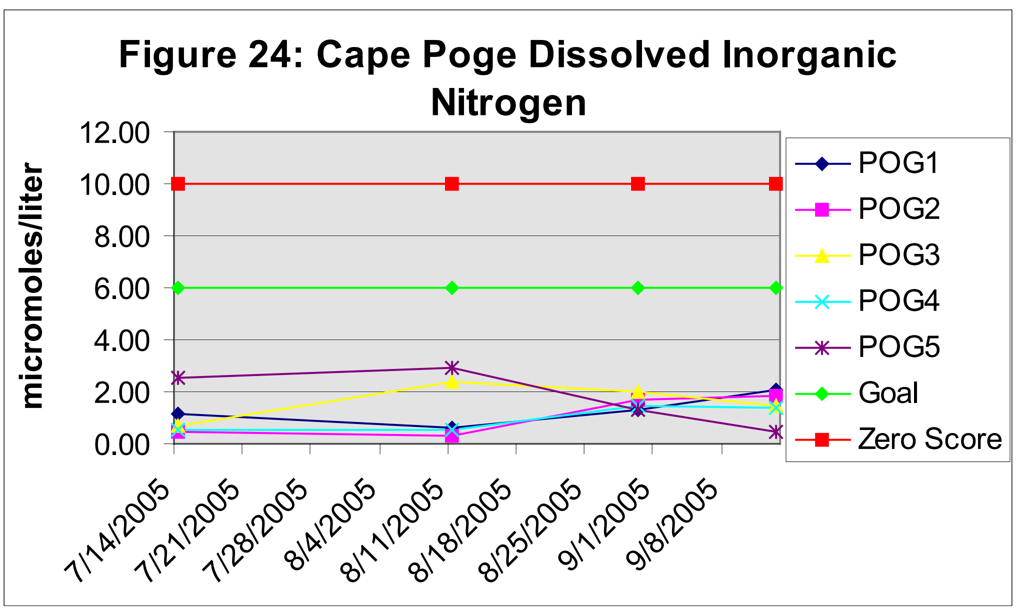
TON concentrations show a pattern of increasing from the outlet (POG1) toward the point where Pocha Pond water enters the system (POG5). All values cluster below the 0.38 ppm threshold to poor water quality. Eutrophication Index scores were over 87 at all stations with the lowest value found at the outlet from Pocha Pond. The scores represent a significant improvement in water quality over 2004.



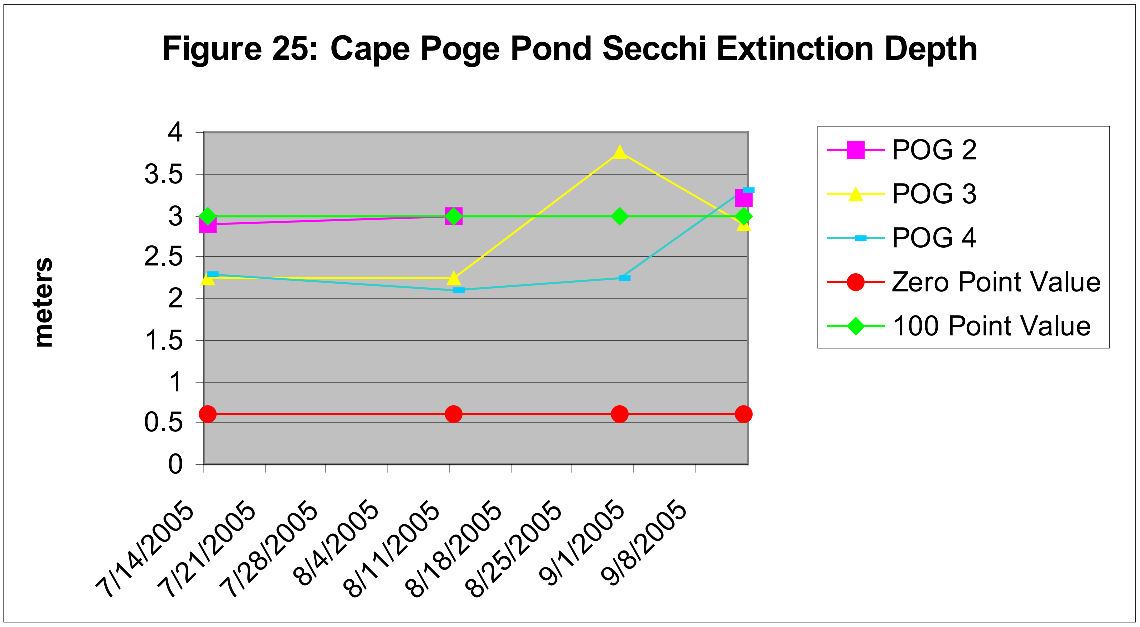
Chlorophyll values, as indicated by the plot of total pigments represent good water quality with eutrophication scores over 90 at all stations.



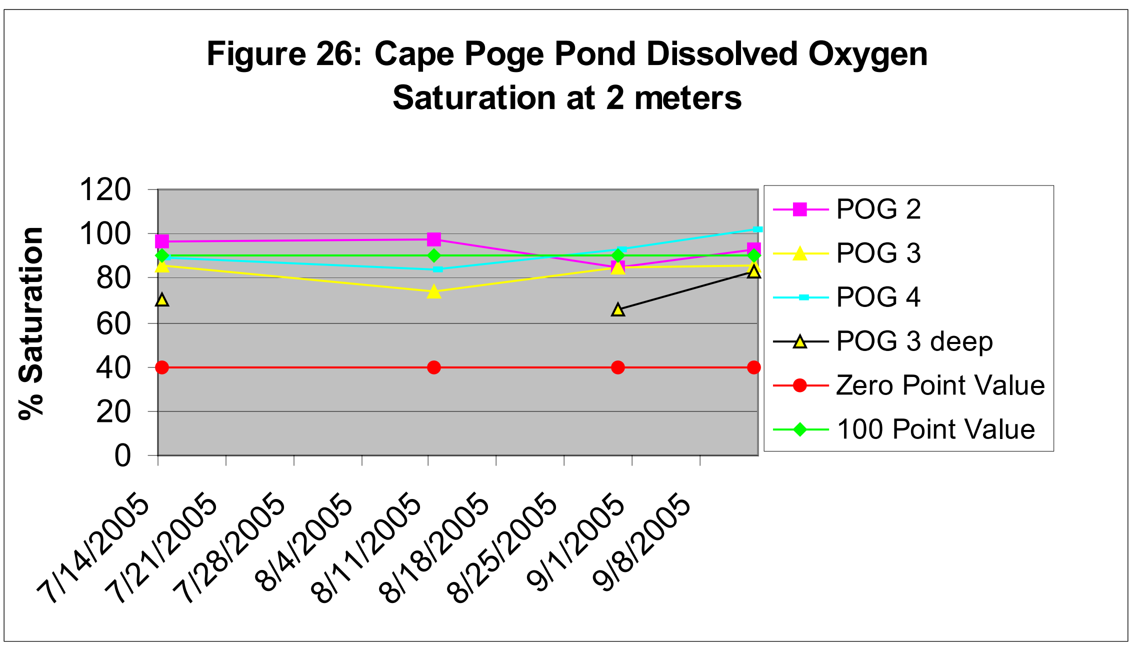
Dissolved inorganic nitrogen values are low throughout the course of the sampling program. For most of the sampling period, the concentrations are very near the value attributed to the highest water quality. The concentrations follow a pattern of higher concentrations proceeding into the Pond and toward the outlet from Pocha Pond. Eutrophication scores were over 90 at all stations (excellent water quality).



Secchi extinction depth values are near or above 2.5 meters at POG 2, POG3 and POG 4. The transparency values increased toward early September. These are good values and reflect the low concentration of pigments and total organic nitrogen. The Eutrophication scoring varied from 100 (excellent) at POG2 in the north basin to 79 (acceptable) at POG4 in the south.



Dissolved oxygen values show a trend toward lower values proceeding away from the inlet to the Pond and moving into the system (from POG2 to POG4). POG3 saturation (in Shear Pen Pond) is lower and approaches the minimum desirable value in the deep water. The eutrophication rating scores at POG 2 and 4 were 100.



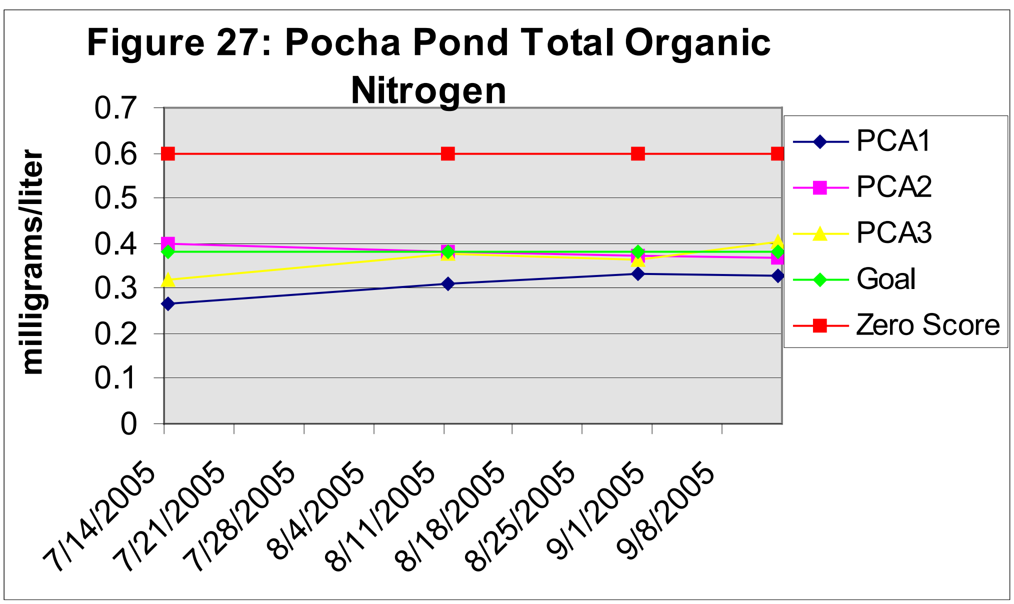
Pocha Pond:

Sample station locations are shown in Figure 5. Pocha Pond is a 115-acre tidal water body that is connected with Edgartown Outer Harbor and Nantucket Sound by way of a narrow elongate water body (the Lagoon) and Cape Poge Pond. The Pond is fringed by salt marsh that is particularly extensive on the inland side (300 acres, Gaines 1998). At one time, it was a fresh water body that was separated from the northern half of the Lagoon by a dike where herring access was provided. The dike was breached in 1949 producing an enormous set of scallops the following year. Unfortunately, this bonanza did not last and recently only a limited number of scallops are found in the Lagoon and virtually none in Pocha Pond itself.

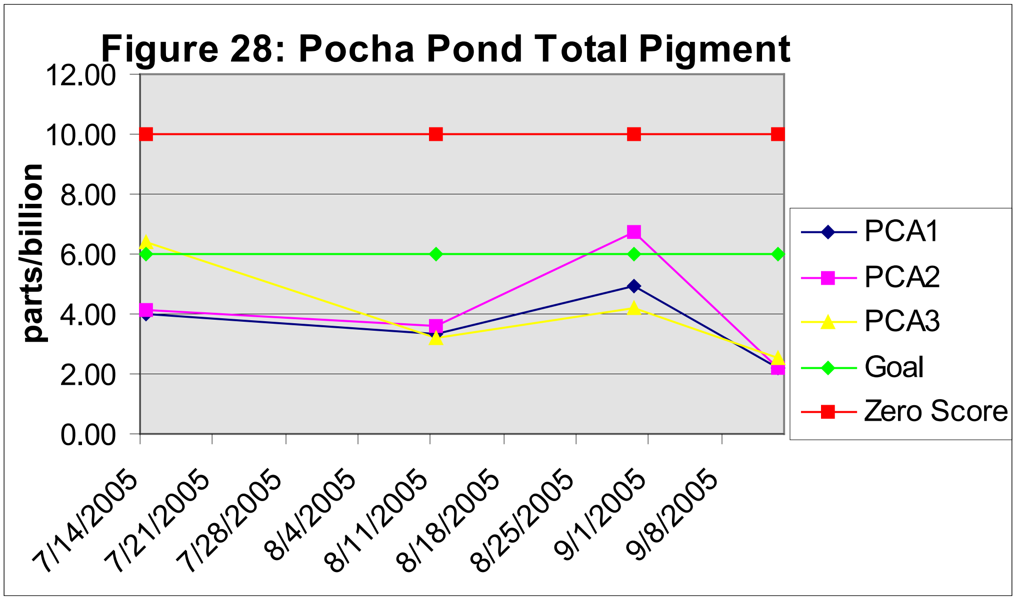
The Pond watershed is low density residential on average but higher density in the area known as the Enos lots and toward the Wasque end of the Pond. A horse farm including hayland and pastureland is also within the watershed. The Trustees of reservations, the MV Land Bank and Sheriff's Meadow Foundation own substantial open space within the watershed.

Bottom sediment in the majority of the system is highly organic muck, becoming sandier toward East Beach, the north-to-south barrier beach that separates the Pond from Nantucket Sound. The Pond is less than 2 meters in depth throughout and probably averages somewhat less than 3 feet. The Pond produces some blue mussels and limited amounts of soft-shelled clams and quahogs. The Lagoon is deeper and with more vigorous tidal flow supports bay scallops. There are large numbers of sponges in the Lagoon north of the Dike Bridge. Eelgrass is not known to exist in the system.

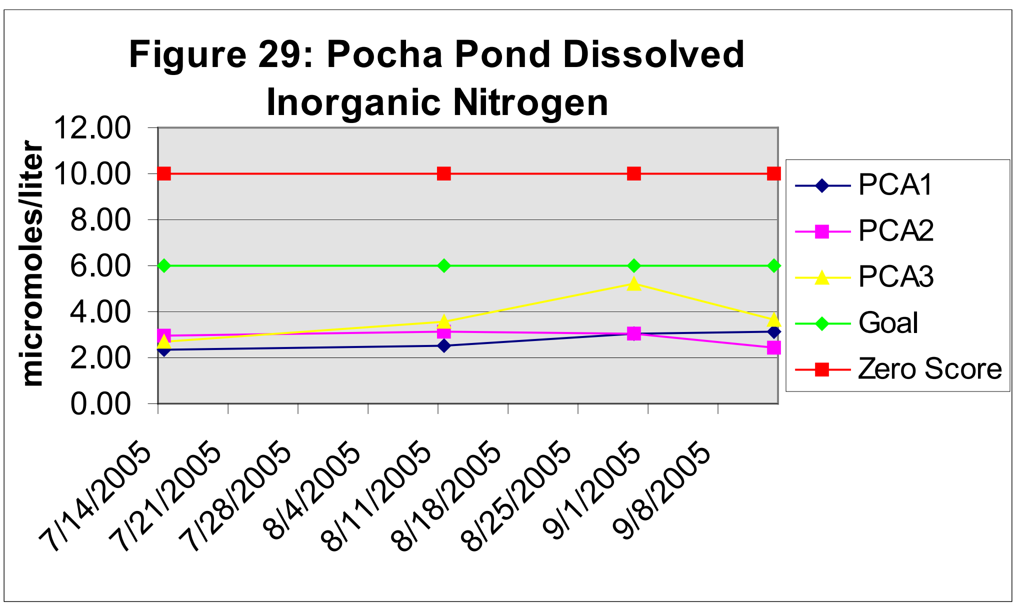
As in most of the other Ponds, Pocha Pond had much improved water quality in 2005. Total organic nitrogen concentrations in Pocha Pond are just higher than desirable levels at times at PCA2 and PCA3 showing a weak increasing trend proceeding from the Dike Bridge (PCA1) and moving further into the pond system. The average TON concentrations score 91at PCA1 (excellent) and in the low 70's (acceptable) at PCA2 and 3 on the Eutrophication Index scale.



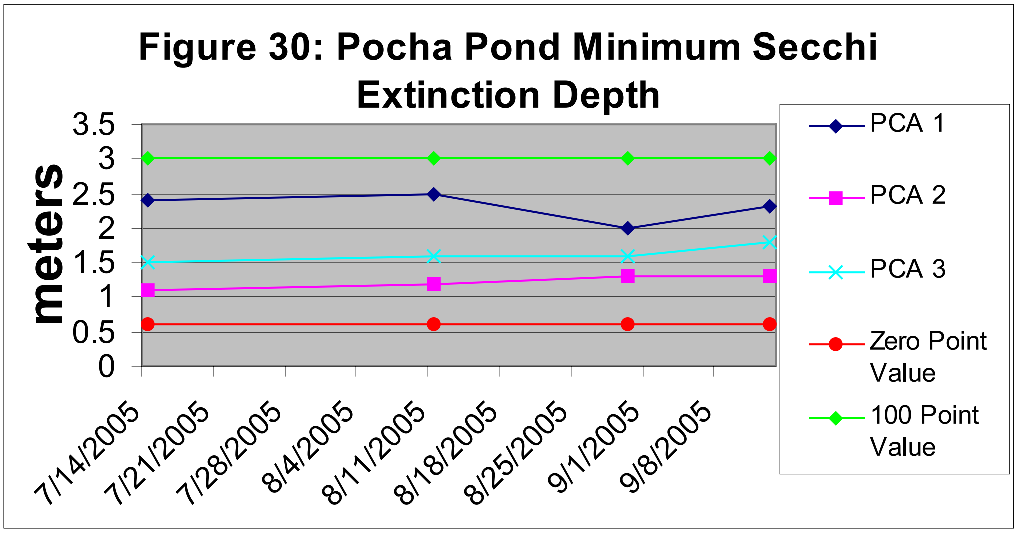
The concentration of chlorophyll found in the water column is not high and only exceeds the desirable water quality limit by a limited amount at PCA2 and PCA3. The Eutrophication Index scores are from 84 to 91 (good to excellent) at the three sampling stations. The particulate carbon content in the water column in Pocha Pond was only slightly higher than that found in Cape Pogue.



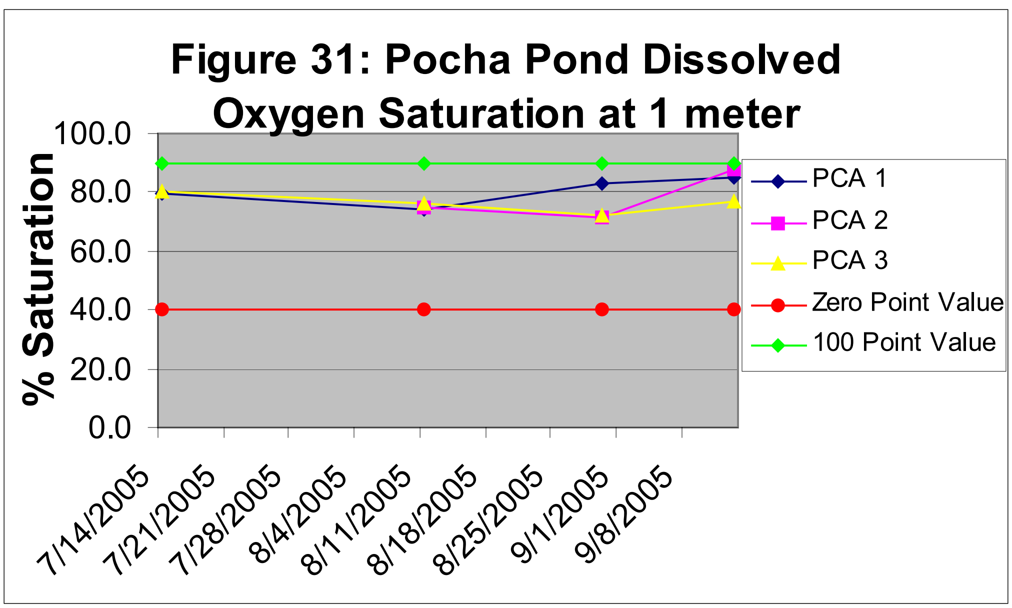
Dissolved inorganic nitrogen concentrations are low and meet or exceed the good water quality concentration throughout the sampling period. These values score 69 to 80 on the Eutrophication Index scale (marginal to acceptable water quality) with a decreasing score for stations located further into the system.



Secchi extinction depth readings could not be acquired during the course of the study because the water was not deep enough. A single reading was collected at 2.25 meters at station PCA1 on July 14. This is a good reading and supports the good water quality rating derived from the other parameters. The minimum readings indicate scores that are above 43.



Dissolved oxygen saturation remained above the minimum acceptable saturation of 60% during the course of the study. However, the order of sampling proceeded from Cape Pogue to Pocha Pond and it is likely that increasing sunlight in a shallow pond was increasing the values recorded above what were the lowest values overnight. These saturation levels rate a score of 73 to 80 on the Eutrophication Index scale (acceptable to good water quality).

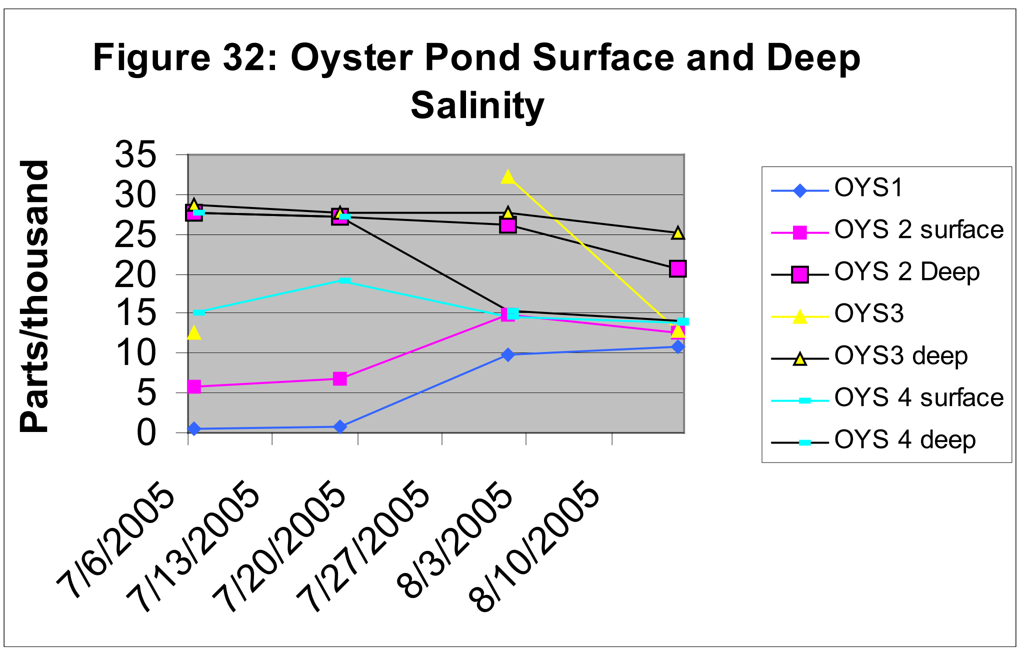


Oyster Pond:

Oyster Pond is a south shore great pond that is breached to the Atlantic 2 to 4 times each year as are the others (Edgartown Great, Tisbury Great and Chilmark ponds). It may remain tidal from a few days to a few months depending on the weather as it determines wave action along the south shore. The Pond is approximately 190 acres in area. It is believed to be a drowned, post-glacial erosional valley, cut by sediment sapping of springs fed by melting glacial ice. It is elongate in the north-south direction and the northern portion is separated into two basins by subsurface bars that bisect the Pond extending out from subaerial sand spits. Sample stations are shown in Figure 6.

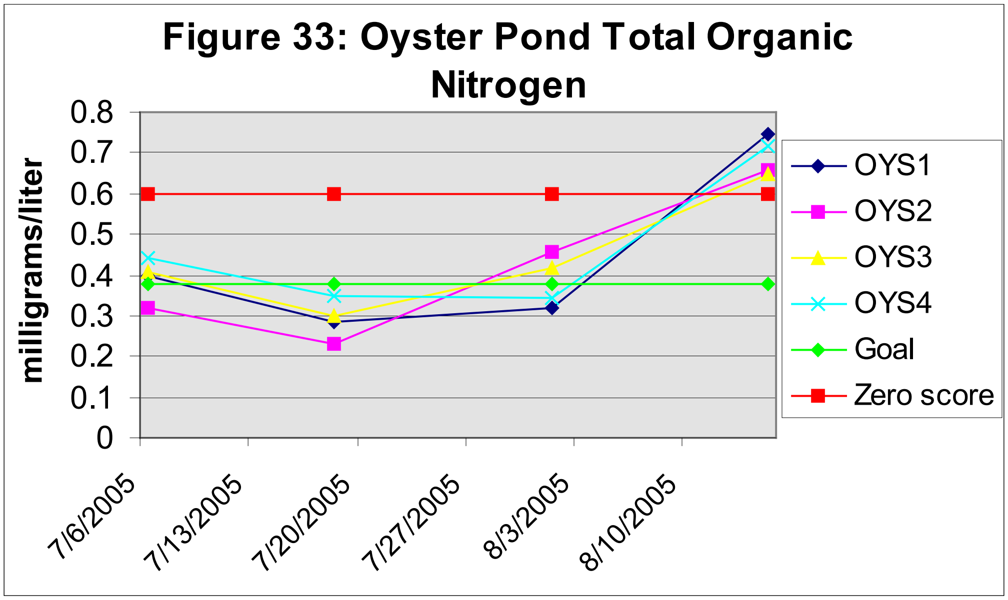
Water quality samples were collected in 1995 from the Pond. Data indicate that during that time, the northern end of the Pond was phosphorus limited (dissolved inorganic nitrogen to orthophosphate ratio well over 16). Over the same time frame, the sampling station in the middle of the north-south length of the Pond was generally nitrogen limited. At this station, specific conductivity rose to 25 to 30 milli-Seimens from mid-July to mid-August in response to a June inlet to the ocean and then declined to about 15 mS as the inlet closed and the system freshened. Chlorophyll pigment content was always less than 6 micrograms per liter.

The Pond was tidal early in the 2005 sampling program. This resulted in significant horizontal (from station to station) as well as vertical stratification. The Pond closed to the ocean in late July and the salinity values dropped at the stations nearest the inlet (OYS3 and 4) over the course of the last two sampling rounds. The salinity values actually increase at stations OYS 1 and OYS2 after the inlet closed as the Pond mixes. At the same time, the stratification breaks up after the inlet closed at OYS4 but continues at OYS2 and OYS3.

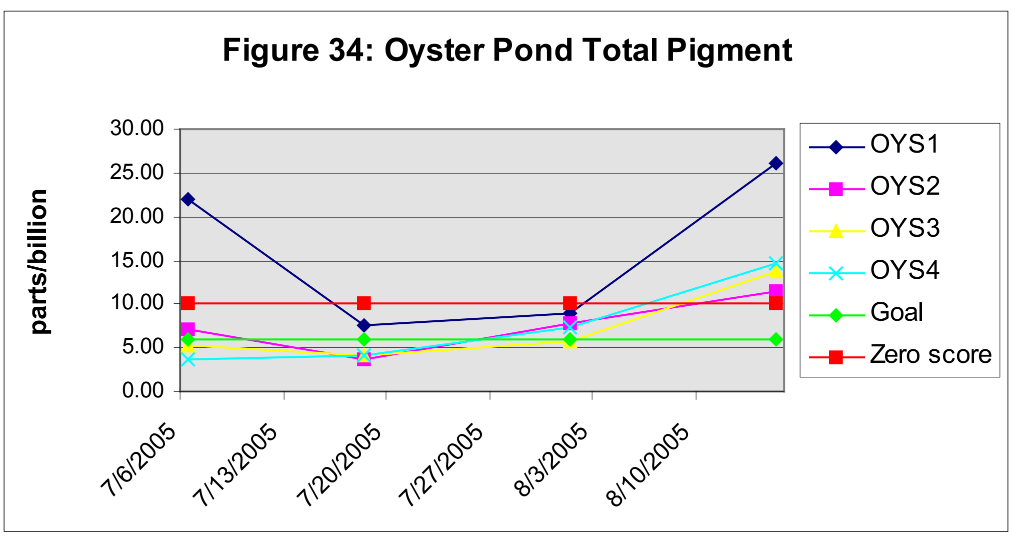


Salinity stratification can set the stage for low dissolved oxygen in the deeper water because the water column is stable and the deep water does not circulate up to the surface and becomes isolated from the air.

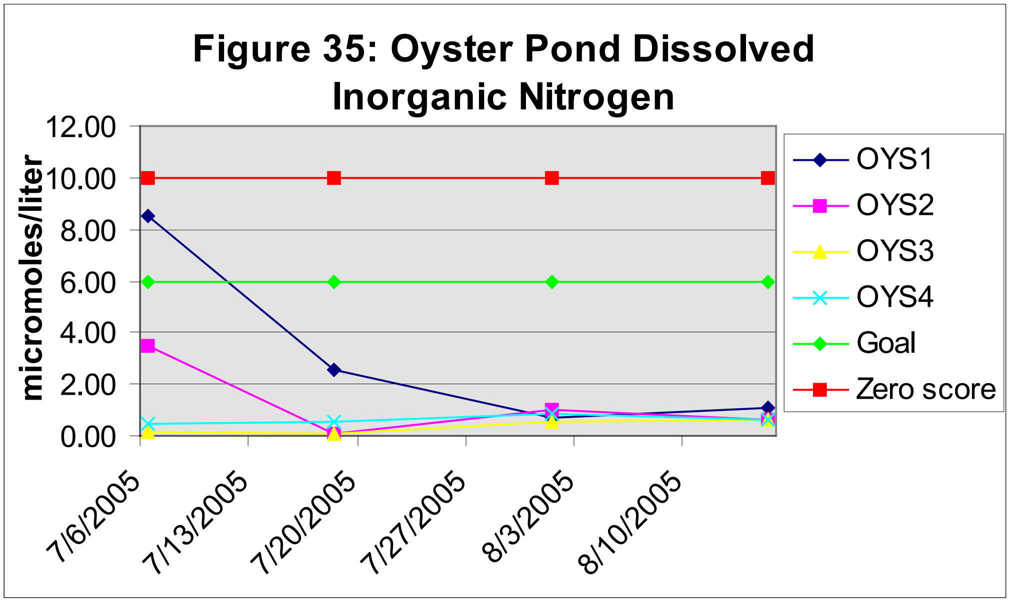
The total organic nitrogen (TON) concentration was at or below the desirable concentration of 0.38 ppm while the Pond is tidal but increases significantly after the inlet closes. One hypothesis is that while the Pond is open to the ocean, groundwater discharge increases to a lowered pond, adding nitrogen to the system. As long as the pond is tidal this extra nitrogen is circulated out to the sea. When the inlet closes, the nitrogen that is converted into biomass accumulates producing higher values of TON and pigments and lower water quality. The average TON values score an undesirable eutrophication rating ranging from 44 at station OYS4 to 56 at station OYS2.



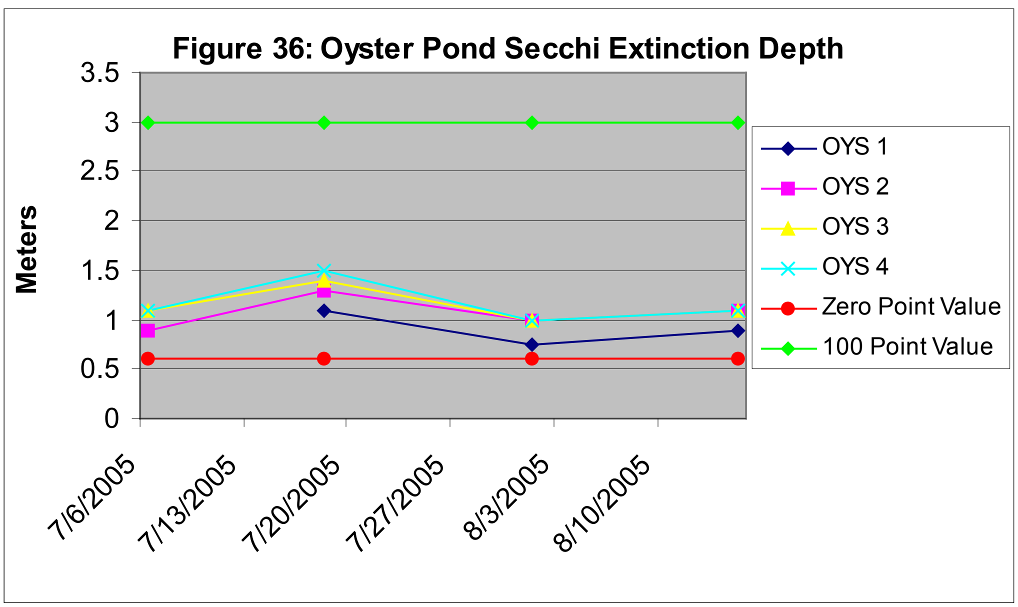
The pigment concentration found in the system is plotted in Figure 34. The general pattern is similar to the TON, increasing after the Pond closed to the ocean. At the time of the August 1 sampling, all stations are at or above the desirable concentration. By the August 15 sampling, all stations exceed the poor water quality threshold. The average pigment concentrations over the summer are undesirable, scoring a zero at station OYS1 and between 36 and 40 at the other stations.



While the Pond is open to the ocean there is a strong pattern of increasing inorganic nitrogen the further away from the inlet the sampling point is located. The concentration drops to very low values as this nutrient is converted into TON and phytoplankton biomass. The average values for inorganic nitrogen score a 76 (acceptable) at station OYS1, reflecting the dominance of fresh water (carrying nitrogen) at that end of the system and 96 to 100 (excellent) at the other stations.



During the 2005, sampling season Secchi depth was greatest nearer to the inlet and was lowest further away although the values did not vary by a large amount. While above the zero score value, the depths were less than the desirable goal of 1.8 meters or more.



The average of the summer readings score 20 to 24 on the eutrophication scale.

Dissolved oxygen concentration in the deep water declines steeply following the closure of the inlet ending at values well below the 40% saturation stress level for marine organisms.

As these readings were collected mid-morning, the overnight low saturations would likely have been even lower. The average of the lower readings score a zero in the deep water at stations OYS2 and OYS4 and an 81(good water quality) at station OYS3.

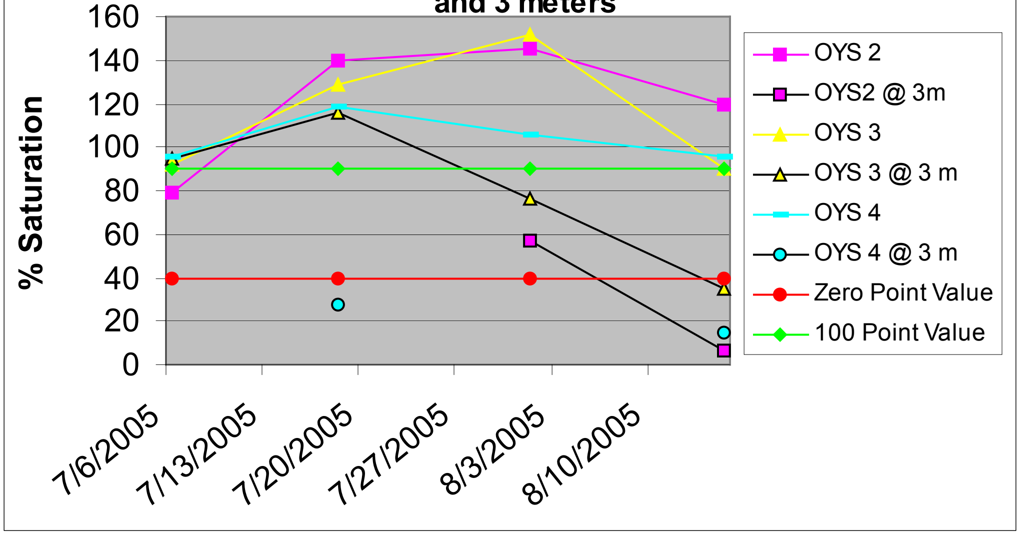


Figure 37: Oyster Pond Dissolved Oxygen Saturation at 2 and 3 meters

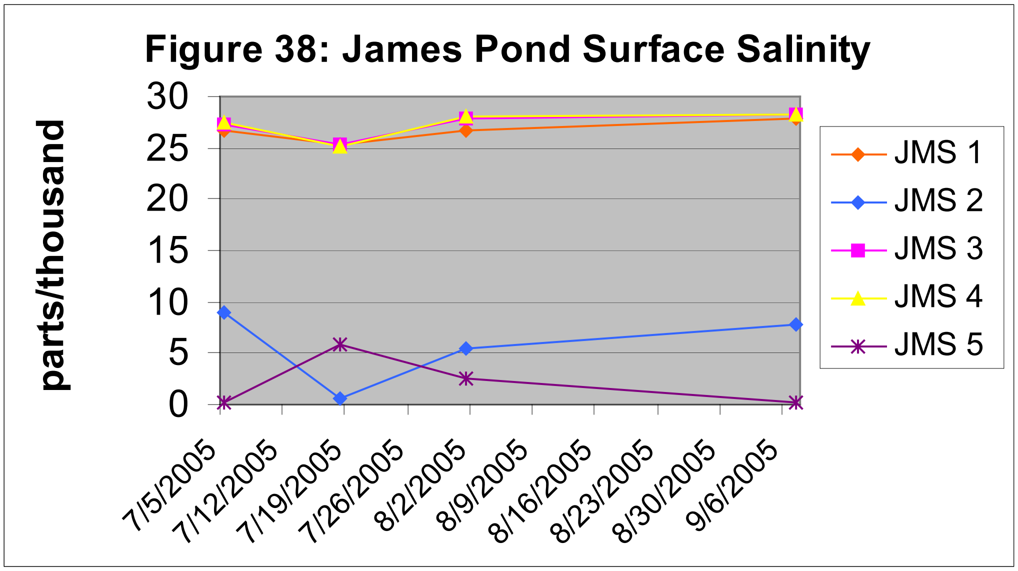
James Pond:

James Pond is a north coastal shore pond that is about 41 acres in area and somewhat less when it is connected tidally to the Atlantic Ocean. The pond is open to the ocean one or two times each year for periods ranging from just a few days to as many as several months. During the 2004-05 winter, it was tidal for much of the time from fall through early April.

A small fresh water pond was cut off from the northwest corner of the main pond by an earthen dam in the past and outlets into the system via a corrugated metal pipe. The Pond is known to have a limited herring run as well as periodic soft shell clams.

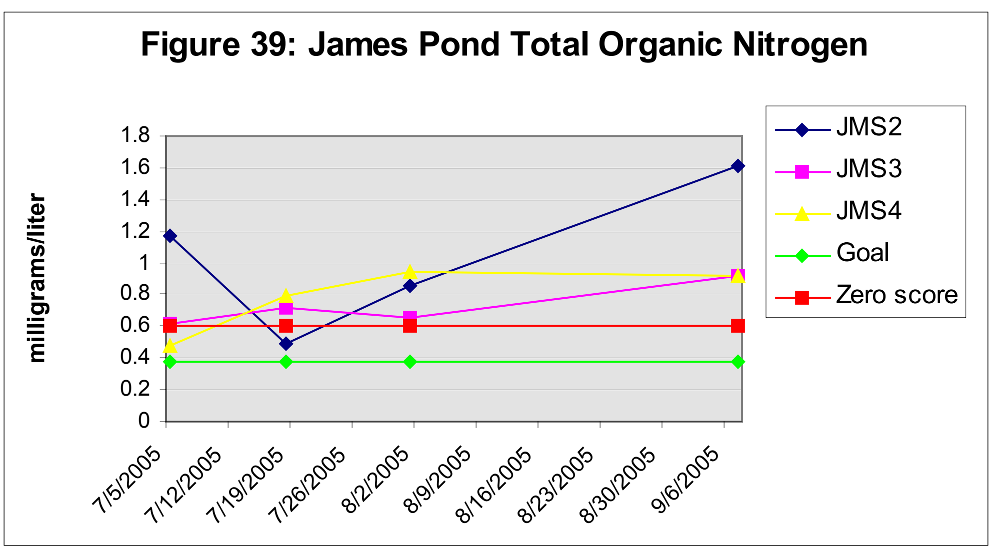
The Pond was sampled during summer 2003 (MVC, 2003-a). An MVC survey in 1982 tied to an arbitrary datum found the Pond to be no deeper than 5.75 feet. These depths were field checked during 2003 and were found to be accurate. The Pond probably averages less than 3 feet in depth. A tide gauge placed at the southern end of the Pond furthest from the inlet indicated a diurnal tide with a maximum range of 0.2 feet and an average of about 0.1 feet. Despite the limited tide, over a 2-month period in the spring of 2003, the Pond managed to get enough head to open itself to the Sound 5 times.

During the course of July and continuing in August 2003, the Pond developed anoxia from the decay of rooted macrophytes, enteromorpha and filamentous algae despite its shallow depth. The odor from the rafted organic matter was strong and sulfurous. Total pigments were above 10 micrograms per liter (ug/l) throughout the July-August time period. Pigments peaked at over 60 ug/l at two stations. Total organic nitrogen peaked at over 1 milligram per liter (mg/l) and was always greater than 0.6 mg/l. Secchi extinction depth was more than 1.2 meters on 14 July declining to 1.1 meters on 14 August and 0.6 meters on 8 September 2003. Sample station locations are shown in Figure 7.

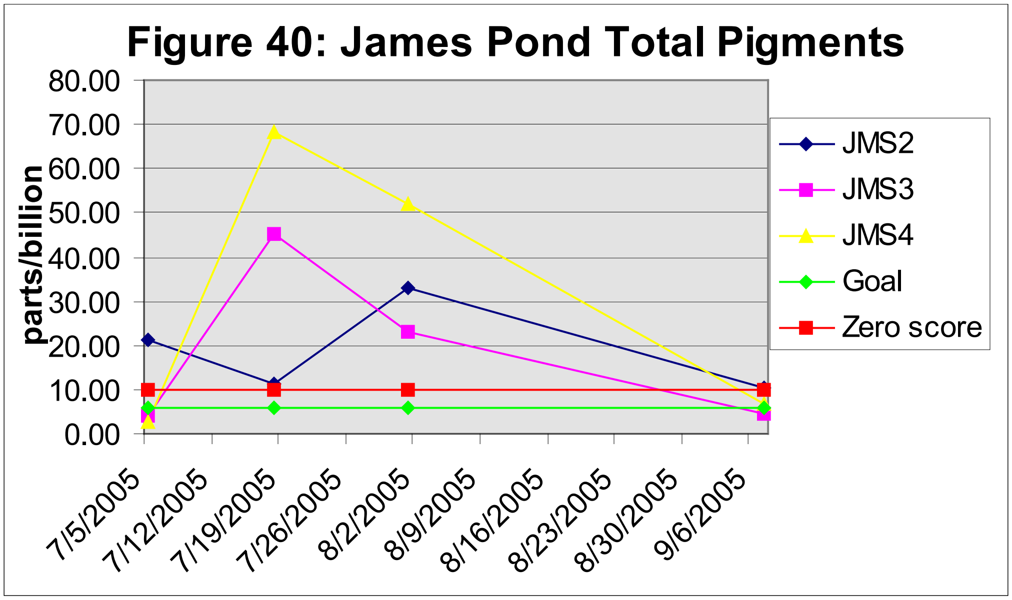


When open to the Sound, the system displays strong horizontal stratification as can be seen in Figure 38. During 2005, the system was weakly tidal over most of the sampling period. In this Figure, the dates when the salinity is zero at stations JMS2 and JMS5 were times when we were able to reach the actual freshwater discharge. On the other dates, when salinity readings were at 5 or more parts per thousand, it is an indication that the water level was too shallow to reach the actual fresh water discharge.

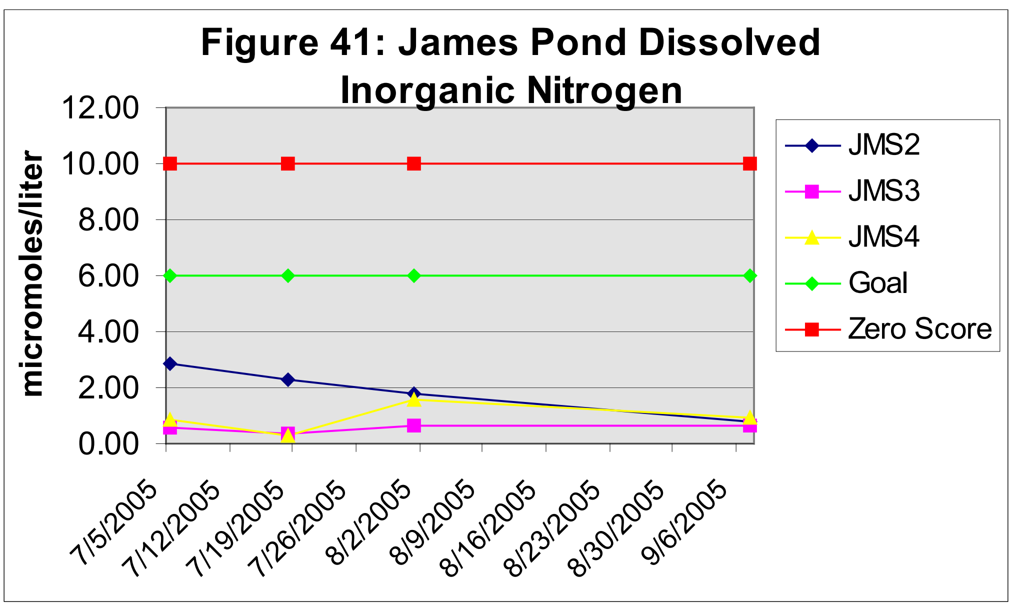
Total organic nitrogen concentrations in the system exceeded the zero score value for much of the sampling period. All stations scored a zero on average in the eutrophication rating system.



The concentration of chlorophyll pigments also exceeded the zero point value for much of the sampling period. On average, all stations scored a 0 in the rating system over the summer.

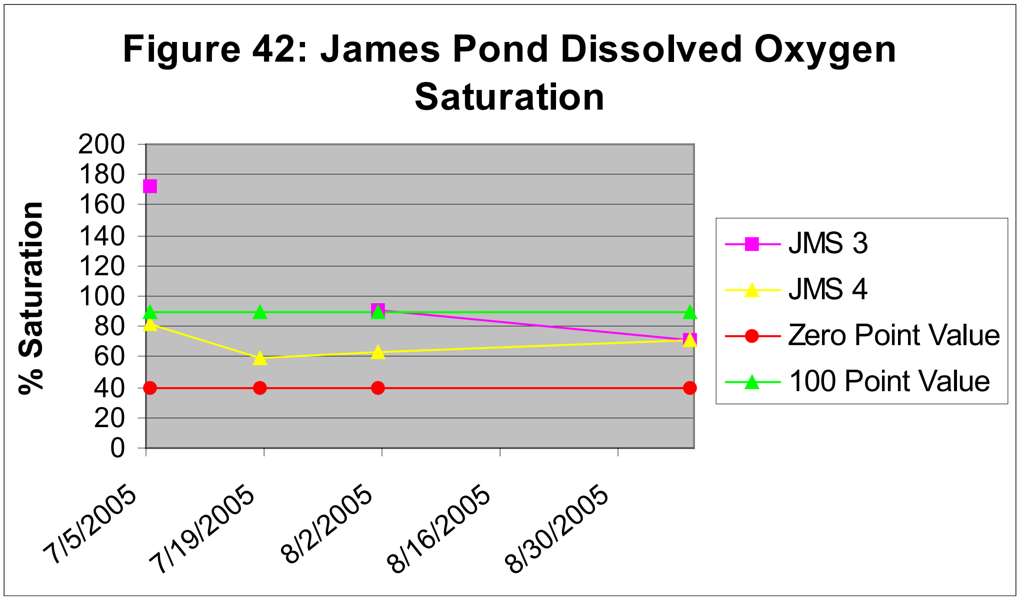


Inorganic nitrogen entering the system is rapidly converted into biomass resulting in low readings of this nutrient over the course of the summer months. Stations JMS5 (not shown, closest to the fresh water input scored a 67 (marginal) while all other stations scored from 82 to 100 (good to excellent) in the eutrophication rating system.



Due to the shallow depth of the Pond, Secchi readings could only be recorded on two dates at station JMS3 and once at JMS4. The values recorded score a zero on the eutrophication rating system reflecting the large amount of particulate matter in the water column.

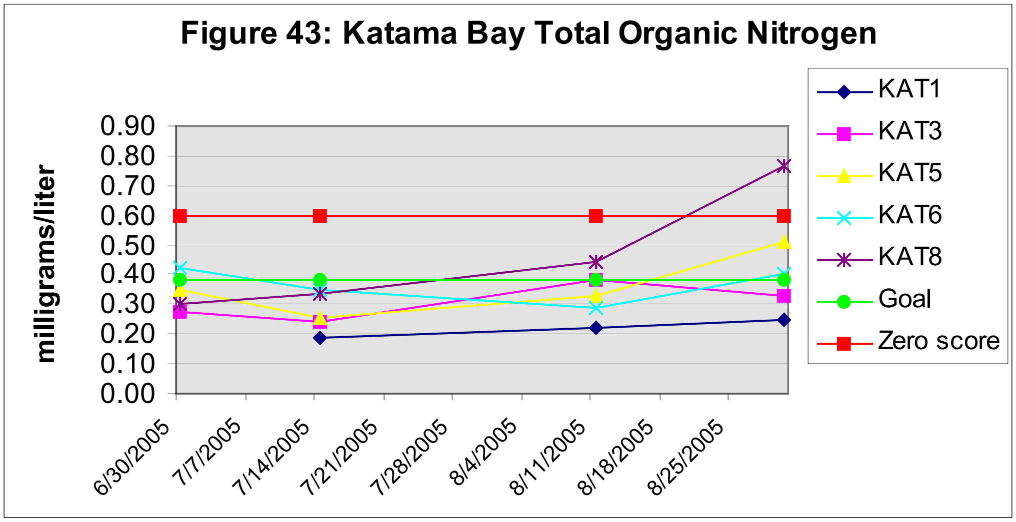
Dissolved oxygen readings in the Pond were quite low at station JMS5 scoring a 21 on the eutrophication rating scale. The rating improved to 58 at station JMS4 and 100 at JMS3. The better ratings probably reflect the large amount of phytoplankton in the water column producing excess oxygen as the sun brightens in the morning. Overnight readings would probably result in much lower scores for all stations.



Katama Bay:

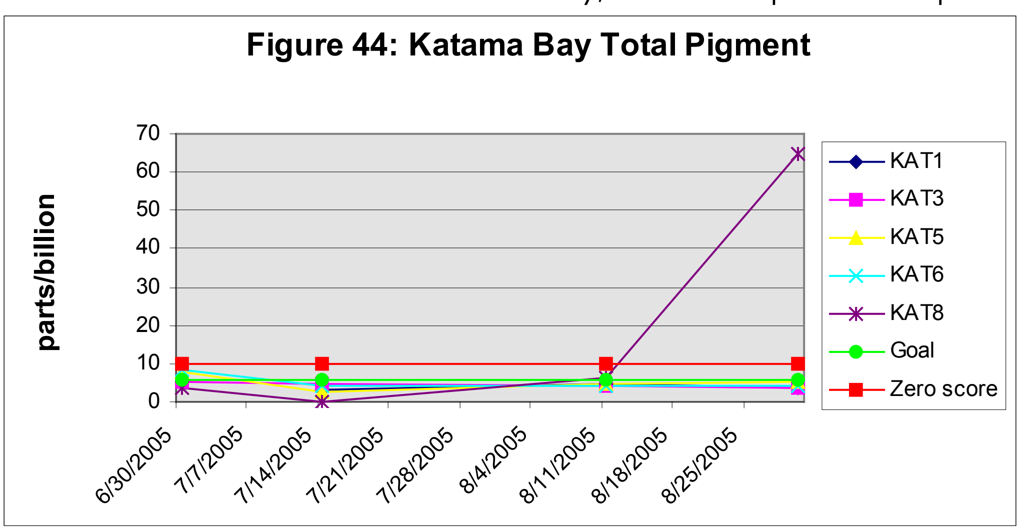
Katama Bay is a 1700-acre tidal water body connected to Nantucket Sound through Edgartown Harbor. A recently dredged tidal channel connects it to Caleb's Pond a 39-acre tidal water body. The tide range in Edgartown Harbor varies between 2 and 2.5 feet as measured at the Town boatyard pier (MVC, 2000-a). A large mooring field is located at the north end of this water body and is used for mooring small to large craft during the summer months. Two other mooring fields are located on the east and west sides of the Bay. Water depth exceeds 20 feet in the main channel that runs from south of the Harbor southward to the point where the Bay opens up in an east-west direction. Large remnant flood tidal deltas mark the entire southern third of the Bay along the north side of Norton Point, a barrier beach. Mattakeset Bay is a 30 acre shoal embayment in the southwest corner of the Bay that receives drainage from Herring Creek, a long, man-made channel that drains Crackatuxet Pond one mile to the West. This Creek also intercepts groundwater from a large area that, without the Creek, would not be a part of the Katama Bay watershed. Stormwater from densely developed downtown Edgartown discharges into the Harbor and during flood tide may have some impact on the Bay.

Station locations are shown in Figure 8. Station KAT1 is located outside the system and is representative of nearshore Nantucket Sound water quality. Station KAT8 was originally located in Mattakeset Bay however shoals in the area would not allow boat access to the point of the Herring Creek discharge. Beginning with the last round, samples were collected from the bridge over Herring Creek. This change in sampling point resulted in some striking changes in salinity as well as water quality parameters.



In Figure 43, TON at stations at stations 1 through 6 is largely meets the 0.38-ppm standard for eelgrass health. The high value at KAT8 on August 29 is from a sample collected in the Creek rather than in Mattakeset Bay. The eutrophication ratings for TON show a marked breakpoint being higher (excellent at 91 to 100 for stations KAT1 through 4) and 71 to 88 (acceptable to good) at stations KAT 5 through 7. This is probably a result of the vigorous tidal exchange at the first 4 stations and more sluggish flow in the interior of the Bay allowing nitrogen inputs to build a more significant response.

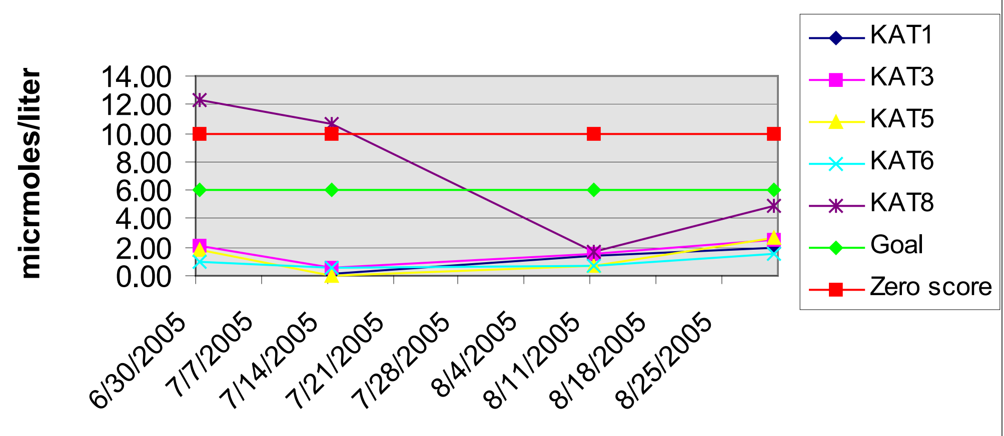
The phytoplankton population is indicated by the concentration of pigments in the water column. In Figure 44, pigment concentrations are largely at or below the 6 parts per billion goal for good water quality. The sample at KAT8 on August 29 was collected from the Creek itself rather than from Mattakeset Bay, as were the previous samples.



Eutrophication ratings for chlorophyll pigments were in the 80's (good) for stations KAT1 and 2 decreasing to 70 (acceptable) for station KAT4 and were in the high 60's (marginal) for stations KAT5 through 7.

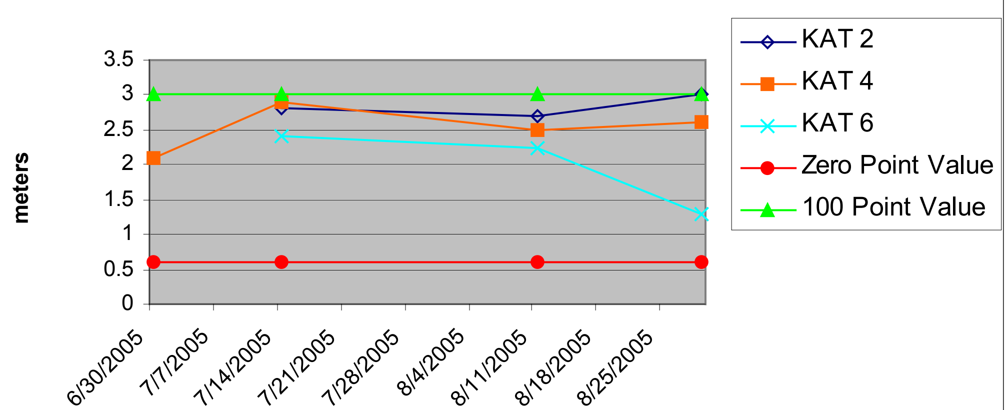
Dissolved inorganic nitrogen concentrations meet the goal for good water quality at all stations except for KAT8. The samples collected in Mattakeset Bay are influenced not only by freshwater input from herring Creek but also from the numerous houses that use on site wastewater disposal in the immediate watershed. The ratings scores for DIN are excellent for stations KAT1 through 7 varying from 93 to 100.

Figure 45: Katama Bay Dissolved Inorganic Nitrogen



Water column transparency is measured with a Secchi disk and, during 2005, values exceeded 2 meters throughout the sampling period. The value of 1.3 meters plotted for KAT6 on August 29 is actually a measurement when the disk was on the bottom so a Secchi depth could not be determined. The ratings are excellent at KAT 1 and 2,

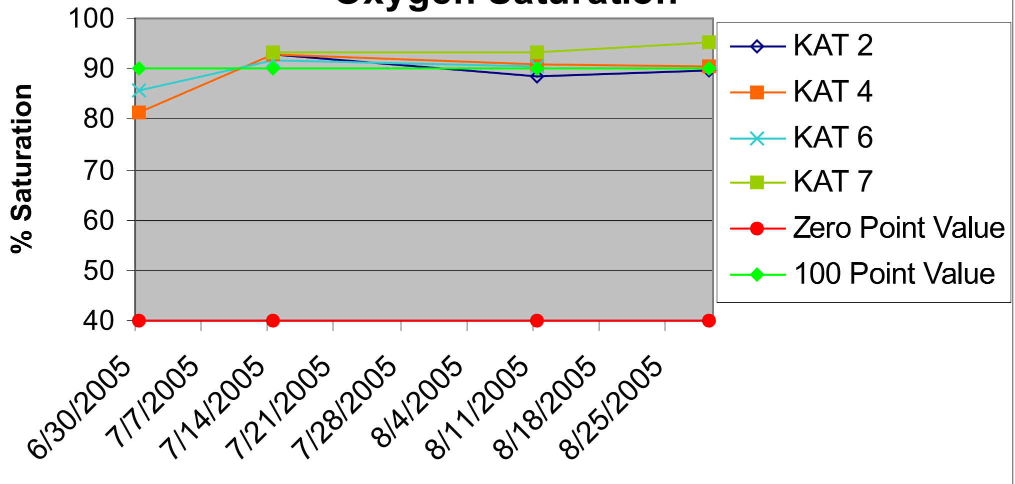
Figure 46: Katama Bay Secchi Extinction Depth



scoring 100 and 93 respectively. The ratings decrease to 79 and 80 (good) at stations KAT4, 5 and 7 and to 58 (undesirable) at station KAT6.

Dissolved oxygen saturation as recorded with an YSI85 meter was over 80% at depths of about 4 meters throughout the sampling period. Even the deeper stations that reach depths over 7 meters at stations KAT1, 2, and 4 average over 80% at depth. The deep measurement at station KAT7 was at 1 meter below the surface.

Figure 47: Katama Bay Deep Dissolved Oxygen Saturation



The eutrophication ratings are excellent for dissolved oxygen varying between 95 and 100.

Quality Control:

In addition to those checks of lab accuracy that are run internally, we provided the lab with a number of blind duplicate samples to evaluate their ability to provided reproducible results. Blind duplicate samples are drawn from the same sample bottle as another sample but identified with a different sample station number. The lab runs both sets of samples as if they were from two distinct locations. The results are then compared by means of statistical analysis to determine how closely the results for each parameter are to each other. The statistical metric applied to the data was the relative percent difference or RPD. The formula used was:

$$RPD == \frac{(X_1 - X_2)100}{(X_1 + X_2)/2}$$

Ideally the two results (X_1 and X_2) are the same and the RPD is zero. In practical application, this is not the case and results that are within 30% of each other are acceptable for field duplicates. The variation in results is more likely to be a higher percentage for parameters such as nitrate, nitrite ammonium or phaeophytin that are typically less than a few micromoles. For these parameters, a very small difference in the lab reported concentration could amount to a substantial percentage difference.

Table 2 summarizes the RPD analysis. All parameters fall within the 30% RPD except for the dissolved inorganic species**.** If the highest and lowest RPDs are left out of the average, both species of inorganic nitrogen average just under 30%. Table 2 in Appendix 1 (at the end of the data table) includes the RPD results for each sample round over the course of the sampling season.

Table 2: Average of Relative Percent Difference from Blind Duplicate Samples

Parameters	**Relative percent difference averaged**
Silicate	11.65%
Ortho-phosphate	3.58%
Ammonium	33.1%
Nitrate + nitrite	32.43%
Dissolved organic nitrogen	17.37%
Particulate carbon	6.85%
Particulate nitrogen	5.81%
Total phosphorus	11.1%
Chlorophyll pigments	13.93%

Samples were collected during the planned field season from mid-June to mid-September and during the morning hours. In the case of certain deep-water stations in Katama Bay and Cape Poge Pond, the interval between meter data collection was increased from 1 meter to 2 meters. The order of data collection was carried out as planned. Samples were processed and shipped on the same day as they were collected via Fast Ferry to New Bedford or were handed directly to SMAST personnel on days when they were sampling on the Vineyard.

<u>Summary:</u>

During the course of this study, over 220 water samples as well as in situ field data such as dissolved oxygen, water-column transparency and salinity were collected from eight coastal ponds. The survey of water quality in these coastal ponds accomplished two important goals. First, it brought these ponds one step closer to qualifying for the Massachusetts Estuaries Project that requires three years of water quality data before entry. The MEP program consists of a two to three year intensive study leading to state-of-the-art guidance as to the nitrogen loading limits for each pond. Second, this data provides additional insights into the water quality condition of these ponds to better inform our decision making about the urgency for regulatory steps to limit nitrogen loads to these systems now. Because it appears that the MEP process may require three to five years to complete for all of our ponds and implementation even longer, there may be a need to take some interim action to reduce the impact of development projects that are proposed or will shortly be implemented. In some cases, the pond systems are clearly impacted now although the present-day nitrogen

load from further back in their watersheds has not yet even reached their shores. These systems clearly need nitrogen management now.

Over the past 20 to 30 years, our coastal ponds have seen dramatic change in their ecology. The negative changes include a significant loss of eelgrass and a variable but probably declining yield of bay scallops. Studies have indicated that excessive nitrogen has produced the same results in some of the coastal ponds on Cape Cod (Valiela et al, 1990; Short and Burdick, 1996). The cause of these changes is not fully understood however, we do know that growth of microscopic and large aquatic plants in all coastal systems are stimulated by the addition of nitrogen. Excessive growth of phytoplankton in the water column intercept sunlight and reduce light levels to eelgrass beds that thin out and are lost from the deeper areas. Nitrogen also stimulates the growth of slime coatings on eelgrass blades that further block sunlight penetration and reduce plant vigor. Nitrogen addition can also lead to excessive growth of large algae like sea lettuce that break loose and drift into shore or settle in quiet water basins where their decay removes oxygen from the water column impacting shellfish and creating what is locally known as "dead bottom".

The data we collected during the summer clearly show that in continuously tidal systems primary producers (phytoplankton) are limited by the availability of nitrogen. The growth-limiting nutrient may vary in the south shore great ponds and James Pond from times where it is clearly nitrogen limited, to a gray zone where the limitation is not clear cut and even to the point where phosphorus is limiting for brief periods. This means that the addition of nitrogen leads to growth of plant material in all coastal ponds. Excessive amounts of plant material have adverse impacts on valuable resources including eelgrass beds that are nursery grounds for fish stocks and bay scallops. The key parameters that we measure that indicate the amount of impact that is likely are total organic nitrogen, chlorophyll-type pigments and dissolved inorganic nitrogen. The data are evaluated based on these parameters and those that are directly affected by them: Secchi extinction depth and dissolved oxygen saturation.

The availability of standards to allow a quality rating system provides a means for consistent evaluation of pond systems on a similar basis. The south shore ponds due to their lack of constant tidal circulation do not score well when held to the standards that were developed for tidal ponds. The ratings allow the general public to gain some understanding of what is otherwise complicated data. The system used here is intended to promote public outreach by converting excessive amounts of lab results into a clear and readily understood verbal rating.

Summer weather exerts a strong influence over water quality in the ponds. By collecting the data over a period of years we can begin to remove weather as a variable. Eelgrass and shellfish yields are two other important sources of insight into the health of the ponds. They are both linked to the system water quality as indicated by the key parameters. There is a need for specific data on eelgrass bed coverage that is being provided by the Department of Environmental Protection.

In general, 2005 brought significant water quality improvement to all ponds studied over both 2003 and 2004. The general ratings are calculated by averaging the numerical ratings that were developed by the Buzzard's Bay Project and are presented on page 10. The ratings used for all parameters are as follows:

Most stations averaging 90 to 100 for the parameters rates Excellent.
Scores above 80 rate Good
Scores between 70 and 80 are Acceptable.
Scores between 60 and 70 are Marginal.
Scores below 60 are Undesirable.

Cape Poge achieved excellent scores above 90 for all or nearly all stations. Sengekontacket, Tashmoo, Lagoon, Farm and Katama Bay scored a good overall rating averaging over 80 at all stations. The scores in Sengekontacket and Lagoon varied from good to excellent. In the case of Tashmoo, the northern half of the Pond rated an excellent overall grade while the southern half scored lower with one station only achieving a marginal rating. Pocha Pond ranged from acceptable to good ratings. Oak Bluffs Harbor scores a marginal rating for most stations and an undesirable grade for one station (the Sunset Lake outlet). James and Oyster ponds score undesirable ratings at all stations.

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APPENDIX 1

Sample Station Figures 1 through 8
Laboratory Data
Field Data

NOTE: *Data are included for Chilmark (CHP), Tisbury Great (TGP), Crackatuxet (CRX), Lagoon (LGP), Oak Bluffs Harbor (OBH) and Fresh Pond (FRS) that are not discussed in the report, as they were not part of the grant program.*

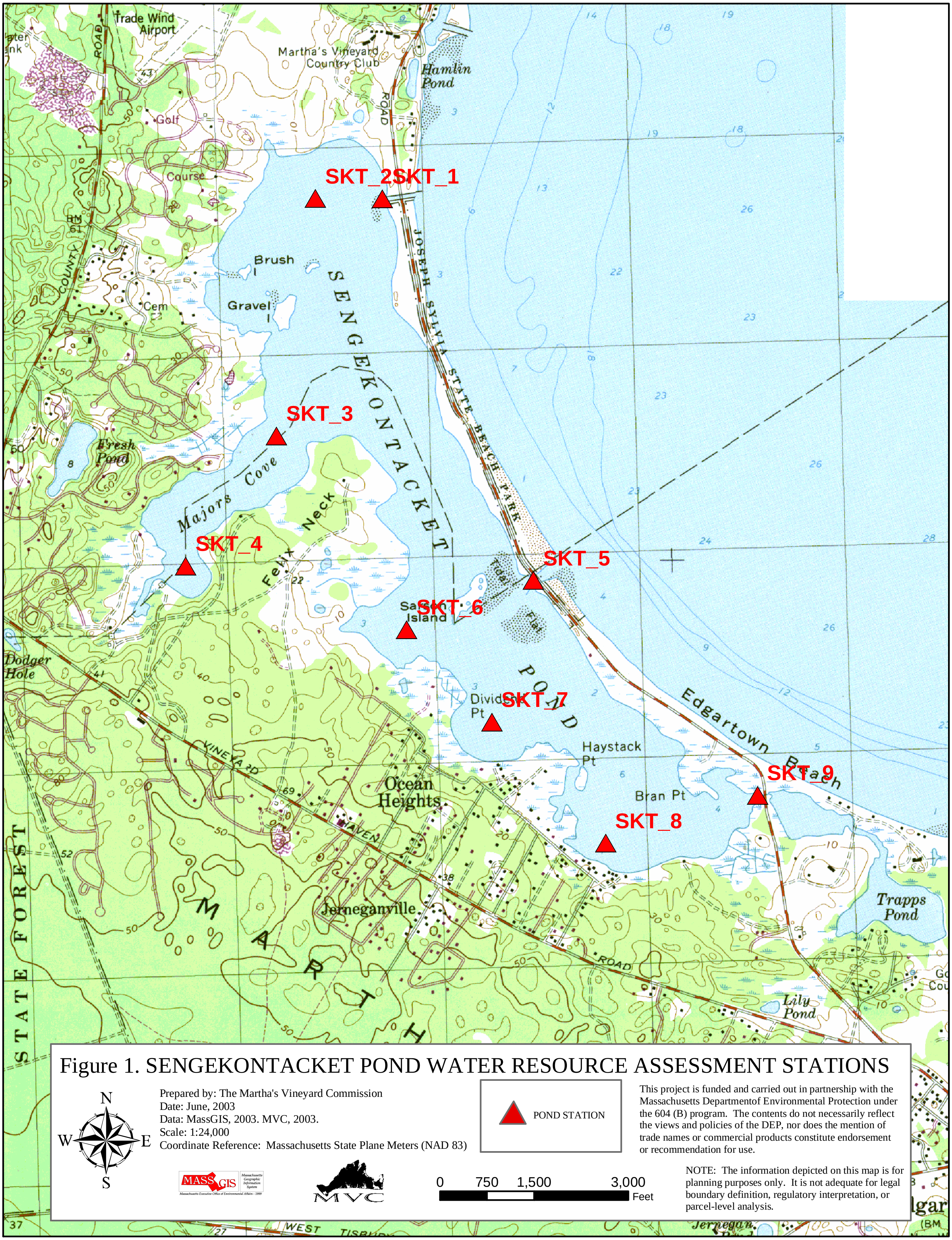

Figure 1. SENGEKONTACKET POND WATER RESOURCE ASSESSMENT STATIONS

Prepared by: The Martha's Vineyard Commission
Date: June, 2003
Data: MassGIS, 2003. MVC, 2003.
Scale: 1:24,000
Coordinate Reference: Massachusetts State Plane Meters (NAD 83)

This project is funded and carried out in partnership with the Massachusetts Departmentof Environmental Protection under the 604 (B) program. The contents do not necessarily reflect the views and policies of the DEP, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

NOTE: The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.

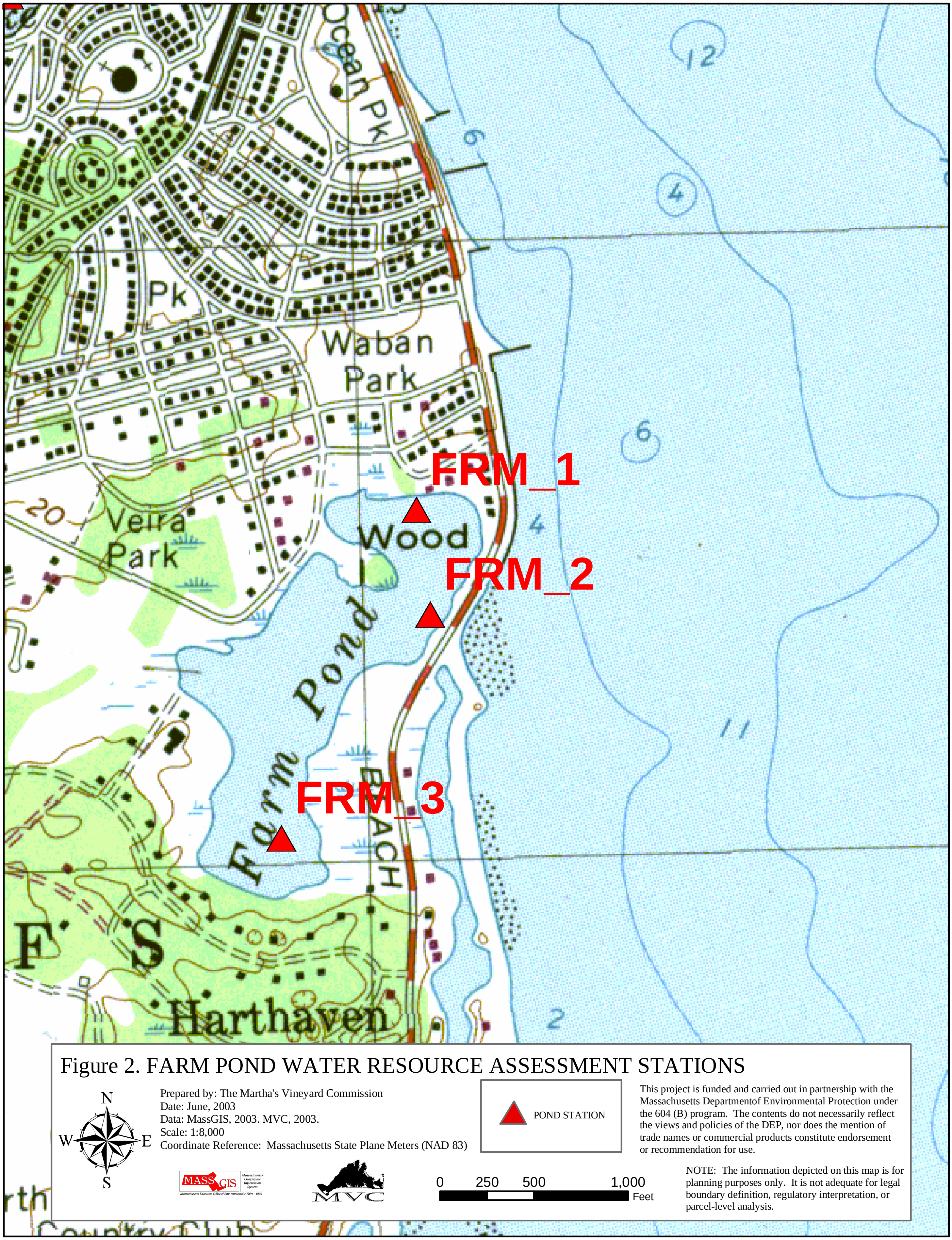

Figure 2. FARM POND WATER RESOURCE ASSESSMENT STATIONS

Prepared by: The Martha's Vineyard Commission
Date: June, 2003
Data: MassGIS, 2003. MVC, 2003.
Scale: 1:8,000
Coordinate Reference: Massachusetts State Plane Meters (NAD 83)

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NOTE: The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.

Sample Station Locations - Tashmoo Pond

MARTHA'S VINEYARD COMMISSION

MASSGIS

Legend

● bwilcox_h2ostats_data

0.25 0.125 0 0.25 0.5 Miles

0.25 0.125 0 0.25 0.5 Kilometers

Note: This map is for planning purposes only. It is not adequate for legal boundary definition. The MVC cannot be responsible for how this data is used or interpreted by the end user.

Prepared by: The Martha's Vineyard Commission, M Turner, 12/19/06, www.mvcommission.org, 508-693-3453
Data: Topo MassGIS/USGS mid1970s; Sampling Stations - UMASS 2004
Coordinate Reference: State Plane, Mass Mainland, NAD 83, Meters
File: cls_estuaries, TSH_samp06.mxd; original in color

Figure 4. CAPE POGE WATER RESOURCE ASSESSMENT STATIONS

Prepared by: The Martha's Vineyard Commission
Date: June, 2003
Data: MassGIS, 2003. MVC, 2003.
Scale: 1:24,000
Coordinate Reference: Massachusetts State Plane Meters (NAD 83)

POND STATION

0 750 1,500 3,000 Feet

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NOTE: The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.

Figure 5. POCHA POND WATER RESOURCE ASSESSMENT STATIONS

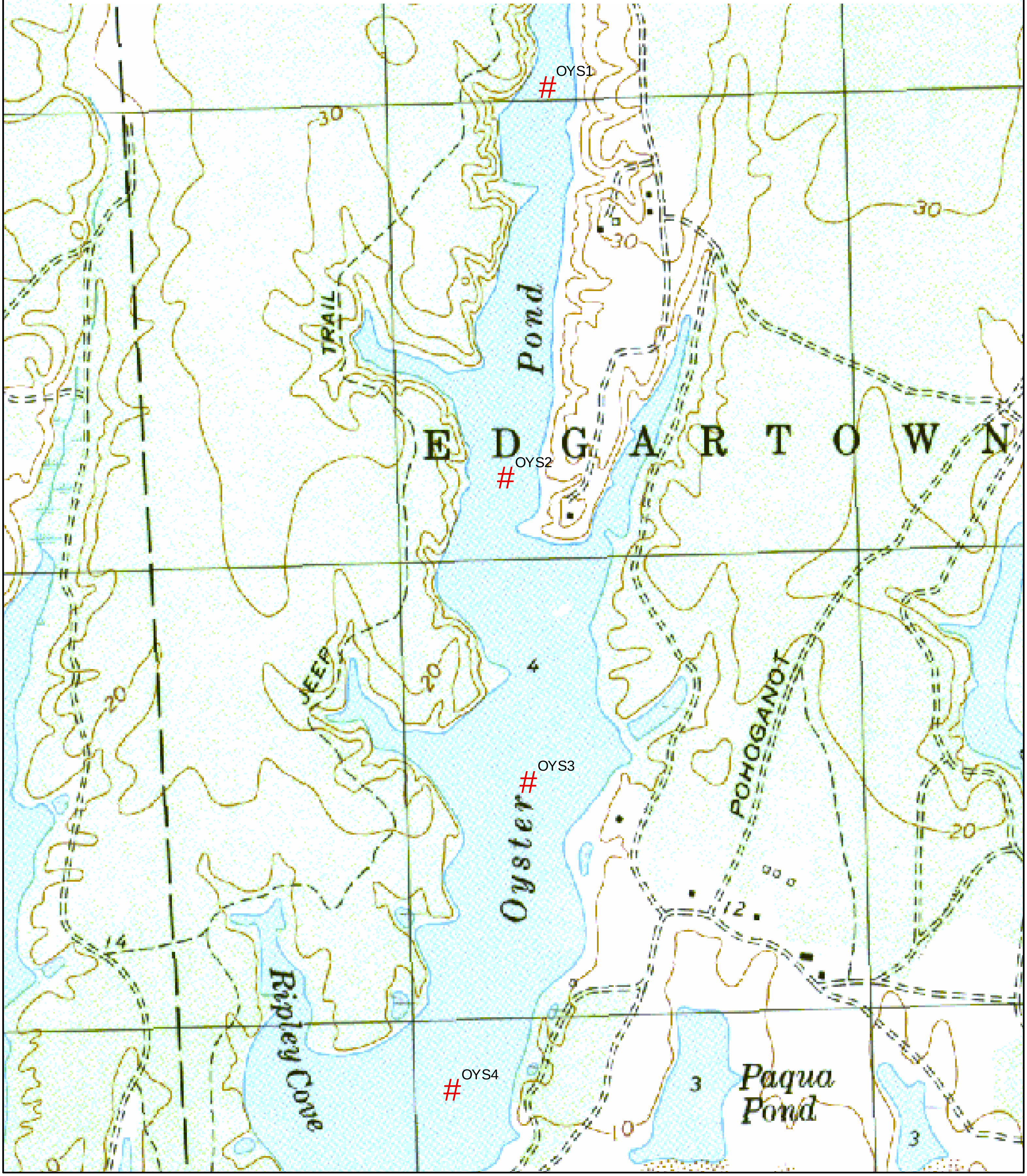
Prepared by: The Martha's Vineyard Commission
Date: June, 2003
Data: MassGIS, 2003. MVC, 2003.
Scale: 1:24,000
Coordinate Reference: Massachusetts State Plane Meters (NAD 83)

POND STATION

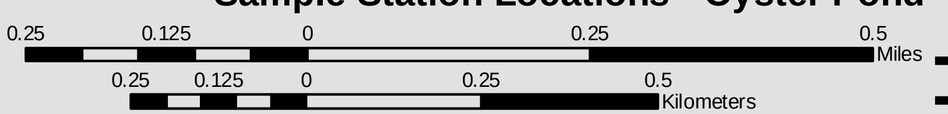
0 750 1,500 3,000 Feet

This project is funded and carried out in partnership with the Massachusetts Departmentof Environmental Protection under the 604 (B) program. The contents do not necessarily reflect the views and policies of the DEP, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

NOTE: The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.



Sample Station Locations - Oyster Pond



Note: This map is for planning purposes only. It is not adequate for legal boundary definition. The MVC cannot be responsible for how this data is used or interpreted by the end user.

Prepared by: The Martha's Vineyard Commission, J Pollak, 6/25/07, www.mvcommission.org, 508-693-3453
Data: Topo MassGIS/USGS mid1970s; Sampling Stations - UMASS 2004
Coordinate Reference: State Plane, Mass Mainland, NAD 83, Meters
File: cls_estuaries, oysterpondstations.mxd; original in color

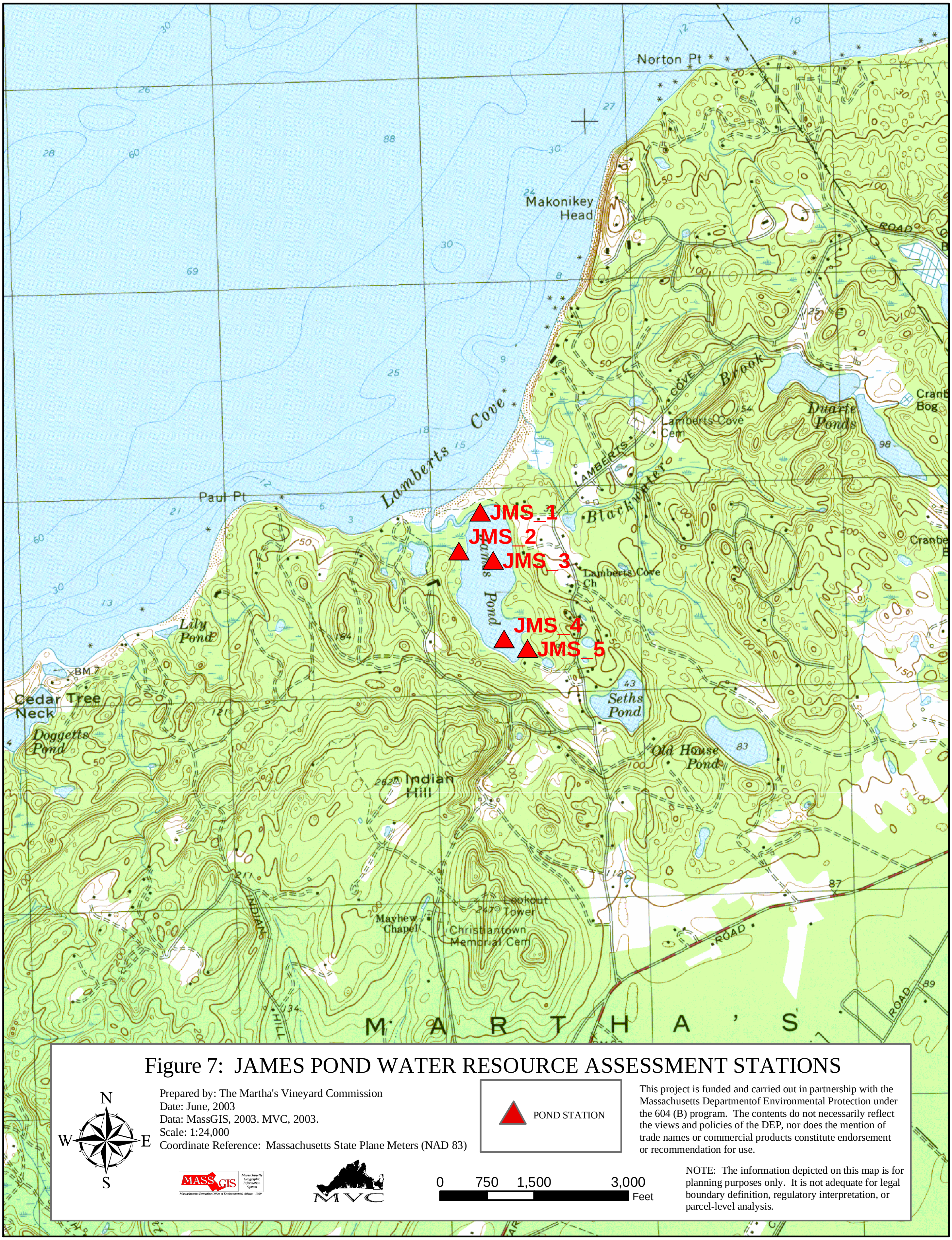


Figure 7: JAMES POND WATER RESOURCE ASSESSMENT STATIONS

Sample Station Locations - Katama Bay

0.25 0.125 0 0.25 0.5 Miles

0.250.125 0 0.25 0.5 Kilometers

Note: This map is for planning purposes only. It is not adequate for legal boundary definition. The MVC cannot be responsible for how this data is used or interpreted by the end user.

Prepared by: The Martha's Vineyard Commission, J Pollak, 6/25/07, www.mvcommission.org, 508-693-3453
Data: Topo MassGIS/USGS mid1970s; Sampling Stations - UMASS 2004
Coordinate Reference: State Plane, Mass Mainland, NAD 83, Meters
File: cls_estuaries, katamastations.mxd; original in color

Coastal Systems Group
SMAST
UMASS Dartmouth
706 Rodney French Blvd
New Bedford, Ma 02747
Project: MV/Wilcox 2005

Key
NS = No Sample Taken
ND = No Data Available

S = Surface
M =Mid water column
D = Deep

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
CHP	1			7/20/2005	7.9	24.21	0.1	1.5	<0.1	0.50	0.55	12.98	NS	301.44	39.42	7.65	26.09	2.58	0.91
CHP	2			7/20/2005	7.1	19.13	0.2	NS	<0.1	0.38	0.43	13.81	NS	146.35	22.66	6.46	19.71	2.11	0.90
CHP	3			7/20/2005	7.7	19.18	0.1	1.5	<0.1	<0.05	<0.1	13.67	21.55	159.53	24.05	6.63	17.54	0.82	0.96
CHP	4			7/20/2005	7.9	17.60	0.1	NS	<0.1	<0.05	<0.1	15.03	NS	146.14	21.06	6.94	16.63	2.19	0.88
CHP	5			7/20/2005	7.9	19.04	<0.1	NS	0.2	0.39	0.56	15.04	21.15	132.54	20.16	6.57	17.22	2.70	0.86
CHP	6			7/20/2005	9.5	29.09	0.1	NS	0.8	0.37	1.20	19.02	NS	165.73	26.19	6.33	19.10	1.99	0.91
CHP	7			7/20/2005	6.8	21.43	0.1	1.4	0.5	0.44	0.90	14.21	NS	160.05	25.07	6.39	17.21	0.83	0.95
CHP	8			7/20/2005	10.3	28.56	0.1	1.8	<0.1	<0.05	<0.1	19.07	NS	162.57	21.80	7.46	21.41	1.34	0.94
CHP	1			8/17/2005	10.1	66.61	<0.1	1.5	0.6	<0.05	0.61	39.68	NS	331.19	49.71	6.66	47.17	<0.05	1.00
CHP	2			8/17/2005	9.2	59.66	0.1	NS	0.6	<0.05	0.61	39.23	NS	318.64	42.18	7.56	83.61	15.22	0.85
CHP	3			8/17/2005	10.2	55.42	<0.1	3.8	0.5	0.38	0.88	34.86	36.50	313.98	39.33	7.98	30.03	<0.05	1.00
CHP	4			8/17/2005	9.9	49.35	<0.1	NS	0.7	<0.05	0.69	40.65	NS	281.17	34.31	8.19	29.75	1.97	0.94
CHP	5			8/17/2005	9.9	55.89	<0.1	NS	0.3	<0.05	0.35	32.36	34.40	308.08	37.51	8.21	28.22	<0.05	1.00
CHP	6			8/17/2005	9.9	61.37	<0.1	NS	0.5	<0.05	0.48	40.72	NS	382.12	51.94	7.36	43.63	<0.05	1.00
CHP	7			8/17/2005	8.5	58.96	<0.1	4.7	0.6	<0.05	0.65	35.39	NS	425.42	61.10	6.96	43.96	0.67	0.98
CHP	8			8/17/2005	8.4	60.25	<0.1	4.8	0.4	<0.05	0.43	33.49	NS	332.92	42.49	7.83	28.23	<0.05	1.00
CHP	2			9/6/2005	9.4	1.85	0.1	3.8	0.8	<0.05	0.85	43.53	NS	381.40	46.82	8.15	12.53	<0.05	1.00
CHP	4			9/6/2005	9.6	0.60	0.1	3.6	0.6	<0.05	0.59	44.55	NS	324.63	43.30	7.50	23.35	0.39	0.98
CHP	5			9/6/2005	9.1	0.55	0.2	3.5	0.5	<0.05	0.50	42.51	NS	306.32	38.26	8.01	13.08	<0.05	1.00
CRX	1			7/27/2005	3.9	14.87	0.1	NS	2.3	0.59	2.91	13.43	NS	98.48	14.91	6.61	24.92	<0.05	1.00
CRX	2			7/27/2005	3.7	22.87	<0.1	NS	0.9	0.45	1.32	10.20	NS	49.30	6.92	7.12	5.90	<0.05	1.00
CRX	3			7/27/2005	2.2	31.45	0.1	NS	1.2	0.56	1.73	13.26	NS	109.70	14.27	7.69	31.58	<0.05	1.00
CRX	4			7/27/2005	3.0	12.76	0.1	NS	1.7	0.58	2.32	11.27	NS	49.50	7.76	6.38	6.43	<0.05	1.00
CRX	5			7/27/2005	3.3	21.29	0.1	NS	0.5	0.63	1.13	8.05	NS	69.92	10.57	6.61	11.48	<0.05	1.00
CRX	1			8/3/2005	6.0	43.82	<0.1	0.7	0.3	0.40	0.75	16.55	NS	134.25	16.75	8.01	8.67	<0.05	1.00
CRX	2			8/3/2005	6.4	45.70	<0.1	0.7	0.3	0.43	0.73	20.03	NS	122.93	16.19	7.59	7.21	0.41	0.95
CRX	3			8/3/2005	6.0	87.65	0.3	1.3	0.3	0.40	0.75	4.63	NS	165.29	21.11	7.83	24.32	8.61	0.74
CRX	4			8/3/2005	5.3	40.46	<0.1	0.7	0.3	1.42	1.68	13.64	NS	102.90	14.99	6.86	6.75	0.10	0.99
CRX	5			8/3/2005	6.4	54.71	<0.1	0.8	0.3	0.40	0.66	24.76	NS	154.88	19.58	7.91	13.52	0.10	0.99
CRX	1			8/9/2005	7.8	59.66	<0.1	0.9	0.6	0.42	0.99	20.60	NS	151.13	22.15	6.82	10.36	<0.05	1.00
CRX	2			8/9/2005	6.2	49.24	<0.1	0.8	0.9	0.41	1.28	17.45	NS	139.07	18.24	7.62	7.29	<0.05	1.00
CRX	3			8/9/2005	7.2	94.07	<0.1	0.8	0.4	0.37	0.73	25.00	NS	111.99	16.37	6.84	15.42	<0.05	1.00
CRX	4			8/9/2005	7.9	69.03	<0.1	NS	0.5	0.97	1.46	24.27	NS	117.67	16.92	6.95	9.82	<0.05	1.00
CRX	5			8/9/2005	5.9	65.38	<0.1	NS	0.4	0.40	0.81	18.25	NS	120.70	18.34	6.58	8.98	<0.05	1.00
CRX	6			8/9/2005	5.9	73.21	<0.1	0.8	0.4	0.38	0.74	22.55	NS	115.70	17.11	6.76	14.56	<0.05	1.00
CRX	1			8/24/2005	9.1	36.51	<0.1	NS	0.3	<0.05	0.33	50.87	NS	58.56	9.01	6.50	8.17	0.30	0.97
CRX	2			8/24/2005	9.3	52.48	<0.1	NS	0.3	<0.05	0.28	32.73	NS	57.59	8.91	6.46	4.02	0.75	0.84
CRX	3			8/24/2005	8.6	85.17	0.3	NS	0.3	<0.05	0.28	36.98	NS	105.19	15.86	6.63	12.42	1.80	0.87
CRX	4			8/24/2005	9.0	61.84	<0.1	NS	0.5	<0.05	0.55	33.68	NS	46.80	7.80	6.00	5.22	<0.05	1.00

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
FRM	1			6/29/2005	27.1	7.06	0.3	NS	0.6	0.16	0.75	29.35	3.65	40.36	6.34	6.37	3.16	0.46	0.87
FRM	2			6/29/2005	31.1	8.30	0.3	0.7	0.8	0.31	1.07	32.94	NS	40.43	5.23	7.73	2.49	0.95	0.72
FRM	3			6/29/2005	29.1	7.63	0.2	NS	1.2	0.10	1.29	18.44	3.71	19.66	2.66	7.39	1.79	0.49	0.78
FRM	1			7/13/2005	25.6	7.25	0.2	NS	0.3	<0.05	0.29	16.80	5.38	67.57	9.67	6.99	3.66	0.48	0.88
FRM	2			7/13/2005	21.7	4.96	0.2	1.0	0.2	<0.05	0.18	13.79	NS	35.92	4.74	7.58	1.96	1.39	0.59
FRM	3			7/13/2005	25.0	3.04	0.3	NS	0.4	<0.05	0.40	18.66	8.23	29.74	4.45	6.68	1.67	1.07	0.61
FRM	1			7/27/2005	29.7	3.57	0.6	NS	0.6	<0.05	0.59	9.51	9.38	37.29	5.53	6.74	2.67	0.87	0.75
FRM	2			7/27/2005	30.0	4.38	0.7	1.7	0.7	<0.05	0.72	14.60	NS	28.70	4.35	6.59	2.38	0.74	0.76
FRM	3			7/27/2005	28.7	3.43	1.2	NS	0.4	0.28	0.72	4.97	4.28	28.04	4.02	6.98	2.04	0.60	0.77
FRM	1			8/10/2005	25.2	15.06	0.8	NS	1.2	<0.05	1.26	11.83	8.40	79.26	9.74	8.14	5.46	0.23	0.96
FRM	2			8/10/2005	23.4	16.16	0.8	2.4	1.2	<0.05	1.26	13.88	NS	80.96	10.65	7.60	7.08	<0.05	1.00
FRM	3			8/10/2005	22.9	19.47	1.3	NS	1.2	0.13	1.33	15.45	8.60	113.32	14.37	7.89	14.54	<0.05	1.00
FRM	4			8/10/2005	24.6	12.95	0.8	1.5	1.3	0.18	1.50	8.98	NS	75.18	9.76	7.70	2.44	1.95	0.56
FRS		B		8/9/2005	0.1	NS	2.2	4.6	43.2	0.14	43.31	24.92	NS	196.61	31.89	6.16	NS	NS	NS
FRS				8/9/2005	0.1	NS	<0.1	5.7	0.7	<0.05	0.77	50.23	NS	445.98	74.81	5.96	NS	NS	NS
FRS	1	B		8/24/2005	0.1	NS	3.9	6.8	117.6	0.10	117.70	34.85	NS	230.90	35.41	6.52	ND	ND	ND
FRS	1	S		8/24/2005	0.1	NS	<0.1	1.1	10.2	0.05	10.28	52.66	NS	183.46	29.23	6.28	13.59	7.48	0.64
FRS	2			8/24/2005	0.1	NS	0.1	NS	7.6	0.08	7.69	56.01	NS	161.91	26.45	6.12	13.43	5.05	0.73
FRS	3			8/24/2005	0.1	NS	0.1	NS	8.8	0.10	8.90	54.04	NS	149.83	23.88	6.27	15.06	5.49	0.73
FRS	4			8/24/2005	0.1	NS	<0.1	1.1	10.2	<0.05	10.25	48.31	NS	184.21	27.78	6.63	13.89	5.98	0.70
FRS	1		Sample	9/22/2005	0.1	NS	0.1	1.2	0.2	0.12	0.36	36.92	NS	126.34	15.38	8.22	NS	NS	NS
FRS	1		DUP	9/22/2005	0.2	NS	<0.1	7.8	8.5	0.43	8.89	60.26	NS	NS	NS	NS	NS	NS	NS
FRS	2			9/22/2005	0.1	NS	<0.1	0.8	1.6	0.17	1.75	34.14	NS	68.81	8.22	8.37	NS	NS	NS
FRS	3			9/22/2005	0.1	NS	<0.1	0.8	0.4	0.22	0.66	31.91	NS	99.98	11.94	8.37	NS	NS	NS
FRS	4			9/22/2005	0.1	NS	<0.1	1.0	0.3	0.10	0.40	29.14	NS	100.47	11.86	8.47	NS	NS	NS
HUDSON AVE				########	ND	NS	14.9	17.7	1.5	8.75	10.26	40.17	14.40	407.78	29.33	13.90	NS	NS	NS
JMS	1			7/5/2005	26.6	9.07	0.3	NS	2.9	0.13	2.99	31.01	NS	51.70	7.45	6.94	1.87	0.10	0.95
JMS	2			7/5/2005	18.6	48.18	0.6	4.0	2.8	<0.05	2.85	39.25	NS	328.82	44.58	7.38	17.77	3.61	0.83
JMS	3			7/5/2005	26.7	10.41	<0.1	NS	0.6	<0.05	0.60	30.71	16.35	80.68	13.10	6.16	4.21	<0.05	1.00
JMS	4			7/5/2005	26.0	8.98	<0.1	ND	0.8	<0.05	0.86	24.74	3.00	61.36	9.49	6.46	2.82	<0.05	1.00
JMS	5			7/5/2005	2.9	5.62	0.2	1.0	4.7	2.87	7.54	13.72	NS	81.54	6.18	13.18	2.53	1.04	0.71
JMS	6			7/5/2005	25.6	9.55	<0.1	0.9	1.1	<0.05	1.17	22.70	NS	101.34	7.10	14.26	4.40	<0.05	1.00
JMS	1			7/18/2005	17.6	8.50	0.5	NS	0.8	0.24	1.07	26.82	NS	244.25	36.24	6.74	44.42	<0.05	1.00
JMS	2			7/18/2005	1.5	140.90	3.6	6.3	1.8	0.50	2.30	22.07	NS	100.53	13.02	7.72	10.18	1.17	0.90
JMS	3			7/18/2005	19.8	6.48	0.3	NS	0.3	<0.05	0.35	23.82	9.20	183.77	27.87	6.59	31.55	13.86	0.69
JMS	4			7/18/2005	24.0	9.17	0.3	3.6	0.3	<0.05	0.28	29.47	8.85	177.38	27.03	6.56	68.26	<0.05	1.00
JMS	5			7/18/2005	15.5	44.82	0.9	4.4	5.8	0.47	6.29	23.76	NS	341.32	36.03	9.47	30.14	2.36	0.93
JMS	1			8/1/2005	26.0	40.99	0.7	NS	5.5	0.14	5.61	21.67	NS	30.51	4.03	7.57	1.10	2.01	0.35
JMS	2			8/1/2005	17.0	76.86	0.6	4.3	1.5	0.27	1.79	23.94	NS	274.55	37.52	7.32	28.66	4.18	0.87
JMS	3			8/1/2005	28.3	28.56	0.1	NS	0.6	<0.05	0.62	26.34	23.88	119.36	19.97	5.98	22.94	<0.05	1.00
JMS	4			8/1/2005	22.7	23.25	0.2	3.9	1.4	0.13	1.56	26.02	32.85	253.11	41.68	6.07	50.28	1.90	0.96
JMS	5			8/1/2005	18.8	30.62	0.5	2.4	1.0	0.20	1.20	20.10	NS	109.38	16.74	6.53	19.93	<0.05	1.00
JMS	1			9/7/2005	28.2	68.21	0.2	NS	0.8	<0.05	0.85	37.62	NS	365.82	52.90	6.92	6.84	<0.05	1.00
JMS	2			9/7/2005	26.4	63.79	0.1	4.1	0.8	<0.05	0.80	40.39	NS	517.56	74.48	6.95	9.76	0.63	0.94
JMS	3			9/7/2005	28.5	64.20	0.1	NS	0.6	<0.05	0.67	37.49	39.00	233.78	28.02	8.34	4.65	<0.05	1.00
JMS	4			9/7/2005	28.6	64.55	0.1	2.1	0.9	<0.05	0.93	37.24	36.35	237.45	28.02	8.47	6.64	<0.05	1.00
JMS	5			9/7/2005	25.8	87.06	0.1	2.8	0.8	<0.05	0.85	37.93	NS	390.49	50.47	7.74	9.81	1.08	0.90
JMS	6			9/7/2005	28.4	64.14	0.1	4.0	0.9	<0.05	0.89	38.19	NS	596.62	77.38	7.71	6.67	0.20	0.97
KAT	3			6/30/2005	29.8	8.59	0.4	1.1	2.0	0.11	2.11	14.32	6.26	35.26	5.25	6.71	3.58	1.52	0.70
KAT	4			6/30/2005	25.6	4.14	0.4	NS	2.2	0.14	2.39	14.68	16.93	44.41	7.09	6.27	5.42	1.40	0.79

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
KAT	5			6/30/2005	30.2	4.48	0.3	1.3	1.8	<0.05	1.85	16.68	9.10	50.25	8.24	6.10	6.07	1.68	0.78
KAT	6			6/30/2005	28.5	2.37	0.2	NS	1.0	<0.05	1.02	19.61	22.70	69.06	10.41	6.63	6.60	1.70	0.79
KAT	7			6/30/2005	29.9	4.38	0.3	NS	1.2	0.15	1.40	19.35	19.93	48.22	7.41	6.51	5.44	0.80	0.87
KAT	8			6/30/2005	23.7	14.34	0.4	1.1	4.5	7.88	12.38	16.98	NS	35.07	4.74	7.41	2.47	1.37	0.64
KAT	9			6/30/2005	30.2	5.14	0.4	1.2	2.4	<0.05	2.44	14.36	NS	38.80	4.77	8.14	3.63	1.37	0.73
KAT	1			7/14/2005	29.1	5.29	0.3	NS	0.2	<0.05	0.20	8.89	NS	30.33	4.35	6.97	2.48	0.45	0.85
KAT	2			7/14/2005	29.4	4.86	0.2	NS	0.1	<0.05	0.08	8.53	NS	34.29	5.57	6.15	2.17	0.79	0.73
KAT	3			7/14/2005	29.5	11.18	0.4	1.4	0.5	<0.05	0.49	11.65	12.03	34.23	5.67	6.03	3.10	1.70	0.65
KAT	4			7/14/2005	30.0	6.15	0.2	NS	0.1	<0.05	0.08	10.96	13.62	38.02	6.56	5.80	2.68	0.66	0.80
KAT	5			7/14/2005	29.8	5.24	0.2	0.9	<0.1	<0.05	<0.1	11.79	11.63	37.18	6.28	5.92	2.29	0.56	0.80
KAT	6			7/14/2005	29.5	7.83	0.3	NS	0.6	<0.05	0.62	17.24	12.47	43.44	7.63	5.69	3.94	0.31	0.93
KAT	7			7/14/2005	29.5	4.67	0.2	NS	0.5	<0.05	0.53	11.64	4.40	44.08	7.55	5.84	2.49	1.22	0.67
KAT	8			7/14/2005	21.6	12.71	0.4	1.4	3.2	7.45	10.65	17.24	NS	41.75	6.95	6.00	ND	ND	ND
KAT	9			7/14/2005	30.4	14.53	0.1	0.9	0.5	<0.05	0.53	11.30	NS	46.58	7.88	5.91	ND	ND	ND
KAT	1			8/11/2005	28.7	5.43	0.6	NS	1.4	<0.05	1.42	11.75	NS	28.51	4.17	6.84	1.18	3.59	0.25
KAT	2			8/11/2005	29.2	4.77	0.6	NS	0.9	<0.05	0.90	13.56	NS	38.59	5.77	6.69	3.97	0.66	0.86
KAT	3			8/11/2005	29.2	13.14	0.9	1.8	1.4	0.06	1.49	19.73	4.67	44.99	7.63	5.90	3.15	1.26	0.71
KAT	4			8/11/2005	25.6	4.10	0.7	NS	0.7	<0.05	0.69	12.01	5.78	42.16	6.42	6.57	4.44	0.64	0.87
KAT	5			8/11/2005	30.5	4.86	1.0	1.7	0.7	<0.05	0.69	16.48	5.69	44.95	6.98	6.44	4.87	<0.05	1.00
KAT	6			8/11/2005	30.3	4.57	0.8	NS	0.7	<0.05	0.69	14.08	5.20	42.09	6.51	6.46	4.07	0.08	0.98
KAT	7			8/11/2005	26.7	4.38	0.9	NS	0.6	0.09	0.70	13.70	4.68	40.43	6.08	6.65	3.90	0.73	0.84
KAT	8			8/11/2005	30.3	6.58	0.9	2.1	1.5	0.14	1.62	21.48	NS	71.98	10.04	7.17	4.66	1.68	0.73
KAT	9			8/11/2005	21.2	8.98	0.9	1.8	1.5	0.16	1.68	10.68	NS	39.14	5.63	6.95	5.23	0.10	0.98
KAT	1			8/29/2005	29.7	5.86	0.6	NS	2.0	<0.05	1.99	14.24	NS	25.10	3.33	7.55	3.03	0.67	0.82
KAT	2			8/29/2005	31.0	7.92	0.6	NS	1.4	<0.05	1.44	12.60	NS	36.69	3.02	12.15	3.33	1.08	0.76
KAT	3			8/29/2005	31.0	10.80	0.7	1.6	2.5	<0.05	2.57	16.84	17.73	42.81	6.72	6.37	3.20	0.47	0.87
KAT	4			8/29/2005	30.3	12.62	0.7	NS	1.3	<0.05	1.28	14.95	6.87	35.79	5.65	6.33	4.18	1.09	0.79
KAT	5			8/29/2005	30.8	11.75	0.7	1.4	2.6	<0.05	2.65	30.97	5.77	36.36	5.52	6.59	4.25	1.23	0.78
KAT	6			8/29/2005	30.5	13.81	0.8	NS	1.5	<0.05	1.49	23.29	4.92	34.58	5.74	6.03	3.37	0.81	0.81
KAT	7			8/29/2005	31.0	13.05	0.7	NS	2.5	0.14	2.60	18.35	3.98	41.04	6.27	6.55	5.25	1.15	0.82
KAT	9			8/29/2005	31.1	11.23	0.6	1.6	2.1	38.14	40.23	15.21	NS	39.62	3.47	11.42	4.25	1.23	0.78
KAT	8			8/30/2005	1.2	45.47	0.1	2.6	4.9	<0.05	4.90	16.25	NS	331.47	38.24	8.67	47.87	17.16	0.74
LAGOON ROAD				########	ND	NS	1.7	26.1	8.0	13.65	21.62	65.24	1008.00	11841.95	713.09	16.61	NS	NS	NS
LGP10	8			6/16/2005	30.1	11.51	0.2	NS	1.0	0.21	1.23	13.24	NS	49.92	7.33	6.81	1.10	3.17	0.26
LGP10	8			7/15/2005	29.1	16.59	0.4	NS	<0.1	0.30	0.35	10.19	NS	32.80	5.56	5.90	4.80	<0.05	1.00
LGP10	8			7/29/2005	30.6	15.78	0.6	NS	2.1	0.50	2.60	8.92	NS	36.76	6.05	6.08	2.69	0.39	0.87
LGP10	8			8/15/2005	30.3	15.83	0.7	NS	0.9	0.25	1.17	15.75	NS	36.25	6.33	5.73	3.04	1.32	0.70
LGP10	8		Sample	8/29/2005	30.1	11.95	0.5	NS	1.7	<0.05	1.69	12.44	NS	39.61	6.35	6.23	4.12	0.24	0.95
LGP10	8		DUP	8/29/2005	30.1	12.52	0.5	NS	1.8	<0.05	1.78	13.93	NS	39.08	6.65	5.88	3.23	0.42	0.89
LGP10	8			9/13/2005	29.8	12.57	0.4	NS	2.6	1.96	4.59	12.49	NS	29.39	4.75	6.18	1.71	1.37	0.56
LGP2	10	B		6/16/2005	30.1	12.19	0.4	NS	1.7	<0.05	1.71	8.90	NS	51.50	8.34	6.17	4.47	2.86	0.61
LGP2	10	M		6/16/2005	30.1	8.21	0.2	NS	0.8	<0.05	0.84	11.55	NS	39.61	6.99	5.67	6.28	0.96	0.87
LGP2	10	S		6/16/2005	28.8	9.21	0.1	NS	0.6	0.19	0.75	8.84	NS	34.21	6.18	5.54	4.77	0.17	0.97
LGP2	10	B		7/15/2005	30.1	20.48	1.2	NS	0.1	<0.05	0.12	8.85	NS	47.73	7.02	6.80	3.55	1.52	0.70
LGP2	10	M		7/15/2005	29.9	11.61	0.5	NS	<0.1	<0.05	<0.1	14.01	NS	54.33	8.62	6.30	6.21	<0.05	1.00
LGP2	10	S		7/15/2005	29.7	11.90	0.5	NS	<0.1	<0.05	<0.1	9.16	NS	38.54	6.10	6.32	2.63	<0.05	1.00
LGP2	10	B		7/29/2005	31.4	13.48	1.0	NS	2.2	<0.05	2.26	7.82	NS	50.06	8.17	6.13	6.82	0.77	0.90
LGP2	10	M		7/29/2005	31.5	13.10	0.8	NS	0.6	<0.05	0.59	9.85	NS	56.72	8.62	6.58	8.28	0.88	0.90
LGP2	10	S		7/29/2005	30.6	14.34	0.8	NS	0.5	<0.05	0.51	10.62	NS	62.40	8.45	7.38	5.89	0.71	0.89
LGP2	10	B		8/15/2005	30.9	17.17	1.0	NS	<0.1	<0.05	<0.1	25.69	NS	47.67	8.18	5.82	5.99	1.91	0.76

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
LGP2	10	M		8/15/2005	29.7	12.66	0.6	NS	<0.1	<0.05	<0.1	13.75	NS	64.27	10.57	6.08	11.22	0.56	0.95
LGP2	10	S		8/15/2005	30.4	12.71	0.6	NS	0.5	<0.05	0.57	16.90	NS	66.71	11.03	6.05	10.70	1.47	0.88
LGP2	10	B		8/29/2005	30.8	10.94	0.6	NS	1.3	<0.05	1.36	12.08	NS	46.38	7.35	6.31	10.09	0.73	0.93
LGP2	10	M	Sample	8/29/2005	30.7	11.32	0.5	NS	1.0	<0.05	0.98	12.15	NS	62.39	9.96	6.27	10.40	<0.05	1.00
LGP2	10	M	DUP	8/29/2005	30.4	11.85	0.5	NS	1.0	<0.05	0.98	13.24	NS	61.68	10.08	6.12	5.95	2.08	0.74
LGP2	10	S		8/29/2005	30.3	12.90	0.4	NS	1.0	<0.05	1.03	14.41	NS	64.58	10.65	6.06	10.39	<0.05	1.00
LGP2	10	B		9/13/2005	31.2	12.04	0.7	NS	1.0	<0.05	1.00	12.38	NS	32.46	5.58	5.81	2.75	2.60	0.51
LGP2	10	M		9/13/2005	30.4	10.84	0.4	NS	0.8	<0.05	0.87	10.72	NS	46.28	8.00	5.78	6.90	2.19	0.76
LGP2	10	S		9/13/2005	30.5	11.51	0.3	NS	1.0	<0.05	1.05	9.95	NS	29.32	5.11	5.74	4.75	0.92	0.84
LGP4	7	B		6/16/2005	30.3	8.11	0.3	NS	1.4	<0.05	1.46	10.10	NS	34.56	6.00	5.76	3.95	1.92	0.67
LGP4	7	S		6/16/2005	27.8	13.67	0.1	NS	1.0	1.11	2.13	12.27	NS	33.61	5.90	5.70	4.43	0.67	0.87
LGP4	7	B		7/15/2005	30.1	18.41	1.0	NS	0.2	<0.05	0.24	8.66	NS	56.09	9.03	6.21	7.24	<0.05	1.00
LGP4	7	S		7/15/2005	29.7	12.19	0.5	NS	<0.1	<0.05	<0.1	10.46	NS	37.81	6.13	6.16	3.33	<0.05	1.00
LGP4	7	B		7/29/2005	30.7	15.59	0.9	NS	0.7	<0.05	0.76	11.89	NS	54.68	9.02	6.06	6.73	1.10	0.86
LGP4	7	S		7/29/2005	30.5	14.58	0.8	NS	0.5	<0.05	0.55	8.45	NS	64.60	10.93	5.91	7.93	0.39	0.95
LGP4	7	B	Sample	8/15/2005	30.1	16.21	0.7	NS	<0.1	<0.05	<0.1	15.57	NS	42.34	7.45	5.68	8.20	0.64	0.93
LGP4	7	B	DUP	8/15/2005	30.2	15.88	0.8	NS	0.1	<0.05	0.10	12.71	NS	41.59	7.41	5.61	7.75	1.29	0.86
LGP4	7	S		8/15/2005	29.6	15.78	0.6	NS	<0.1	<0.05	<0.1	14.72	NS	59.36	10.92	5.44	11.11	0.30	0.97
LGP4	7	B		8/29/2005	30.7	15.20	0.7	NS	1.9	<0.05	1.90	13.23	NS	46.57	8.09	5.75	5.50	1.66	0.77
LGP4	7	S		8/29/2005	30.7	11.75	0.5	NS	1.2	<0.05	1.19	12.16	NS	77.58	12.72	6.10	10.75	0.09	0.99
LGP4	7	B		9/13/2005	30.9	10.94	0.5	NS	1.4	<0.05	1.44	8.03	NS	28.44	4.69	6.07	1.80	2.00	0.47
LGP4	7	S		9/13/2005	27.6	23.11	0.5	NS	2.0	1.86	3.88	10.41	NS	27.21	4.30	6.33	3.09	1.37	0.69
LGP4	7	S		9/13/2005	27.3	22.82	0.5	NS	2.3	1.81	4.09	9.96	NS	29.07	4.62	6.30	2.25	1.28	0.64
LGP8	11	B		6/16/2005	30.4	4.72	0.3	NS	1.4	<0.05	1.38	17.06	NS	45.72	7.86	5.82	5.44	0.84	0.87
LGP8	11	S		6/16/2005	29.1	8.83	0.1	NS	0.8	0.56	1.33	14.87	NS	27.24	4.64	5.87	2.73	0.36	0.88
LGP8	11	B		7/15/2005	30.0	9.69	0.5	NS	<0.1	<0.05	<0.1	7.34	NS	28.88	4.74	6.10	4.88	0.19	0.96
LGP8	11	S		7/15/2005	29.6	10.94	0.4	NS	<0.1	<0.05	<0.1	8.08	NS	37.96	5.73	6.62	4.66	<0.05	1.00
LGP8	11	B		7/29/2005	31.8	6.87	0.6	NS	0.7	<0.05	0.68	8.16	NS	48.44	7.59	6.38	5.18	1.06	0.83
LGP8	11	S		7/29/2005	30.1	13.10	0.7	NS	0.5	<0.05	0.51	7.65	NS	38.27	5.38	7.11	3.37	0.64	0.84
LGP8	11	B		8/15/2005	30.5	11.28	0.7	NS	<0.1	<0.05	<0.1	13.45	NS	NS	NS	NS	6.79	0.68	0.91
LGP8	11	S		8/15/2005	30.4	11.23	0.6	NS	<0.1	<0.05	<0.1	16.36	NS	34.03	5.04	6.75	11.65	3.11	0.79
LGP8	11	B		8/29/2005	30.6	9.60	0.5	NS	1.1	<0.05	1.15	15.20	NS	43.47	7.09	6.13	6.11	0.60	0.91
LGP8	11	S		8/29/2005	30.4	10.75	0.3	NS	0.9	<0.05	0.94	13.83	NS	50.27	7.83	6.42	5.95	0.35	0.94
LGP8	11	B		9/13/2005	31.3	6.39	0.5	NS	1.3	<0.05	1.31	10.38	NS	32.34	5.19	6.23	3.67	1.67	0.69
LGP8	11	S		9/13/2005	30.5	10.65	0.4	NS	0.9	0.07	0.96	10.36	NS	30.50	5.01	6.09	3.33	1.03	0.76
LGP9	9	B		6/16/2005	29.9	4.72	0.1	NS	0.9	<0.05	0.88	7.94	NS	30.87	4.72	6.55	3.01	0.73	0.81
LGP9	9	S		6/16/2005	29.5	8.30	0.1	NS	0.7	<0.05	0.75	11.48	NS	29.96	5.00	5.99	3.03	0.14	0.96
LGP9	9	B		7/15/2005	29.9	9.69	0.4	NS	<0.1	<0.05	<0.1	7.74	NS	36.01	5.77	6.24	3.62	0.34	0.91
LGP9	9	S		7/15/2005	29.7	10.22	0.4	NS	<0.1	<0.05	<0.1	8.11	NS	33.39	5.14	6.50	2.41	<0.05	1.00
LGP9	9	B		7/29/2005	31.2	9.55	0.6	NS	0.6	<0.05	0.59	8.56	NS	40.61	5.93	6.85	3.18	0.20	0.94
LGP9	9	S	Sample	7/29/2005	30.2	13.72	0.7	NS	0.6	<0.05	0.65	20.20	NS	36.63	4.91	7.46	2.77	0.35	0.89
LGP9	9	S	DUP	7/29/2005	30.3	13.81	0.6	NS	0.5	<0.05	0.56	35.18	NS	36.53	5.27	6.92	2.85	0.40	0.88
LGP9	9	B		8/15/2005	30.6	9.93	0.7	NS	0.1	<0.05	0.10	13.25	NS	35.04	5.91	5.93	3.56	0.89	0.80
LGP9	9	S	Sample	8/15/2005	30.5	10.41	0.6	NS	<0.1	<0.05	<0.1	13.84	NS	44.26	7.78	5.69	3.54	0.80	0.82
LGP9	9	S	DUP	8/15/2005	30.6	10.36	0.6	NS	<0.1	<0.05	<0.1	13.37	NS	31.10	5.24	5.93	3.63	1.12	0.76
LGP9	9	B		8/29/2005	30.3	10.60	0.3	NS	0.9	<0.05	0.94	10.41	NS	47.63	7.07	6.74	5.63	<0.05	1.00
LGP9	9	S		8/29/2005	30.4	10.36	0.3	NS	0.9	<0.05	0.94	11.65	NS	42.48	7.06	6.01	4.81	<0.05	1.00
LGP9	9	B		9/13/2005	31.2	5.91	0.4	NS	1.0	<0.05	1.05	8.61	NS	30.15	4.60	6.55	4.22	1.57	0.73
LGP9	9	S		9/13/2005	30.7	9.50	0.3	NS	1.1	<0.05	1.09	15.50	NS	30.36	4.96	6.13	2.93	1.68	0.64
MV SOUND	6	B		6/16/2005	30.3	1.27	0.2	NS	1.0	<0.05	1.00	11.35	NS	18.95	2.84	6.66	2.11	<0.05	1.00

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
MV SOUND	6	S		6/16/2005	30.1	5.67	0.2	NS	1.7	<0.05	1.71	9.12	NS	20.35	3.23	6.31	1.88	0.52	0.78
MV SOUND	6	B		7/15/2005	30.5	4.33	0.4	NS	<0.1	<0.05	<0.1	10.01	NS	22.10	3.47	6.36	3.62	<0.05	1.00
MV SOUND	6	S		7/15/2005	23.1	9.55	0.4	NS	<0.1	<0.05	<0.1	8.08	NS	25.95	4.00	6.49	3.17	<0.05	1.00
MV SOUND	6	B		7/29/2005	31.7	2.56	0.4	NS	0.5	<0.05	0.55	5.91	NS	26.42	3.91	6.75	4.47	<0.05	1.00
MV SOUND	6	S		7/29/2005	30.7	9.50	0.4	NS	0.7	<0.05	0.72	8.12	NS	29.26	4.68	6.25	2.44	0.38	0.86
MV SOUND	6	B		8/15/2005	31.3	0.75	0.4	NS	0.2	<0.05	0.24	12.38	NS	28.25	4.08	6.92	4.89	<0.05	1.00
MV SOUND	6	S		8/15/2005	30.6	3.43	0.5	NS	0.3	<0.05	0.28	12.03	NS	30.67	4.85	6.33	3.37	0.38	0.90
MV SOUND	6	B		8/29/2005	31.1	2.85	0.5	NS	1.3	<0.05	1.36	12.02	NS	27.66	3.87	7.14	3.88	0.37	0.91
MV SOUND	6	S	Sample	8/29/2005	30.1	5.96	0.5	NS	1.1	<0.05	1.11	9.57	NS	30.32	4.61	6.57	3.03	0.70	0.81
MV SOUND	6	S	DUP	8/29/2005	30.7	6.05	0.5	NS	1.2	<0.05	1.19	8.76	NS	26.84	3.80	7.06	3.39	0.49	0.87
MV SOUND	6	B		9/13/2005	31.8	3.33	0.5	NS	0.9	<0.05	0.96	7.16	NS	28.35	4.09	6.94	1.18	0.36	0.77
MV SOUND	6	S		9/13/2005	30.8	8.11	0.5	NS	1.4	<0.05	1.39	9.80	NS	29.63	4.50	6.59	3.92	0.58	0.87
OBH1	14			6/16/2005	28.4	9.07	0.1	NS	3.1	2.85	5.91	13.31	NS	101.59	13.57	7.49	7.93	2.77	0.74
OBH1	14			7/15/2005	26.9	18.22	0.2	NS	4.7	6.10	10.80	13.39	NS	51.77	7.72	6.71	4.55	0.76	0.86
OBH1	14			7/29/2005	29.3	10.51	0.4	NS	5.0	4.16	9.13	9.75	NS	72.10	9.63	7.49	4.54	1.54	0.75
OBH1	14			8/15/2005	28.6	18.03	0.6	NS	4.9	0.66	5.52	22.64	NS	51.64	7.19	7.18	4.07	1.59	0.72
OBH1	14		Sample	8/29/2005	29.2	12.28	0.5	NS	2.8	1.81	4.60	13.58	NS	94.62	13.99	6.77	10.26	4.52	0.69
OBH1	14		DUP	8/29/2005	29.2	NS	0.6	NS	3.0	1.96	4.96	15.51	NS	100.87	13.27	7.60	10.55	3.67	0.74
OBH1	14			9/13/2005	29.3	9.65	0.6	NS	3.0	1.58	4.60	16.21	NS	70.65	10.05	7.03	4.18	1.29	0.76
OBH2	17			6/16/2005	30.1	3.57	0.2	NS	0.9	<0.05	0.88	12.10	NS	52.86	8.93	5.92	10.63	1.68	0.86
OBH2	17			7/15/2005	29.6	7.63	0.2	NS	0.3	0.46	0.72	9.51	NS	53.22	9.79	5.44	9.58	0.38	0.96
OBH2	17			7/29/2005	30.7	9.02	0.7	NS	5.4	1.87	7.23	11.40	NS	52.62	7.80	6.75	4.14	2.33	0.64
OBH2	17			8/15/2005	30.3	10.46	0.6	NS	1.6	0.81	2.38	21.69	NS	73.35	12.37	5.93	18.59	<0.05	1.00
OBH2	17		Sample	8/29/2005	30.5	6.91	0.6	NS	2.3	0.43	2.77	15.46	NS	55.93	8.57	6.52	6.73	3.95	0.63
OBH2	17		DUP	8/29/2005	30.6	7.59	0.6	NS	2.3	0.41	2.66	13.15	NS	55.16	8.37	6.59	6.67	2.93	0.69
OBH2	17		Sample	9/13/2005	31.0	7.44	0.5	NS	1.5	<0.05	1.48	12.63	NS	48.28	8.88	5.43	5.17	2.12	0.71
OBH2	17		DUP	9/13/2005	31.0	7.39	0.5	NS	1.1	<0.05	1.09	14.87	NS	49.05	8.83	5.56	8.04	3.58	0.69
OBH3	16	B		6/16/2005	30.1	2.09	0.2	NS	0.8	<0.05	0.79	10.34	NS	48.51	7.99	6.07	7.90	1.84	0.81
OBH3	16	S		6/16/2005	30.0	2.47	0.1	NS	0.7	<0.05	0.71	12.93	NS	43.44	6.44	6.75	7.16	1.22	0.85
OBH3	16	B		7/15/2005	30.0	6.05	0.1	NS	<0.1	<0.05	<0.1	9.13	NS	46.23	7.94	5.82	9.81	0.09	0.99
OBH3	16	S	Sample	7/15/2005	30.0	6.10	0.1	NS	<0.1	<0.05	<0.1	10.67	NS	51.55	9.05	5.70	10.27	<0.05	1.00
OBH3	16	S	DUP	7/15/2005	29.9	6.00	0.2	NS	<0.1	<0.05	<0.1	8.94	NS	44.13	7.24	6.10	11.22	<0.05	1.00
OBH3	16	B		7/29/2005	30.8	8.11	0.6	NS	3.2	1.29	4.46	9.18	NS	51.75	7.56	6.85	5.61	0.96	0.85
OBH3	16	S	Sample	7/29/2005	30.8	8.06	0.6	NS	3.2	1.30	4.52	19.03	NS	52.39	8.11	6.46	5.00	1.83	0.73
OBH3	16	S	DUP	7/29/2005	31.5	8.06	0.6	NS	3.1	1.30	4.39	18.06	NS	54.99	8.17	6.73	5.82	1.62	0.78
OBH3	16	B		8/15/2005	31.0	6.10	0.6	NS	0.9	0.31	1.23	15.13	NS	48.17	8.40	5.73	9.27	0.96	0.91
OBH3	16	S	Sample	8/15/2005	29.7	6.10	0.6	NS	0.9	0.31	1.23	14.46	NS	41.43	7.05	5.87	9.93	1.32	0.88
OBH3	16	S	DUP	8/15/2005	29.9	6.05	0.6	NS	1.1	0.32	1.43	14.92	NS	44.02	6.94	6.35	10.37	1.66	0.86
OBH3	16	B		8/29/2005	30.7	7.39	0.4	NS	1.1	<0.05	1.11	10.84	NS	49.55	6.73	7.36	6.75	3.38	0.67
OBH3	16	S		8/29/2005	30.8	7.92	0.4	NS	1.1	<0.05	1.11	12.60	NS	57.40	7.95	7.22	7.35	2.85	0.72
OBH3	16	B		9/13/2005	30.4	5.09	0.5	NS	1.2	0.14	1.33	10.77	NS	38.09	5.59	6.81	5.42	1.42	0.79
OBH3	16	S		9/13/2005	31.1	6.39	0.5	NS	1.0	<0.05	1.00	13.38	NS	32.34	5.15	6.28	4.27	1.82	0.70
OBH4	15			6/16/2005	30.1	4.33	0.2	NS	1.0	0.60	1.62	11.69	NS	49.70	7.74	6.42	8.92	1.67	0.84
OBH4	15			7/15/2005	29.9	6.24	0.1	NS	<0.1	<0.05	<0.1	9.69	NS	59.47	9.47	6.28	10.84	<0.05	1.00
OBH4	15			7/29/2005	31.2	9.93	0.7	NS	4.1	1.45	5.57	10.44	NS	99.46	13.59	7.32	8.46	2.18	0.80
OBH4	15			8/15/2005	30.8	9.07	0.7	NS	1.2	0.68	1.84	15.60	NS	49.99	8.42	5.94	9.62	0.61	0.94
OBH4	15			8/29/2005	30.3	10.22	0.5	NS	1.3	0.75	2.04	13.61	NS	67.71	10.24	6.61	7.64	4.25	0.64
OBH4	15			9/13/2005	31.0	7.15	0.6	NS	1.7	<0.05	1.70	13.26	NS	36.01	6.09	5.92	5.95	2.31	0.72
OUT OBH	12	B		6/16/2005	30.3	0.22	0.2	NS	0.8	<0.05	0.84	8.82	NS	22.67	3.00	7.56	2.17	<0.05	1.00
OUT OBH	12	S		6/16/2005	30.5	0.17	0.2	NS	0.8	<0.05	0.79	15.97	NS	21.12	2.97	7.11	1.54	<0.05	1.00

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
OUT OBH	12	B		7/15/2005	30.6	4.33	0.4	NS	<0.1	<0.05	<0.1	7.25	NS	23.24	3.51	6.61	3.01	0.08	0.97
OUT OBH	12	S		7/15/2005	30.8	4.43	0.4	NS	<0.1	<0.05	<0.1	8.44	NS	22.58	3.32	6.80	2.80	<0.05	1.00
OUT OBH	12	B		7/29/2005	31.5	0.89	0.4	NS	0.6	<0.05	0.63	7.16	NS	35.01	4.74	7.38	3.99	<0.05	1.00
OUT OBH	12	S		7/29/2005	31.5	0.89	0.4	NS	0.7	<0.05	0.68	6.37	NS	37.57	5.61	6.69	3.29	<0.05	1.00
OUT OBH	12	B		8/15/2005	31.2	0.94	0.5	NS	<0.1	<0.05	<0.1	11.53	NS	36.64	5.72	6.40	7.16	<0.05	1.00
OUT OBH	12	S		8/15/2005	30.1	1.61	0.5	NS	0.1	<0.05	0.10	14.59	NS	39.28	5.59	7.03	7.29	0.46	0.94
OUT OBH	12	B		8/29/2005	31.0	4.14	0.5	NS	1.1	<0.05	1.11	11.63	NS	30.35	4.25	7.14	2.14	0.79	0.73
OUT OBH	12	S		8/29/2005	31.0	3.95	0.5	NS	1.2	<0.05	1.19	9.19	NS	31.63	4.51	7.01	2.26	0.86	0.73
OUT OBH	12	B		9/13/2005	31.5	2.09	0.6	NS	1.1	<0.05	1.13	10.52	NS	24.24	3.30	7.34	2.29	0.34	0.87
OUT OBH	12	S		9/13/2005	31.8	2.28	0.6	NS	1.1	<0.05	1.13	9.31	NS	22.66	3.11	7.29	2.41	0.18	0.93
OYS	3	B		7/6/2005	26.6	64.32	0.1	2.0	ND	<0.05	ND	ND	NS	215.38	25.65	8.40	9.32	4.41	0.68
OYS	1			7/6/2005	0.9	90.65	0.3	1.9	0.3	8.21	8.50	6.46	NS	131.22	22.03	5.96	19.61	2.48	0.89
OYS	2			7/6/2005	4.5	3.62	<0.1	NS	0.8	2.74	3.52	8.77	10.60	92.11	13.98	6.59	7.12	<0.05	1.00
OYS	3			7/6/2005	11.9	54.42	<0.1	0.8	0.1	<0.05	0.14	15.12	139.20	94.64	13.85	6.83	5.18	<0.05	1.00
OYS	4			7/6/2005	14.9	60.84	<0.1	0.7	0.5	<0.05	0.48	18.11	16.64	91.35	13.52	6.76	3.57	<0.05	1.00
OYS	5			7/6/2005	12.1	67.26	<0.1	NS	0.7	<0.05	0.68	13.11	NS	125.26	21.28	5.89	4.33	<0.05	1.00
OYS	1			7/18/2005	1.1	125.35	0.1	0.9	0.1	2.45	2.58	6.97	NS	90.21	13.45	6.71	6.60	0.90	0.88
OYS	2			7/18/2005	4.2	99.37	<0.1	NS	<0.1	<0.05	<0.1	4.10	5.35	85.71	12.49	6.86	3.65	<0.05	1.00
OYS	3			7/18/2005	17.7	69.09	<0.1	0.8	0.1	<0.05	0.08	7.86	6.85	101.90	13.61	7.49	4.04	<0.05	1.00
OYS	4			7/18/2005	19.2	62.02	<0.1	1.0	0.5	<0.05	0.51	11.16	6.35	104.85	13.71	7.65	4.10	<0.05	1.00
OYS	5			7/18/2005	19.4	62.49	<0.1	0.8	0.4	<0.05	0.39	10.86	NS	94.88	13.62	6.97	3.41	<0.05	1.00
OYS	1			8/1/2005	7.8	89.47	<0.1	1.0	0.2	0.43	0.68	6.50	NS	109.21	16.24	6.72	8.96	<0.05	1.00
OYS	2			8/1/2005	10.7	68.62	<0.1	NS	0.6	0.38	1.02	15.48	6.35	126.35	17.27	7.32	7.64	<0.05	1.00
OYS	3			8/1/2005	12.4	75.33	<0.1	1.1	0.2	0.28	0.53	10.55	18.25	139.41	19.25	7.24	5.65	<0.05	1.00
OYS	4			8/1/2005	6.9	45.17	<0.1	1.1	0.4	0.40	0.83	7.21	6.25	123.43	17.18	7.18	7.27	<0.05	1.00
OYS	5			8/1/2005	7.9	54.13	<0.1	1.1	0.5	0.36	0.83	7.95	NS	116.67	17.80	6.55	7.68	<0.05	1.00
OYS	1			8/15/2005	10.5	128.94	0.3	NS	1.0	<0.05	1.05	17.99	NS	227.44	35.13	6.47	24.35	1.81	0.93
OYS	2			8/15/2005	12.6	100.78	0.1	1.8	0.6	<0.05	0.58	19.01	12.35	191.11	27.86	6.86	11.33	<0.05	1.00
OYS	3			8/15/2005	12.3	99.72	0.1	1.7	0.6	<0.05	0.63	18.81	19.55	188.07	27.61	6.81	13.73	<0.05	1.00
OYS	4			8/15/2005	13.5	93.95	0.1	1.8	0.6	<0.05	0.63	21.42	20.05	201.85	29.84	6.76	14.59	<0.05	1.00
OYS	5			8/15/2005	12.1	101.61	0.1	1.8	0.3	<0.05	0.33	16.63	NS	234.36	35.27	6.64	14.19	<0.05	1.00
PCA	1			7/14/2005	29.4	15.20	0.2	NS	2.2	0.12	2.33	13.55	10.64	35.90	5.41	6.63	2.77	1.20	0.70
PCA	2			7/14/2005	29.4	17.03	0.2	NS	2.9	0.11	2.99	21.20	NS	46.77	7.34	6.37	2.80	1.30	0.68
PCA	3			7/14/2005	29.4	19.18	0.2	1.0	2.6	0.05	2.67	17.00	NS	33.86	5.83	5.81	2.36	4.06	0.37
PCA	1			8/11/2005	30.9	16.45	0.4	NS	2.5	0.06	2.53	16.47	5.48	40.32	5.62	7.18	2.33	1.03	0.69
PCA	2			8/11/2005	30.9	18.75	0.3	NS	3.0	0.15	3.14	20.95	NS	45.80	6.25	7.33	2.50	1.07	0.70
PCA	3			8/11/2005	30.9	20.76	0.4	1.4	3.5	<0.05	3.53	21.91	6.42	38.31	5.08	7.55	2.22	0.98	0.69
PCA	1			8/30/2005	30.2	10.27	0.3	NS	3.0	<0.05	3.04	19.43	18.66	30.18	4.44	6.79	3.57	1.38	0.72
PCA	2			8/30/2005	30.3	6.58	0.3	NS	3.1	<0.05	3.08	20.29	NS	46.35	6.24	7.43	5.11	1.63	0.76
PCA	3			8/30/2005	30.3	8.35	0.5	1.3	5.1	0.14	5.26	20.79	16.33	36.25	5.11	7.09	2.75	1.45	0.66
PCA	1			9/13/2005	31.2	4.00	0.5	NS	3.1	<0.05	3.13	18.79	16.08	31.83	4.49	7.09	1.47	0.75	0.66
PCA	2			9/13/2005	32.0	4.29	0.4	NS	2.4	<0.05	2.44	21.56	NS	43.69	4.64	9.42	1.54	0.63	0.71
PCA	3			9/13/2005	31.9	6.29	0.5	1.5	3.6	<0.05	3.65	24.21	14.05	33.77	4.51	7.48	1.78	0.77	0.70
POG	1			7/14/2005	30.4	6.87	0.3	NS	1.1	<0.05	1.15	11.30	10.68	28.66	4.46	6.43	1.64	<0.05	1.00
POG	2			7/14/2005	30.3	4.86	0.3	NS	0.4	<0.05	0.45	17.07	13.20	35.54	5.37	6.62	2.02	0.40	0.84
POG	3			7/14/2005	29.3	9.93	0.2	0.9	0.6	<0.05	0.66	12.07	15.38	56.42	9.04	6.24	3.68	0.35	0.91
POG	4			7/14/2005	30.3	13.96	0.1	0.9	0.5	<0.05	0.57	12.03	13.18	43.01	7.11	6.05	3.61	0.32	0.92
POG	5			7/14/2005	29.8	13.29	0.2	0.9	2.5	0.06	2.56	14.59	12.82	42.69	6.69	6.38	1.68	0.76	0.69
POG	1			8/11/2005	31.1	8.50	0.4	NS	0.6	<0.05	0.60	14.89	3.87	33.00	4.90	6.73	2.25	0.48	0.82
POG	2			8/11/2005	31.0	5.10	0.4	NS	0.3	<0.05	0.34	11.49	4.77	38.08	5.04	7.56	2.67	0.72	0.79

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
POG	3			8/11/2005	26.4	12.19	0.5	1.4	2.2	0.14	2.35	17.30	4.36	33.64	5.02	6.70	2.98	0.94	0.76
POG	4			8/11/2005	27.2	13.67	0.3	1.1	0.5	<0.05	0.51	14.71	5.13	38.31	5.72	6.69	3.97	0.41	0.91
POG	5			8/11/2005	30.9	16.16	0.4	1.1	2.9	<0.05	2.93	18.18	5.12	40.76	5.62	7.25	2.72	1.30	0.68
POG	1			8/30/2005	30.2	3.95	0.6	NS	1.2	<0.05	1.27	10.65	17.54	33.15	4.68	7.09	1.29	0.39	0.77
POG	2			8/30/2005	30.3	4.00	0.6	NS	1.7	<0.05	1.68	12.45	21.25	22.83	3.32	6.87	0.26	<0.05	1.00
POG	3			8/30/2005	31.0	7.06	0.5	1.0	2.0	<0.05	2.01	18.79	15.53	30.26	4.72	6.41	2.09	0.92	0.69
POG	4			8/30/2005	31.9	10.03	0.3	1.3	1.4	<0.05	1.44	16.34	16.03	31.61	5.11	6.18	2.31	0.83	0.74
POG	5			8/30/2005	31.5	11.32	0.3	1.2	1.3	<0.05	1.31	16.54	14.43	36.83	5.65	6.52	2.54	0.85	0.75
POG	6			8/30/2005	30.9	4.14	0.6	1.1	1.2	<0.05	1.19	10.49	NS	45.09	5.46	8.26	2.62	1.07	0.71
POG	1			9/13/2005	31.4	0.98	0.5	NS	2.1	<0.05	2.09	13.50	19.63	33.70	4.66	7.23	1.97	0.22	0.90
POG	2			9/13/2005	30.5	1.22	0.5	NS	1.8	<0.05	1.87	12.57	20.20	38.75	5.24	7.39	2.52	0.05	0.98
POG	3			9/13/2005	31.7	2.66	0.5	1.4	1.4	0.08	1.49	15.41	21.13	44.78	6.40	7.00	1.95	0.45	0.81
POG	4			9/13/2005	31.0	3.23	0.3	1.3	1.4	<0.05	1.39	17.44	19.75	34.44	5.20	6.62	2.44	0.50	0.83
POG	5			9/13/2005	31.9	3.23	0.3	1.2	0.5	<0.05	0.48	18.29	19.50	34.03	4.83	7.05	2.04	0.92	0.69
POG	6			9/13/2005	31.9	3.14	0.5	1.1	1.8	<0.05	1.87	19.69	NS	41.90	4.72	8.88	2.56	0.31	0.89
SKT	1			6/29/2005	30.2	7.25	0.5	NS	1.6	<0.05	1.63	14.43	NS	29.33	4.00	7.33	1.54	0.38	0.80
SKT	2			6/29/2005	20.3	6.91	0.5	1.1	1.8	0.06	1.86	13.94	4.07	35.48	4.99	7.11	2.37	0.63	0.79
SKT	3			6/29/2005	29.1	9.17	0.6	NS	2.0	0.07	2.03	15.03	3.55	33.27	4.73	7.04	2.61	0.72	0.78
SKT	4			6/29/2005	30.7	13.14	0.7	1.2	2.8	0.22	3.04	21.97	5.43	32.19	4.43	7.27	2.64	0.51	0.84
SKT	5			6/29/2005	31.2	3.52	0.4	NS	0.5	<0.05	0.53	33.47	NS	22.78	3.07	7.43	1.87	0.10	0.95
SKT	6			6/29/2005	30.2	4.19	0.4	NS	1.1	<0.05	1.10	15.63	11.11	23.06	2.99	7.71	1.86	0.21	0.90
SKT	7			6/29/2005	30.2	3.52	0.4	NS	1.0	<0.05	1.02	15.65	2.30	21.38	3.06	6.98	2.29	<0.05	1.00
SKT	8			6/29/2005	27.5	4.38	0.4	1.0	1.1	<0.05	1.10	17.41	10.85	41.99	6.56	6.40	3.42	0.89	0.79
SKT	9			6/29/2005	29.0	8.02	0.5	1.2	3.5	0.09	3.64	19.81	4.76	38.98	5.28	7.38	2.19	1.19	0.65
SKT	10			6/29/2005	30.4	4.33	0.4	0.8	0.8	<0.05	0.78	13.07	NS	37.90	4.90	7.73	2.29	0.80	0.74
SKT	1			7/13/2005	20.4	9.07	0.4	NS	0.2	<0.05	0.18	10.43	NS	32.85	5.06	6.49	2.82	0.29	0.91
SKT	2			7/13/2005	24.8	11.18	0.6	1.6	1.8	0.14	1.94	13.04	3.40	46.47	8.24	5.64	4.77	0.69	0.87
SKT	3			7/13/2005	24.8	12.95	0.5	NS	0.2	<0.05	0.26	21.84	8.86	29.69	4.98	5.97	3.22	0.12	0.96
SKT	4			7/13/2005	25.8	14.15	0.6	1.6	0.3	0.29	0.62	21.33	2.54	28.97	4.79	6.05	3.57	1.05	0.77
SKT	5			7/13/2005	23.7	3.43	0.3	NS	0.6	<0.05	0.65	10.09	NS	29.86	4.23	7.07	1.83	0.19	0.91
SKT	6			7/13/2005	23.7	4.48	0.3	NS	0.5	0.15	0.67	25.84	3.27	26.92	4.03	6.67	1.92	<0.05	1.00
SKT	7			7/13/2005	20.3	3.28	0.5	NS	0.6	<0.05	0.61	10.30	3.00	30.72	4.58	6.71	1.93	<0.05	1.00
SKT	8			7/13/2005	22.5	4.91	0.2	1.0	1.0	0.37	1.35	11.06	9.09	33.16	5.18	6.40	2.27	0.36	0.86
SKT	9			7/13/2005	24.1	13.19	0.2	1.0	2.5	0.31	2.85	16.49	3.10	39.06	5.47	7.15	2.60	1.34	0.66
SKT	10			7/13/2005	29.4	13.91	0.6	1.6	2.3	<0.05	2.32	15.66	NS	30.55	4.48	6.82	2.47	0.24	0.91
SKT	1			7/27/2005	30.3	6.10	0.6	NS	2.2	<0.05	2.19	16.50	NS	34.55	4.86	7.11	2.42	0.09	0.97
SKT	2			7/27/2005	30.6	6.87	0.6	1.0	1.7	<0.05	1.72	11.85	5.73	40.08	5.94	6.75	3.03	<0.05	1.00
SKT	3			7/27/2005	30.2	10.17	0.8	NS	2.1	0.05	2.17	16.20	5.24	52.68	8.43	6.25	4.26	<0.05	1.00
SKT	4			7/27/2005	28.7	11.32	0.8	1.5	1.2	0.35	1.53	14.19	12.28	34.70	5.18	6.70	1.58	0.50	0.76
SKT	5			7/27/2005	30.6	2.28	0.5	NS	0.8	<0.05	0.82	10.74	NS	32.51	4.75	6.84	2.52	<0.05	1.00
SKT	6			7/27/2005	30.5	2.66	0.5	NS	0.8	<0.05	0.86	8.35	6.77	32.50	4.70	6.92	2.55	0.34	0.88
SKT	7			7/27/2005	30.4	2.95	0.4	NS	0.6	0.09	0.71	8.62	5.44	24.92	3.86	6.45	2.51	0.72	0.78
SKT	8			7/27/2005	29.7	5.72	0.3	1.0	0.8	<0.05	0.82	14.10	9.58	51.57	8.30	6.22	5.91	<0.05	1.00
SKT	9			7/27/2005	29.1	15.40	0.4	1.0	1.9	0.08	1.94	17.96	8.42	35.33	4.62	7.64	1.62	0.97	0.63
SKT	10			7/27/2005	30.1	6.00	0.3	1.0	0.7	<0.05	0.69	12.97	NS	35.18	5.00	7.04	2.02	0.74	0.73
SKT	1			8/10/2005	24.2	10.36	0.5	NS	1.8	0.15	1.94	9.96	NS	34.72	5.33	6.52	2.37	1.65	0.59
SKT	2			8/10/2005	25.5	12.66	0.8	1.8	1.1	0.20	1.35	10.03	3.74	43.77	6.61	6.62	3.41	2.01	0.63
SKT	3			8/10/2005	27.3	16.79	0.9	NS	1.2	<0.05	1.22	12.66	6.03	60.96	10.68	5.71	9.48	0.76	0.93
SKT	4			8/10/2005	26.3	15.40	1.1	2.0	2.3	0.32	2.57	15.62	3.78	40.03	6.31	6.34	2.03	1.73	0.54
SKT	5			8/10/2005	25.8	6.53	0.6	NS	1.7	0.07	1.77	6.82	NS	30.19	4.04	7.47	1.95	1.04	0.65

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
SKT	6			8/10/2005	26.8	8.69	0.7	NS	1.4	<0.05	1.43	7.04	3.22	28.64	4.02	7.12	1.45	1.14	0.56
SKT	7			8/10/2005	25.2	5.62	0.5	NS	1.1	0.51	1.57	7.24	3.04	30.31	4.77	6.35	2.34	0.88	0.73
SKT	8			8/10/2005	25.0	6.96	0.2	1.0	0.9	0.19	1.12	14.97	4.10	43.13	6.85	6.29	4.03	1.41	0.74
SKT	9			8/10/2005	25.5	28.50	0.7	1.7	3.7	0.15	3.90	24.92	4.91	45.62	6.28	7.27	2.39	3.64	0.40
TGP	10			7/21/2005	21.3	61.55	0.2	3.6	0.2	<0.05	0.22	12.42	NS	265.03	29.18	9.08	15.00	<0.05	1.00
TGP	11			7/21/2005	19.4	62.55	0.1	NS	0.7	0.25	0.95	13.39	NS	247.40	31.05	7.97	16.48	<0.05	1.00
TGP	12			7/21/2005	21.6	54.42	<0.1	1.7	0.5	<0.05	0.55	12.02	8.55	102.34	13.71	7.47	5.28	<0.05	1.00
TGP	13			7/21/2005	13.0	44.41	<0.1	0.8	0.6	0.34	0.91	7.06	6.63	52.42	7.72	6.79	2.42	<0.05	1.00
TGP	14		Sample	7/21/2005	13.8	70.68	<0.1	NS	0.3	<0.05	0.34	22.11	NS	77.27	10.20	7.57	3.75	<0.05	1.00
TGP	14		DUP	7/21/2005	21.4	95.54	0.1	NS	0.1	<0.05	0.09	43.03	NS	224.46	25.44	8.82	11.51	1.27	0.90
TGP	15			7/21/2005	19.8	67.56	<0.1	NS	0.3	0.20	0.48	10.79	NS	125.80	18.24	6.90	7.96	<0.05	1.00
TGP	16			7/21/2005	17.4	54.30	0.3	NS	1.7	0.22	1.89	11.28	NS	48.74	7.27	6.71	1.07	<0.05	1.00
TGP	17			7/21/2005	21.3	54.83	<0.1	0.8	0.2	<0.05	0.22	13.04	NS	57.08	8.49	6.72	2.23	<0.05	1.00
TGP	10			8/16/2005	17.1	116.10	0.6	3.5	0.7	1.91	2.58	23.47	NS	254.03	39.94	6.36	43.84	<0.05	1.00
TGP	11			8/16/2005	19.3	116.63	0.5	NS	0.7	0.23	0.90	21.93	NS	176.24	26.82	6.57	23.42	<0.05	1.00
TGP	12			8/16/2005	22.6	93.54	0.9	4.0	0.7	<0.05	0.69	48.38	NS	170.50	27.84	6.13	23.83	<0.05	1.00
TGP	13			8/16/2005	21.6	70.38	0.7	2.7	1.1	<0.05	1.08	24.66	NS	125.46	20.59	6.09	13.82	<0.05	1.00
TGP	14			8/16/2005	19.1	104.96	1.3	NS	0.5	<0.05	0.52	19.95	NS	155.87	25.98	6.00	15.55	<0.05	1.00
TGP	15			8/16/2005	22.1	105.97	0.5	NS	0.6	<0.05	0.61	18.56	NS	172.73	28.36	6.09	17.77	0.71	0.96
TGP	16			8/16/2005	20.3	65.08	0.8	2.2	3.7	<0.05	3.72	21.08	NS	76.34	12.27	6.22	7.30	1.82	0.80
TGP	17			8/16/2005	19.0	105.85	1.3	4.2	0.8	<0.05	0.87	22.48	NS	129.24	21.65	5.97	23.24	<0.05	1.00
TGP	12			9/6/2005	22.8	88.41	0.6	5.3	0.6	<0.05	0.67	20.70	NS	220.39	27.39	8.05	9.95	0.57	0.95
TGP	13			9/6/2005	23.6	73.04	0.9	3.5	0.6	<0.05	0.67	20.16	NS	155.27	19.48	7.97	5.92	0.51	0.92
TGP	14			9/6/2005	21.1	87.35	0.8	NS	0.6	<0.05	0.59	20.15	NS	164.50	19.96	8.24	4.78	0.10	0.98
TIS BUOY	13	B		6/16/2005	30.8	1.32	0.3	NS	0.6	<0.05	0.67	8.09	NS	35.87	5.53	6.48	4.07	0.39	0.91
TIS BUOY	13	S		6/16/2005	30.0	2.76	0.2	NS	0.6	<0.05	0.63	9.30	NS	25.73	4.37	5.88	2.58	0.37	0.88
TIS BUOY	13	B		7/15/2005	30.5	5.33	0.5	NS	0.3	<0.05	0.33	6.45	NS	43.26	6.96	6.22	4.10	0.27	0.94
TIS BUOY	13	S		7/15/2005	29.3	10.22	0.4	NS	0.2	<0.05	0.20	7.19	NS	29.53	4.71	6.27	3.47	<0.05	1.00
TIS BUOY	13	B		7/29/2005	31.7	2.23	0.4	NS	1.2	<0.05	1.23	7.24	NS	30.14	4.30	7.02	4.91	0.13	0.98
TIS BUOY	13	S		7/29/2005	31.0	8.02	0.6	NS	0.7	<0.05	0.76	7.49	NS	40.86	5.66	7.22	3.02	0.27	0.92
TIS BUOY	13	B		8/15/2005	31.1	3.43	0.6	NS	1.1	0.20	1.31	13.34	NS	34.01	4.73	7.20	3.11	0.28	0.92
TIS BUOY	13	S		8/15/2005	30.9	4.19	0.5	NS	0.2	0.06	0.22	14.22	NS	29.37	4.69	6.27	4.26	<0.05	1.00
TIS BUOY	13	B		8/29/2005	31.1	2.56	0.6	NS	1.5	<0.05	1.53	27.68	NS	28.84	4.16	6.92	4.45	0.66	0.87
TIS BUOY	13	S		8/29/2005	30.7	5.05	0.5	NS	1.2	<0.05	1.24	29.66	NS	29.45	4.49	6.56	3.07	0.73	0.81
TIS BUOY	13	B		9/13/2005	29.9	3.43	0.6	NS	1.8	<0.05	1.83	22.43	NS	33.84	4.36	7.76	3.17	1.33	0.70
TIS BUOY	13	S		9/13/2005	31.2	4.77	0.5	NS	1.2	<0.05	1.22	11.37	NS	23.49	3.46	6.79	2.49	0.91	0.73
TRP	1			7/13/2005	16.7	22.58	0.1	1.2	1.0	0.39	1.40	23.90	NS	87.69	10.89	8.05	4.72	1.16	0.80
TRPS				7/26/2005	27.3	NS	0.4	0.9	4.3	0.30	4.60	22.36	NS	21.68	2.38	9.12	NS	NS	NS
TRPS				8/10/2005	22.5	63.73	0.2	1.4	1.3	0.14	1.42	27.09	NS	51.55	7.53	6.84	5.51	6.64	0.45
TSH1	21			6/16/2005	29.5	7.59	0.2	NS	0.6	<0.05	0.63	13.01	NS	31.05	4.74	6.55	1.12	1.44	0.44
TSH1	21			7/15/2005	29.9	8.50	0.4	NS	0.4	<0.05	0.45	11.39	NS	30.95	5.39	5.74	2.60	0.44	0.86
TSH1	21			7/29/2005	29.3	13.14	0.4	NS	0.7	0.24	0.98	9.87	13.75	37.30	5.58	6.69	1.75	0.43	0.80
TSH1	21			8/15/2005	30.3	6.00	0.6	NS	0.9	0.13	0.99	20.45	13.63	41.46	6.80	6.09	4.29	<0.05	1.00
TSH1	21			8/29/2005	29.6	6.58	0.6	NS	2.4	0.12	2.54	11.57	8.00	38.23	6.26	6.11	3.18	1.35	0.70
TSH1	21			9/13/2005	31.5	9.93	0.4	0.6	1.8	0.18	1.94	15.56	13.68	28.35	4.27	6.64	1.68	0.97	0.63
TSH2	3			6/16/2005	30.4	3.81	0.3	NS	0.6	<0.05	0.59	10.34	NS	33.01	5.36	6.15	1.68	1.93	0.47
TSH2	3			7/15/2005	29.8	11.61	0.4	NS	<0.1	<0.05	<0.1	9.35	NS	61.46	10.04	6.12	5.27	0.67	0.89
TSH2	3			7/29/2005	30.8	9.74	0.4	NS	0.5	<0.05	0.51	8.15	17.02	45.11	7.15	6.31	4.54	0.16	0.96
TSH2	3			8/15/2005	30.2	6.96	0.4	NS	0.1	<0.05	0.10	15.90	11.82	37.17	6.25	5.94	5.21	0.52	0.91
TSH2	3			8/29/2005	30.4	8.98	0.4	NS	1.0	<0.05	1.07	11.28	7.42	49.97	7.81	6.40	5.02	0.58	0.90

Sample ID	cmast Station No.	Depth	QC	Date	Sal (ppt)	SiO4 (uM)	PO4 (uM)	TP (uM)	NH4 (uM)	NOX (uM)	DIN (uM)	DON (uM)	TSS mg/L	POC (uM)	PON (uM)	C/N Ratio	CHl-a (ug/L)	Phaeo (ug/L)	Ratio Chla/ Chla + Phaeo
TSH2	3			9/13/2005	30.9	7.59	0.5	1.0	1.0	<0.05	1.05	10.67	13.93	33.55	4.98	6.73	2.20	1.04	0.68
TSH3	5			6/16/2005	30.4	6.00	0.3	NS	0.4	<0.05	0.38	15.94	NS	74.18	13.09	5.67	5.67	1.00	0.85
TSH3	5	B		7/15/2005	30.0	22.97	0.8	NS	<0.1	<0.05	<0.1	9.90	NS	132.07	18.91	6.98	ND	ND	ND
TSH3	5	M		7/15/2005	ND	ND	ND	ND	ND	ND	ND	ND	25.03	134.93	20.79	6.49	ND	ND	ND
TSH3	5	S		7/15/2005	26.6	30.03	0.6	NS	<0.1	1.96	2.01	10.56	NS	76.08	12.44	6.12	12.00	<0.05	1.00
TSH3	5			7/29/2005	30.2	14.25	0.5	NS	0.5	<0.05	0.55	8.88	13.69	87.32	13.36	6.54	11.33	<0.05	1.00
TSH3	5			8/15/2005	28.8	15.16	0.5	NS	0.7	0.61	1.34	14.92	13.55	54.21	9.85	5.50	9.27	0.38	0.96
TSH3	5			8/29/2005	30.5	8.45	0.5	NS	1.4	0.05	1.43	15.21	7.40	74.91	12.18	6.15	8.97	1.78	0.83
TSH3	5			9/13/2005	30.6	10.41	0.5	1.4	1.0	<0.05	1.05	9.85	20.98	50.87	8.14	6.25	2.95	1.23	0.70
TSHNW	1			6/16/2005	29.3	9.45	0.2	NS	0.3	0.18	0.49	11.22	NS	37.05	5.63	6.59	2.86	1.85	0.61
TSHNW	1			7/15/2005	29.7	10.80	0.4	NS	<0.1	<0.05	<0.1	10.24	NS	24.94	4.23	5.90	2.43	<0.05	1.00
TSHNW	1			7/29/2005	30.1	13.58	0.4	NS	0.6	0.27	0.88	8.79	NS	29.09	4.54	6.41	1.68	0.57	0.75
TSHNW	1			8/15/2005	30.1	9.50	0.6	NS	1.7	0.06	1.73	17.04	NS	33.90	5.77	5.88	2.96	0.82	0.78
TSHNW	1			8/29/2005	30.0	11.71	0.6	NS	1.8	0.21	1.97	13.53	NS	28.28	4.36	6.48	2.73	1.04	0.72
TSHNW	1			9/13/2005	30.3	10.41	0.5	1.4	2.3	<0.05	2.31	10.54	9.71	22.83	3.01	7.58	1.49	0.96	0.61
TSHX	2			6/16/2005	30.1	5.48	0.2	NS	0.3	<0.05	0.34	11.10	NS	29.00	4.77	6.08	2.16	1.11	0.66
TSHX	2			7/15/2005	29.7	12.38	0.4	NS	<0.1	<0.05	<0.1	10.12	NS	42.11	6.85	6.15	4.28	<0.05	1.00
TSHX	2			7/29/2005	30.5	11.80	0.4	NS	0.5	<0.05	0.55	9.16	NS	36.93	5.79	6.38	2.47	0.07	0.97
TSHX	2		Sample	8/15/2005	30.5	5.72	0.5	NS	0.3	<0.05	0.28	12.52	NS	34.67	6.07	5.71	4.38	0.59	0.88
TSHX	2		DUP	8/15/2005	30.6	5.86	0.5	NS	<0.1	<0.05	<0.1	11.72	NS	36.12	6.29	5.75	4.90	0.51	0.91
TSHX	2			8/29/2005	30.3	9.55	0.4	NS	1.4	<0.05	1.44	11.33	NS	33.58	4.98	6.75	3.54	1.24	0.74
TSHX	2		Sample	9/13/2005	30.7	9.45	0.4	0.9	0.7	<0.05	0.75	11.68	12.82	32.31	4.82	6.71	2.49	1.06	0.70
TSHX	2		DUP	9/13/2005	30.6	8.69	0.5	NS	1.1	<0.05	1.09	9.02	12.80	32.10	4.57	7.03	2.28	1.16	0.66
TSHY	4			6/16/2005	30.1	4.77	0.3	NS	0.4	<0.05	0.46	12.43	NS	37.24	6.13	6.08	2.40	2.61	0.48
TSHY	4			7/15/2005	29.6	13.48	0.4	NS	<0.1	<0.05	<0.1	9.64	NS	53.26	8.87	6.00	5.11	1.01	0.83
TSHY	4		Sample	7/29/2005	30.5	9.69	0.4	NS	0.5	<0.05	0.55	10.92	NS	67.02	10.16	6.60	8.61	<0.05	1.00
TSHY	4		DUP	7/29/2005	30.9	9.98	0.4	NS	0.6	<0.05	0.59	10.47	NS	56.42	9.41	6.00	8.21	<0.05	1.00
TSHY	4			8/15/2005	30.3	8.50	0.4	NS	0.2	<0.05	0.19	13.10	NS	46.77	8.65	5.41	5.91	0.60	0.91
TSHY	4			8/29/2005	30.2	9.55	0.5	NS	0.9	0.06	0.97	10.95	NS	53.66	8.88	6.04	7.19	0.38	0.95
TSHY	4			9/13/2005	30.1	10.60	0.5	1.1	1.3	<0.05	1.35	9.97	13.43	48.07	7.33	6.56	5.19	0.79	0.87

2005 Relative Percent Difference Values

	SOURCE	DATE	SiO4	PO4	TP	NH4	NOX	DIN	DON	TSS	POC	PON	C/N	Chl-a	Phaeo	Ratio
	SKT	6/29/05	3.368197	0		35.43996	0	34.49703	17.80002		6.589906	1.830394	8.417761	8.326014	17.41983	2.435306
	KAT	6/30/05	21.51223	0		7.165739	130.1806	2.068822	2.202797		10.10194	0.647249	9.456234	1.489758	9.948364	3.274193
	JMS	7/5/05	6.207605	0	3.472222	31.04435	0	30.28241	8.633239		21.64523	13.83701	7.867127	4.517454	0	0
	OYS	7/6/05	21.10798	0		138.5418	0	130.174	14.22929		4.643616	3.468208	1.175881	19.24482	0	0
	SKT	7/13/05	21.77141	0	0.985646	24.36738	128.1204	18.18354	18.21816		2.292769	5.895692	3.604141	8.550186	40.59777	5.476573
	KAT	7/14/05	4.036174	22.22222	2.247191	7.848806	0	7.494299	6.260357		5.500731	4.349167	1.152253			
	OYS	7/18/05	0.757013	0	24.5614	27.3292	0	25.80953	2.732719		5.044344	1.304541	3.740419	18.44508	0	0
	CHP	7/20/05	39.28411	0	15.82096	0	0	0	33.00731		10.64525	3.456221	7.195645	19.89193	48.445	1.517003
	TGP	7/21/05	0.754892	0	67.70842	93.37043	0	87.30765	8.103456		15.75947	15.54083	0.219981	7.905198	0	0
	SKT	7/27/05	4.905516	0	0.995025	17.57651	0	16.99504	8.404748		1.799999	2.788678	0.988803	24.77605	38.92497	3.691617
	OYS	8/1/05	32.76347	0	3.468208	61.32351	26.60404	44.91284	28.15429		6.611873	9.161675	2.553669	0.460299	0	0
	CRX	8/9/05	11.30679	0	3.931911	11.16328	5.905006	8.512508	21.05788		1.687999	1.09799	2.78586	5.769892	0	0
	FRM	8/10/05	2.244574	6.514821	13.28125	13.79615	8.55615	10.85085	11.04775		7.405571	8.703772	1.300296	18.34448	12.14676	2.816968
	KAT	8/11/05	37.69313	0	0.356506	5.825948	94.94766	12.00069	59.54724		1.419703	2.317492	3.736888	7.06002	109.391	1.939979
	OYS	8/15/05	1.872676	0	7.763401	66.21817	0	62.74305	12.33569		2.995584	0.400205	2.595456	22.39329	0	0
	TGP	8/16/05	0.838324	2.018483	4.527713	51.68501	0	49.82315	11.93967		2.964012	5.001076	2.03782	2.512032	0	0
	CHP	8/17/05	2.174376	0	2.105263	41.74189	0	39.81909	5.531322		4.381946	0.747409	3.634835	0.024092	0	0
	KAT	8/29/05	4.58694	7.947642	13.33333	23.01091	199.6857	175.2427	68.2567		7.676204	13.83285	6.173036	1.560909	11.99106	2.250509
	POG	8/30/05	4.729898	0	8.695652	6.837497	0	6.698546	1.513488		2.767029	13.34373	10.58647	64.31901	41.80508	6.428096
	JMS	9/7/05	6.142699	35.37604	2.469136	5.062922	0	4.916856	1.486443		14.192	3.828153	10.37795	38.07674	137.1727	7.481434
	POG	9/13/2005	16.51025	1.180683	24	26.67353	86.99364	22.82188	24.40977		7.801672	10.43826	18.20287	4.878049	47.31958	7.215081
Average RPD			**11.65**	**3.58**	**11.10**	**33.14**	**32.43**	**37.67**	**17.37**		**6.85**	**5.81**	**5.13**	**13.93**	**25.76**	**2.23**
Average RPD	**with Highest and lowest removed**		**10.81**	**2.17**	**8.40**	**29.53**	**25.69**	**32.68**	**15.63**		**6.39**	**5.59**		**12.01**	**21.25**	

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POND/STA	DATE	Secchi Z	DO %	Sp. Cond mS	Temp C	DO %	Sp. Cond mS	Temp C	DO %	Sp. Cond mS	Temp C	DO %	Sp. Cond mS	Temp C	DO %	Sp. Cond mS	Temp C	DO %	Sp. Cond mS	Temp C
		meters	surface	surface	surface	0.5M	0.5 M	0.5 M	1	1	1	2	2	2	2.5	2.5	2.5	3	3	3
OYS1	7/6/2005		92.90	0.91	17.40	70.00	1.10	17.10												
	7/18/2005	1.10	96.40	18.62	21.70				109.10	23.68	25.20									
	8/1/2005	0.75	107.30	16.83	22.20	117.00	23.71	24.80												
	8/15/2005	0.90	73.00	18.30	25.60	79.40	21.49	27.80	84.30	23.10	27.80									
OYS2	7/6/2005	0.90	97.40	9.55	21.80				114.90	42.71	25.50									
	7/18/2005	1.30	89.50	14.53					149.99	41.20	25.60									
	8/1/2005	1.00	114.70	24.29	24.50				115.70	27.04	25.11									
	8/15/2005	1.10	100.70	21.17	26.80				100.50	21.28	26.90									
OYS3	7/6/2005	1.10	97.10	20.84	22.70				132.20	41.84	23.60	91.50	42.74	21.70				94.70	44.45	20.50
	7/18/2005	1.40							100.30	32.62	26.20	128.90	42.34	24.50				115.90	42.98	23.10
	8/1/2005	1.00	95.70	24.62	14.90				110.50	26.27	24.30	151.30	35.03	26.00				76.40	43.20	26.40
	8/15/2005	1.10	100.50	21.32	26.40				99.50	21.52	26.50	90.10	27.42	27.30				34.90	39.78	27.60
OYS4	7/6/2005	1.10	100.60	25.16	22.80				117.00	40.82	21.60	95.40	43.09	20.30						
	7/18/2005	1.50							130.80		25.70	118.50	42.36	24.40	127.00	42.59	24.00			
	8/1/2005	1.00	106.20	23.93	22.80				104.20	25.38	23.60	106.20	25.37	23.60				52.80	43.00	25.70
	8/15/2005	1.10	99.10	23.12	26.50				98.30	23.16	26.60	95.70	23.51	26.60	88.20	24.04	26.60	1.50	38.35	27.30
JMS1	7/5/2005		125.5	41.46	25.4															
	7/18/2005		110.2	29.7	27															
	8/1/2005		70.3	41.72	25.7															
	9/7/2005		97.3	43.39	22.9															
JMS2	7/5/2005		120	16.7mS	27.1															
	7/18/2005		47.5	1152-2805 us	27.5															
	8/1/2005		78.7	11.19mS	24.5															
	9/7/2005		72	25 ms	23.2															
JMS3	7/5/2005> 1.2		124.9	42.38	24	128.3	42.42	23.5	172	43.65	23									
	7/18/2005> 0.6		127.9	39.93	26.4															
	8/1/2005	1.2	93.1	43.4	25.2	91.5	43.45	24.7	90.6	43.46	24.7									
	9/7/2005	0.4	90.6	43.87	23.3	82.2	43.91	23.2	71.5	43.91	23.1									
JMS4	7/5/2005>0.9		118.2	42.67	24.4	81.7	45	26												
	7/18/2005>0.9		90.2	39.6	26.7	59.8	40.4	26.3												
	8/1/2005>0.75		75.6	43.46	25.3	63	43.57	25.2												
	9/7/2005	0.45	84.7	43.61	22.3	70.6	43.61	22.3												
JMS5	7/5/2005		95.3	344 uS	20.4															
	7/18/2005		37.4	15.48	24.2															
	8/1/2005		38.6	11.1	20.0-22.4															
	9/7/2005		30.1	235.6 uS	18.4															
PCA1	7/14/2005	2.25	78.9	45.75	22.5				79.9	45.81	22.5	80.7	45.82	22.5						
	8/11/2005>2.5		74.1	48.19	25.3				74.0	48.24	25.3	74.8	48.29	25.3						
	8/30/2005>2		80.3	48.8	24.3				83.3	48.8	24.4									

	9/13/2005>2.3		85.8	48.19	22.1				84.8	48.22	21.9	84.1	48.26	21.9
PCA2	7/14/2005>1.1		85.6	45.55	22.8	84.5	45.56	22.8						
	8/11/2005>1.2		75.1	48.15	25.4				74.5	48.15	25.4			
	8/30/2005>1.3		72.7	48.8	24.3				71.6	48.9	24.3			
	9/13/2005>1.3		85.7	48.21	22.1				87.7	48.25	22			
PCA3	7/14/2005>1.5	?		45.58	22.9	80.8	45.59	22.9	80.4	45.6	22.9			
	8/11/2005>1.6		78.0	48.16	25.4				76.2	48.17	25.4			
	8/30/2005>1.6		73.0	48.91	24.4				71.8	48.89	24.4			
	9/13/2005>1.8		79.4	48.3	22.2				77.1	48.29	22.1			
POG1	7/14/2005>2.3		100.5	46.23	21.8				98.5	46.35	21.7	97.9	46.32	21.6
	8/11/2005>2.4		101.7	48.1	25.4				97.6	48.08	25.1	96.4	48.13	25.1
	8/30/2005>2.2		98.2	48.01	23.4				97	48.11	23.3			
	9/13/2005>2.3		116.4	47.51	22.4				111.4	47.7	22.2	113.1	47.7	22.1
												102.4667		
POG2	7/14/2005	2.9	98.0	46.44	21.6				97.2	46.45	21.6	96.3	46.47	21.6
	8/11/2005	3	97.5	48.06	24.7				97.4	48.08	24.6	97.2	48.07	24.6
	8/30/2005>3.3		87.8	47.85	23.4				87.5	48.06	23.4	84.6	48.06	23.2
	9/13/2005	3.2	97.2	47.65	21.8				94.4	47.67	21.8	93.2	47.7	21.8
												92.825		
POG3	7/14/2005	2.25	88.8	46.39	22.2				85.3	46.4	22.1	85.3	46.4	22.1
	8/11/2005	2.25	78.5	48.4	25.4				74.4	48.4	25.4	74.1	48.4	25.3
	8/30/2005	3.75	84.5	48.6	24.3				85.9	48.7	24.4	84.5	48.7	24.4
	9/13/2005	2.9	92.4	47.91	22.1				87.4	48.03	22	85.5	48.04	22
												82.35		
POG4	7/14/2005	2.3	91.3	46.3	22.6				88.4	46.31	22.6	89.6	46.3	22.5
	8/11/2005	2.1	87.3	48.3	25.6				85.5	48.3	25.6	83.7	48.3	25.5
	8/30/2005	2.25	92.5	48.83	24.5				93.5	48.84	24.5	92.8	48.88	24.5
	9/13/2005	3.3	105.3	48.16	22.1				104.9	48.17	22	101.8	48.23	22
												91.975		
POG5	7/14/2005	2	86.0	45.88	22.7				84	45.85	22.7	84.4	45.83	29.7
	8/11/2005>2.4		78.0	48.19	25.5				76	48.16	25.4			
	8/30/2005>2.6		84.0	48.77	24.3				83.8	48.78	24.4			
	9/13/2005>1.9		100.7	48.21	22.1				100.2	48.21	22.1			
FRM1	6/29/2005>0.8		111.4	43.45	22.8	119.1	43.73	22.7						
	7/13/2005		85.4	44.19	21.4									
	7/27/2005>0.6 -grass		72.2	47.12	24.1	71.1	47.15	24.1						
	8/10/2005>0.8		67.1	45.29	24.3	55.5	46.27	23.9						
	>0.8													
FRM2	6/29/2005>1		104.6	43.82	22.6	105.3	43.85	22.5						
	7/13/2005		96.3	43.94	22									
	7/27/2005>0.9		71.8	46.93	24.1	71.7	46.93	24.1						
	8/10/2005>0.9		82.5	45.03	24.4	70.7	45.31	24.3						
FRM3	6/29/2005>1.2		126	45.2~22.6		118.9	45.17							
	7/13/2005		93	41.16	23.8	100.9	42.22	24.8						
	7/27/2005>1.2		92.1	45.2	25.7	94.7	45.55	25.8						
	8/10/2005>1.3		98	44.21	26	100.4	45.34	26.1	40.2	46.10	26.8			
												@ 1.5	@ 1.5	@ 1.5

SKT1	6/29/2005>1.3	92.4	46.50	20.8	90.4	46.54	20.7			
	7/13/2005>1.4	102.9	45.36	22.3	101.7	45.39	22.4			
	7/27/2005>1.8	78.4	46.35	23.3	78.4	46.38	23.2	78.7	46.41	23.3
	8/10/2005>1.6	79.1	46.33	24.2	79.5	46.34	24.3			
					87.5					
SKT2	6/29/2005>1.6	88.9	46.60	20.8	88.2	46.64	20.8			
	7/13/2005>1.6	91.9	46.10	23.0	91.4	46.12	23.0			
	7/27/2005>1.2	80.5	46.36	23.7	79.9	46.40	23.7			
	8/10/2005>1.5	78.2	46.97	24.3	56.3	47.42	24.1			
					79.0					
SKT3	6/29/2005>2.4	89.2	46.30	21.5	87.4	46.31	21.5	85.8		
	7/13/2005>2.4	108.1	45.25	23.7	99.4	45.91	24.1	78.3		
	7/27/2005>1.7	79.7	46.08	24.4	78.4	46.08	24.4	77.3	46.09	24.4
	8/10/2005>2.25	72.3	45.56	24.9	79.5	46.50	25.1	61.5	47.17	24.8
					86.2			75.7		
SKT4	6/29/2005>1.3	89.4	46.04	21.8	88.6	46.09	21.8			
	7/13/2005>1.8	94.5	43.50	24.0	101.1	46.21	24.4			
	7/27/2005>1.4	65.1	44.30	24.0	59.9	45.74	24.4			
	8/10/2005>1.9	58.0	45.60	25.2	64.2	46.87	25.7	67.0	46.91	25.7
					78.5					
SKT5	6/29/2005>1.3	102.1	47.13	19.5	101.7	47.19	19.4			
	7/13/2005>2.2	98.6	46.91	21.2	97.8	47.03	21.1			
	7/27/2005>1.5	89.0	46.54	22.2	87.2	46.57	22.1			
	8/10/2005>2	76.3	47.57	23.0	75.7	47.58	23.0			
					90.6					
SKT6	6/29/2005>2.1	98.4	47.09	19.4	97.2	47.12	19.4			
	7/13/2005>1.8	98.3	46.17	21.1	99.6	46.52	21.2			
	7/27/2005>2	87.1	46.50	22.3	86.4	46.54	22.3	85.0	46.54	22.3
	8/10/2005>2	71.8	47.14	23.8	74.3	47.51	23.2	75.9	47.67	22.8
					89.4			80.5		
SKT7	6/29/2005>1.6	103.8	46.87	19.5	103.1	46.92	19.5			
	7/13/2005>1.5	85.7	46.71	21.3	113.7	47.04	21.1			
	7/27/2005>1.4	83.7	46.23	22.4	84.8	46.30	22.4			
	8/10/2005>1.2	66.9	46.78	23.0	65.4	47.61	22.9			
					91.8					
SKT8	6/29/2005>2	93.5	46.67	21.0	92.7	46.67	21.0	92.5	46.67	21.0
	7/13/2005>1.7	110.6	45.76	22.9	90.9	46.44	22.8	78.0	46.42	23.0
	7/27/2005>1.9	78.0	45.99	24.5	74.9	45.98	24.5	74.0	46.00	24.5
	8/10/2005>1.8	71.6	47.04	25.1	66.1	47.10	24.2	71.5	47.14	24.0
SKT9	6/29/2005>0.5	97.1	45.38	22.4						
	7/13/2005>0.6	119.0	44.73	23.3						
	7/27/2005>0.5	81.0	44.76	25.1						
	8/10/2005>0.5	63.0	45.68	25.4						

POND/STA	DATE	Secchi Z	DO %	Sp. Cond mS	Temp C	DO %	Sp. Cond r	Temp C	DO %	Sp. Cond r	Temp C	DO %	Sp. Cond mS	Temp C	DO %	Sp. Cond mS	Temp C	DO %	Sp. Cond mS	Temp C		Sp. Cond		DO%	Sp. Cond r	Temp C	DO%	Sp. Cond	Temp C
		meters	surface	surface	surface	0.5M	0.5 M	0.5 M	1	1	1	2	2	2	2.5	2.5	2.5	3	3	3	3.5	3.5	3.5	4	4	4	6	6	6
KAT1	6/30/2005	-	-	-	-				-	-	-	-	-	-										-	-	-	-	-	-
	7/14/2005	3.1	93.5	46.11	21.1				92.7	46.27	20.8	91.9	46.41	20.5										86.1	46.55	20.1	83	46.57	20.1
	8/11/2005	3	91.4	47.83	23.5				89.5	47.86	23.4	89.9	47.88	23										87.8	47.96	22.6	85.5	48	22.5
	8/29/2005	4.25	98.4	47.22	22.9				96.0	47.27	22.9	96.1	47.27	22.9										94.8	47.28	22.8	96.7	47.28	30.8
																								89.56667			88.4		
KAT2	6/30/2005		-	-	-					-	-	-	-	-											-	-	-	-	-
	7/14/2005	2.8	94.3	45.91	21.5				95.0	45.88	29.8	93	45.95	21.4										93	45.95	20.9	86	46.18	20.6
	8/11/2005	2.7	93.2	47.71	24.4				91.2	47.7	24.4													88.4	47.74	23.9			
	8/29/2005	3	94.6	47.11	23.4				93.3	47.15	23.3	92.6	47.18	23.1										89.6	47.25	22.7	88.4	47.28	22.6
																								90.33333					
KAT3	6/30/2005	>0.5	84.5	46.67	20.5																								
	7/14/2005	>0.5	94	45.51	22.1																								
	8/11/2005	>0.5	101.7	47.3	26.1																								
	8/29/2005	>0.8	94.6	47.02	24																								
			93.7																										
KAT4	6/30/2005	2.1	80.2	46.97	21							80.5	47	20.5										81.4	47.14	20.3	80.9	47.35	19.8
	7/14/2005	2.9	90.9	45.71	21.9				90.7	45.75	21.8	90.6	45.76	21.8										92.9	45.88	29.8	85.1	46.17	21.1
	8/11/2005	2.5	96.2	47.61	24.8				95.6	47.63	24.8	94.2	47.66	24.8										91	47.67	24.7	88.1	47.66	24.4
	8/29/2005	2.6	90.6	46.87	23.9				90.7	46.9	23.9	89.7	46.95	23.9										90.3	47.09	23.7	82.7	47.2	23
												88.75												88.9					
KAT5	6/30/2005	1.9	84.4	46.96	21.1							78.8	46.96	20.9															
	7/14/2005	2.75	95.5	45.44	21.7				93.0	45.79	21.7	92.5	45.8	21.7															
	8/11/2005	2.6	92.4	47.57	25.7				90.1	47.57	25.6	89.3	47.59	25.5															
	8/29/2005	2.7	92.3	47.17	24.1				91.5	47.2	24.1	90	47.18	24.1										85	47.16	23.9			
												87.65																	
KAT6	6/30/2005		87.9	46.93	20.8							85.5	46.86	20.8										79.8	46.93	20.8			
	7/14/2005	>2.4	91.8	45.59	22.2				91.7	45.58	22.1	91.7	45.57	22.1															
	8/11/2005	2.25	90.7	47.2	25.7				90.0	47.33	25.7	90.4	47.83	25.6															
	8/29/2005	>1.3	92.9	47.17	24.4				91.7	47.18	24.4																		
												89.2																	
KAT7	6/30/2005		85.4	46.77	20.3																								
	7/14/2005	2.6	95.7	45.6	21.7				93.4	45.68	21.7	94	45.69	21.7															
	8/11/2005	2.4	96.1	47.58	25.8				93.1	47.58	25.7	97.4	47.68	25.1															
	8/29/2005		94.6	46.77	24.5				95.1	47.04	24.5																		
		2.5																											
KAT8	6/30/2005	>0.8	82.9	43.12	19.7																								
	7/14/2005	>0.5	70.2	32.1	20.9																								
	8/11/2005	>0.33	108	47.28	25.9																								
	8/29/2005		95.3	1978uS	21.6																								

APPENDIX 2

Sampling and Analysis Plan

Sampling and Analysis Plan

May 24, 2005

FOR: Coastal Pond Water Quality Assessment/ Island Basin

Prepared By: William M. Wilcox, Martha's Vineyard Commission

Submitted to: Massachusetts Department of Environmental Protection

Project: 604(b) # 2005-01/604

Funded by: Funded partially by federal Funds from the Environmental Protection Agency to the Massachusetts Department of Environmental Protection under Section 604(b) Water Quality Management Planning Grant

Start Date: 15 June 2005

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2005 MVC Coastal Ponds Water Quality Assessment

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1.0 Background and Overview of Sampling and Analysis Plan:

The proposed project will obtain data necessary to prepare seven coastal salt ponds for entry into the Estuaries Project and continue sampling in one pond that has just entered the program. The fundamental requirement is three years of high-quality water chemistry and field data. Some of the coastal salt ponds of Martha's Vineyard have adequate water quality analyses for entry into the Estuaries Project however a number do not. In order to bring the remaining ponds to the point where they can enter the Estuaries Project and receive the intensive scrutiny necessary for full evaluation of protective measures, the MVC received DEP 604(b) funding support for collection, processing and analyses of water samples from 8 of these coastal ponds. We will obtain first-year data for Katama Bay and James Pond, second year data from Oyster Pond and will complete the required dataset for Cape Pogue, Pocha, Tashmoo and Farm Ponds. In addition, we propose to collect post-MEP entry data for Sengekontacket Ponds in support of School for Marine Science and Technology (SMAST) personnel. A locus map is provided as Figure 1.

Samples and field data will be collected from 41 sample stations during 4 sample rounds from late June through mid-September. The data will be incorporated into a report and converted to an internet-ready format as was the 2003 sampling data for placement on the Martha's Vineyard Commission's website. All lab analyses will be performed at the University of Massachusetts School of Marine Science and Technology under their laboratory SOP and Quality Assurance Plan procedures. This document is intended to provide specific details of the sampling locations, sample collection, handling and shipping procedures as well as the use of field equipment for collection of temperature, dissolved oxygen, specific conductivity and GPS locations. Additional details are provided in the Massachusetts Estuaries Project (MEP) QAPP, approved 13 June 2003 in Appendix B-1 (Field Protocols and Data Sheets). Sampling rounds will be scheduled at approximately two-week intervals during the falling tide or at dead-low water and during the morning hours. The state of the tide will be the prime determining factor in timing sample collection however afternoon sampling will only occur when samples must be acquired and low tide is late in the afternoon. Sampling would begin in late June and conclude by mid-September to focus on what is typically the lowest water quality period. Sample stations will be located in the field with Global Positioning System (GPS, see detail below) and on-shore landmarks such that the same stations can be acquired for each round. Final locations will be decided in consultation with SMAST personnel to assure that the data is sufficient for numerical modeling. On station, an YSI 85 meter (see detail below) will be used to collect vertical profile data at no greater than 1 meter intervals. The Secchi disk will be used to determine light penetration on site. Standard data sheets will be used for this information as well as to record weather conditions and the presence of any unusual natural phenomena such as jellyfish, rafts of algae, large numbers of waterfowl etc. Water samples will be collected at a depth of 6 inches (15 centimeters) below the surface. Where a deep sample is collected, sample collection depth will be 0.5 meters above the bottom sediment. Samples will be immediately placed in a cooler on ice during the sample collection process.

Samples will be processed prior to shipping to provide dissolved nutrient samples (nitrate, nitrite, ammonium, organic nitrogen, silica and ortho-phosphate), chlorophyll *a*, particulate carbon and nitrogen and, for a sub-set of sites, total phosphorus samples. Total Suspended Solids (TSS) samples will be collected and shipped to the SMAST Lab in lab-clean, 1-liter

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HDPE bottles for filtration and processing as per their procedures. The samples will be shipped on ice with an accompanying Chain of Custody by the Steamship Authority, Fast Ferry or by Cape Air to New Bedford where SMAST personnel will pick them up at the pier or airport for analysis. Oversight of sample collection, processing, handling and shipping will be the responsibility of William M. Wilcox, Water Resource Planner, Martha's Vineyard Commission. All chemical laboratory analyses will be performed at the School for Marine Science & Technology (SMAST, Dr. Brian Howes and Roland Samimy, 508-910-6352). Dr. Brian Howes will be the laboratory leader.

2.0 Data to Be Collected:
Lab methodology is contained within the SMAST Laboratory SOP and Quality Assurance Plan, Section B.1 (Review of Nitrogen Related Water Quality Monitoring Data). Sample collection and processing methodology is described in detail in Sections 3.0, 5.0 and 6.0.

2.1 Lab analyses planned are identical to those from previous years to allow direct comparability. Total Suspended Solids is added to the list that includes:
Nitrate + Nitrite Silicate Ortho-phosphate Total phosphorus
Particulate carbon particulate nitrogen Dissolved organic nitrogen
Ammonium chlorophyll *a*& pheophytin Specific conductance
Total Suspended Solids

2.2 Blind Duplicate Samples:
To assess lab performance and provide confidence in the results, a blind duplicate sample will be sent along to the lab for analysis with each batch of 20 samples. The blind sample will be drawn from, handled and processed as the source sample and numbered in sequence with the actual samples. A logbook will be kept identifying the actual source of each blind sample to allow comparison of the results. Additional details are provided in the MEP QAPP Section B.1.1 (Data Quality Objectives).

2.3 In the field, vertical profile data will be collected at no greater than 1-meter intervals including:
Dissolved oxygen saturation Temperature
Specific conductivity Salinity
The deepest data record at each site will be collected at a distance of 0.5 meters or less from the bottom. A Secchi extinction depth will be determined at each station using a standard 8-inch, black and white quadrant disk.

3.0 Sample Collection:
3.1 **Schedule:** All sampling will be completed between 14 June and 15 September 2005. This sampling schedule is designed to include the expected lowest water quality period in July and August and to provide flexibility to substitute dates to replace cancelled sampling rounds due to weather conditions, boat problems or other, unforeseen difficulties.

3.2 **Personnel:** Samples and field data will be collected by MVC personnel under the direction of William Wilcox, SMAST personnel under the direction of Roland Samimy. William Wilcox has prepared and carried out water quality assessments involving in excess of 1200 samples in the coastal ponds of Martha's Vineyard since 1995 including a 604(b) sampling

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project in Chilmark Pond completed in 2001 and a DEM Lakes and Ponds sampling project in Lagoon Pond (Oak Bluffs, 2002). All of these projects were conducted in close association with Dr. Brian Howes both at Woods Hole Oceanographic Institute and at SMAST. All personnel will be trained by William Wilcox or, in the case of SMAST personnel, by Dr. Brian Howes to assure that the sample collection and handling procedures are followed. All personnel will be provided with a copy of the relevant pages from this document that describe the methodology to be followed.

William Wilcox, (MV Commission) or Roland Samimy (or staff directly under his supervision SMAST) will collect the samples from Katama Bay, Oyster Pond, James Pond, Cape Pogue, Pocha Pond, Farm, Tashmoo and Sengekontacket ponds.

3.3 **Materials:** One liter HDPE bottles for initial sample acquisition and for particulate, TSS and chlorophyll *a* samples and 60 milliliter dissolved nutrient and total phosphorus sample bottles will be provided by the SMAST lab. Carbon-clean glass fiber filters for particulate analysis and nitro-cellulose filters for chlorophyll *a* analysis will also be provided by SMAST. Cellulose acetate filters required by SMAST for preparing dissolved nutrient samples will be purchased direct from GeoTech Environmental Equipment, Inc. in Denver, Colorado or provided by SMAST. Dissolved oxygen membrane replacement kits are provided by YSI. Conductivity calibration standards will be NIST certified reagent grade solutions.

3.4 **Deep samples:** At this time, we do not anticipate sampling from deep within the water column of these ponds. The decision regarding deep sampling will be made on-station based on the presence of either a well-developed thermocline or a deep-water oxygen deficiency (below 40% saturation). If samples are collected toward the bottom of the waster column, a Niskin sampler will be used to collect discrete samples at 0.5 to 1.0 meters above the bottom at any locations. Possible locations include station POG2 or POG4 in Cape Pogue Pond or KAT 2 or KAT 4 in Katama Bay. The Niskin sampler will be rinsed with distilled water prior to use for field sampling. Sample collection depth will be determined using a depth sounder to avoid stirring the bottom. Sample collection for deep stations will occur prior to use of the Secchi disk to avoid stirring the bottom or mixing a possible stratified layer near the bottom. The sampler will be armed, triggered and the sample discharged to an HDPE 1-liter bottle following manufacturers instructions. Analyses performed on these samples will be the same as those from the surface samples. Total phosphorus will be run on all deep samples.

4.0 Ponds to be sampled:

All ponds proposed for sampling within this project are continuously tidal except for James and Oyster ponds. All ponds will be sampled from a boat. The sample station locations shown in Figures 2 through 9 are approximate until they are refined with GPS in the field to obtain exact locations. The location of most stations is meant to coincide with sample sites used in previous studies. However, most of these earlier stations were located without benefit of GPS and for those stations, this study will utilize USGS maps or other paper maps within reports to identify and duplicate previous stations. All stations identified will be sampled for the parameters outlined in items 2.1 and 2.3. Lab analyses from the 2003 604(b) funded project are available and are briefly reviewed along with the field results are discussed in 4.8 below.

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4.1 Cape Pogue Pond:

Samples collected from this pond will be labeled with the identifier “POG”. This pond is a 1470-acre tidal pond situated in Edgartown. In addition, the pond receives ebb tidal waters from Pocha Pond to which it is connected by a long, back-barrier channel. There is limited water quality data available from a 2000 sampling project (Phinney, unpublished) and 1991 (Gaines, 1998). The pond has a tide range of 2 to 2.5 feet (MVC data, 2000-a). In 1991, Total Dissolved Inorganic Nitrogen was less than 8 micromoles per liter (uM/l) and orthophosphate was less than 0.8 uM/l yielding a nitrogen/phosphorus ratio of less than 10 and indicating the system was nitrogen limited. Silicate was less than 4.5 uM/l indicating that silica was also limiting. Phinney’s data is similar but included chlorophyll *a* that reached 8 ppb in August.

The bathymetry of the bay (Gaines, 1998 from National Ocean Survey) shows a maximum depth of 12 feet. A bathymetric survey update was conducted in 2002 using GPS linked recording fathometer (Coastal Zone Management, unpublished). This data is not yet available. The pond is the most productive bay scallop source in the Commonwealth. The pond is somewhat divided into a northern and southern basin by a bar extending out from Oliver Point as shown in Figure 2 attached. Five sample stations are proposed and are shown in Figure 2 including:

- The inlet to the system: POG-1
- The north basin: POG-2
- Shear Pen Pond: POG-3
- The southern basin of the Pond: POG-4
- The outlet from Pocha Pond: POG-5

Previous studies do not provide GPS locations for sampling stations in this pond.

4.2 Pocha Pond:

Samples collected from this system will be labeled with the identifier “PCA”. This tidal pond is 114 acres in area and is situated in the Town of Edgartown. The pond has a tide range of 1.5 to 2 feet (MVC data, 2000-a). In 2000, Phinney (2001) found Dissolved Inorganic Nitrogen less than 5.1 uM/l and orthophosphate less than 0.5 uM/l indicating a nitrogen limited system. Chlorophyll *a* reached 7.4 uM/l in August.

There is no bathymetric data available on this pond, however it is known to be shallow. Maximum depth of 1.5 to 2 meters was found in the main basin and 2 to 3 meters in the channel connecting Pocha Pond to Cape Pogue Pond during the 2003 sampling project. Three sample stations are proposed and are shown in Figure 3 including:

- In the connecting channel: PCA-1
- In the connecting channel: PCA-2
- In the main basin of the pond: PCA-3

Previous studies do not provide GPS locations for sampling stations in this pond.

4.3 Sengekontacket Pond:

Samples collected from this system will be labeled with the identifier “SKT”. This pond is a 691-acre pond that is connected to Nantucket Sound through two fixed, armored channels beneath Beach Road. The pond occurs in the Towns of Oak Bluffs and Edgartown. It is connected to Trapp’s Pond, a 46-acre tidal pond, by a culvert beneath Beach Road. The tide

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range in the pond is about 2 feet (MVC, unpublished data). Gaines (1995) reported July time series water quality data collected at the inlet and in Major's Cove that indicated an average Total Dissolved Inorganic Nitrogen of 1.64 uM/l and an orthophosphate concentration of 0.6 indicating the system was nitrogen limited. That data also indicates the system was silica limited. Gaines concluded that the pond had a low standing stock of phytoplankton and reported that chlorophyll *a* concentration was less than 3.1 ppb. Secchi transparency was over 2.8 meters.

The pond is shallow, generally less than 5 feet except in Majors Cove where depth is 8 feet. The pond is divided into a series of basins in which sample stations are proposed. The proposed sample stations are shown in Figure 4, including:
- At the northern inlet: SKT-1
- In the northern basin: SKT-2
- At the entrance to Majors Cove: SKT-3
- At the interior of Majors Cove: SKT-4
- At the southern inlet: SKT-5
- In the northern Edgartown Basin: SKT-6
- In the middle Edgartown Basin: SKT-7
- In the southern Edgartown Basin: SKT-8
- At the outlet from Trapp's Pond: SKT-9

Previous studies do not provide GPS locations for sampling stations in this pond. Some stations sampled in 1995 (Wilcox, 1999) will be utilized in the proposed study.

4.4 Farm Pond:
Farm Pond is a 39-acre tidal pond in the Town of Oak Bluffs that is connected to Nantucket Sound by way of a culvert beneath Beach Road. The tide range is less than 0.5 feet (MVC, 1998). The pond is shallow, being less than 5 feet (1.5 meters) throughout. Samples collected from this system will be labeled with the identifier "FRM" and are shown in Figure 5. Sample stations located by GPS in 2003 are as follows:
- North basin north of the island: FRM-1.
- At the outlet to Nantucket Sound: FRM-2.
- In the south basin: FRM-3

4.5 Katama Bay:
Katama Bay is a 1700-acre tidal water body connected to Nantucket Sound through Edgartown Harbor. It is connected to a Caleb's Pond a 39-acre tidal water body. The tide range in Edgartown Harbor varies between 2 and 2.5 feet as measured at the boatyard pier (MVC, 2000-a). A large mooring field is located at the north end of this water body and is used for mooring small to large craft during the summer months. Water depth exceeds 20 feet in the main channel that runs from south of the Harbor southward to the point where the Bay opens up in an east-west direction. Mattakeset Bay is a 30 acre shoal embayment in the southwest corner of the Bay that receives drainage from Herring Creek, a long, man-made channel that drains Crackatuxet Pond one mile to the West. This Creek also intercepts groundwater from a large area that, without the Creek, would not be a part of the Katama Bay watershed.

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Stormwater from the portion of the Bay watershed that is heavily developed discharges into the Harbor and during flood tide may have some impact on the Bay.

Samples collected from this system will be labeled with the identifier “KAT” and are shown in Figure 6. They are:
• Outside the system in the Outer Harbor: KAT-1
• In the mooring field: KAT -2
• At the outlet from Caleb’s Pond: KAT -3
• Mid-pond, mid channel: KAT -4
• Mid-pond, south end of channel: KAT-5
• Mid-Pond, south of the channel: KAT -6
• East side of main embayment: KAT -7
• Mid-pond, middle of main embayment: KAT -8
• Mattakeset Bay at outlet to Herring Creek: KAT -9
GPS coordinates will be collected at each station.

4.6 Tashmoo Pond:
Tashmoo Pond is a 270-acre tidal pond connected to Vineyard Sound by way of an armored inlet. Mid-tide mean depth is 1.3 meters (MVC, 2003-b). The pond has a deep area in excess of 3 meters in the central area shown in Figure 7. A portion of the pond is used as a mooring field for recreational vessels (in excess of 100). The pond has an average tide range of 2 feet (MVC, 2003-b).
In 2001 (MVC, 2003-b), Total Dissolved Inorganic Nitrogen was less than 2.8 uM/l throughout the pond during July through September. Orthophosphate was less than 0.7 indicating the system was nitrogen limited during the summer period. In September, Chlorophyll *a* peaked at 12 to 30 ug/liter at the upper end of the pond but remained below 6 ug/l in the main body of the system. Samples collected from this system will be labeled with the identifier “TSH” and are shown in Figure 7. Sample stations are located as follows:
• At the inlet to the pond from Vineyard Sound: TSH-1
• Mid-Pond in the deeper basin near the mooring field: TSH-2.
• In the southern basin: TSH-3.
• At the outlet from the upper pond: TSH-4.
SMAST sampled this pond during summer 2003 and has GPS coordinates to use for station location. Some stations sampled in 2001 will be utilized in the proposed study (MVC 2003-b).

4.7 James Pond:
James Pond is a north coastal shore pond that is about 41 acres in area and somewhat less when it is connected tidally to the Atlantic Ocean. The pond is open to the ocean one or two times each year for periods ranging from just a few days to as many as several months. During the 2004-05 winter, it was tidal for much of the time from fall through early April.
A small fresh water pond was cut off from the northwest corner of the main pond by an earthen dam in the past and outlets into the system via a corrugated metal pipe. The Pond is known to have a limited herring run.
The Pond was sampled during summer 2003 (MVC, 2003-a). An MVC survey in 1982 tied to an arbitrary datum found the Pond to be no deeper than 5.75 feet. These depths were field checked during 2003 and were found to be accurate. The Pond probably averages less than 3 feet in depth. A tide gauge placed at the southern end of the Pond furthest from the inlet

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indicated a diurnal tide with a maximum range of 0.2 feet and an average of about 0.1 feet. Despite the limited tide, over a 2-month period in the spring of 2003, the Pond managed to get enough head to open itself to the Sound 5 times.
During the course of July and continuing in August 2003, the Pond developed anoxia from the decay of rooted macrophytes, enteromorpha and filamentous algae despite its shallow depth. The odor from the rafted organic matter was strong and sulfurous. Total pigments were above 10 micrograms per liter (ug/l) throughout the July-August time period. Pigments peaked at over 60 ug/l at two stations. Total organic nitrogen peaked at over 1 milligram per liter (mg/l) and was always greater than 0.6 mg/l. Secchi extinction depth was more than 1.2 meters on 14 July declining to 1.1 meters on 14 August and 0.6 meters on 8 September.
Samples collected from this system will be labeled with the identifier “JMS” and are shown in Figure 8. They are as follows:
• At the inlet: JMS-1
• Outlet from fresh pond: JMS -2
• Mid-basin north: JMS -3
• Mid-basin, south: JMS -4
• At fresh stream input: JMS –5

4.8 Oyster Pond:
Oyster Pond is a south shore great pond that is breached to the Atlantic 2 to 4 times each year. It may remain tidal from a few days to a few months depending on the weather as it affects wave action along the south shore. The Pond is approximately 190 acres in area. It is elongate in the north-south direction and the northern portion is separated into two basins by subsurface bars that extend into the Pond from subaerial sand spits.
Water quality samples were collected in 1995 from the Pond. Data indicate that during that time, the northern end of the Pond was phosphorus limited (dissolved inorganic nitrogen to orthophosphate ratio well over 16). Over the same time frame, the sampling station in the middle of the north-south length of the Pond was generally nitrogen limited. At this station, specific conductivity rose to 25 to 30 milli-Seimens from mid-July to mid-August in response to a June inlet to the ocean and then declined to about 15 mS as the inlet closed and the system freshened. Chlorophyll pigment content was always less than 6 micrograms per liter.
Samples collected from this system will be labeled with the identifier “OYS” and are shown in Figure 9. The stations are located as follows:
• At the northern end just south of the wetlands: OYS-1
• At the mid-point of the north-south length of the Pond: OYS-2
• Middle of the southern basin: OYS-3
• Deep area just north of the inlet location: OYS-4

4.9 Data from 2003
During 2003, all of the ponds except Katama Bay, James Pond and Oyster Pond were sampled under the previous 604(b) grant (2003-01/604). The lab analyses results have been processed into a draft report now in review.
In Sengekontacket, dissolved oxygen saturation decreased to moderate levels by August 18 that coincided with the lowest Secchi disk readings (1.75 meters). Total organic nitrogen varied from below to 0.6 milligrams per liter (stations 2 and 6) where tidal circulation is more vigorous to more than that value at stations 4 and 8 that are more isolated from tidal flow.

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The same pattern is seen with the chlorophyll pigments that are higher (and exceeded 10 micrograms per liter in August) at stations 4 and 8 than at stations 2 and 6.

In the Cape Pogue-Pocha Pond system, Secchi transparency and dissolved oxygen saturation were best in the area nearest the inlet and decreased toward the inner reaches of the system. In Cape Pogue, Secchi depths varied from 2.5 to over 3 meters throughout the sampling period. Stations 2 and 4 had the deepest readings generally over 3 meters and exceeding 4.4 meters at both stations on August 19. Secchi readings in Pocha Pond reached a low of 2.1 meters on August 13 in the channel near Dike Bridge. At the other stations in the Pond, readings could not be obtained, as pond depth was approximately 1.5 meters depending on stage of the tide. Dissolved oxygen saturation levels followed a similar pattern, being in the 70 to 85% range in Pocha Pond and in the range of 90 to over 100% in Cape Pogue.

Tashmoo Pond was sampled by MVC on August 21 and by SMAST personnel on three other dates. On August 21, Secchi depth was 2.7 meters and dissolved oxygen saturation 90 to 100% at the surface, decreasing to 80% near the bottom. On 21 August, Station 1 at the south end of the pond was the exception with a deep dissolved oxygen saturation value of 55%. Secchi extinction depths (SMAST) in 2003 ranged from 2.5 to 3.0 meters depending on location and date. Dissolved oxygen ranged between 8.5 and 10 milligrams per liter during the SMAST sampling rounds. Total organic nitrogen content was less than 0.5 mg/l in the pond and over 0.5 mg/l at the freshwater herring run discharge at station 4. Chlorophyll pigment concentration was almost entirely less than 5 micrograms per liter and close to the value found in Vineyard Sound.

Farm Pond was sampled by the MVC on 4 dates during the summer of 2003. Total organic nitrogen was just above or below 0.6 milligrams per liter over the sampling period. Chlorophyll pigments that were initially well below 10 micrograms per liter, exceeded that value by the last sampling round. Dissolved oxygen saturation reached a low level on August 18 at just below 50%. The Secchi reading on that date was 0.75 meters.
James Pond was sampled three times during the summer 2003. The Pond developed anoxia as a substantial amount of filamentous algae and macrophytes died out and gathered into a large raft swept by the wind up to the north end of the Pond. Total organic nitrogen content during July and August was always more than 0.6 milligrams per liter and reached a maximum of 1.6 milligrams per liter in late August. In mid-August, chlorophyll pigments peaked at over 60 micrograms per liter (ug/l) at two stations and were always above 10 ug/l. Dissolved oxygen content in the deeper layer (1.0 meter or more) was less than 40% throughout the sampling period and was below 5% at several stations.

Oyster Pond was sampled by the MVC in 1995 (see also discussion in section 4.8). The pond is elongate in the north-south direction away from the portion of the barrier beach where the inlet to the ocean is cut. The pond is divided by shoals into several basins that vary in their salinity due to proximity to or isolation from the saltwater. In 1995, the system was found to be phosphorus limited where the fresh water dominated at the north end of the system and nitrogen limited where the saltwater dominated. During the summer months, total

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organic nitrogen exceeded 1 milligram per liter indicating a high level of productivity (average of 4 samples).

Summary Table of Ponds and Parameters to be Analyzed:

Pond	Station numbers	Dissolved parameters	Particulate parameters	Chlorophyll and pheophytin	Total Solids TSS	Total P	Field parameters
Cape Pogue	**POG1- 5**	**X**	**X**	**X**	**X**	**3, 4, 5**	**X**
Pocha Pond	**PCA1 - 3**	**X**	**X**	**X**	**1 & 3**	**3**	**X**
Sengekontacket	**SKT1 - 9**	**X**	**X**	**X**	**2, 3, 4, 6, 7, 8, 9**	**2, 4, 8 & 9**	**X**
Farm Pond	**FRM1- 3**	**X**	**X**	**X**	**1 & 3**	**2**	**X**
James Pond	**JMS1 - 5**	**X**	**X**	**X**	**3 & 4**	**2,4, 5**	**X**
Tashmoo Pond	**TSH1 - 4**	**X**	**X**	**X**	**X**	**2 & 4**	**X**
Oyster Pond	**OYS1- 4**	**X**	**X**	**X**	**2, 3 & 4**	**1, 3 & 4**	**X**
Katama Bay	**KAT1- 8**	**X**	**X**	**X**	**3, 4, 5, 6 & 7**	**3, 5, &8**	**X**

NOTE: X signifies all stations will be analyzed for the parameters indicated

Dissolved parameters**: nitrate, nitrite, ammonium, silicate, orthophosphate and organic nitrogen**

Particulate parameters**: particulate carbon and nitrogen**

TSS: Total Suspended Solids**- this analysis will be performed on samples from stations spread throughout the system and from inlets of subsidiary ponds.**

Total P: Total phosphorus- **this analysis will be performed on samples from selected stations as identified**

Field parameters: **Dissolved oxygen (saturation and milligrams per liter), temperature, specific conductivity, salinity and Secchi depth.**

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5.0 Massachusetts Estuaries Project

Field Sampling Protocol: Nutrients

Water Quality Program

5.1 Nutrient Sample Collection Overview (MEP QAPP Appendix B-1, H)

The goal of the Water Quality Monitoring Program is to provide needed data with which to evaluate overall water quality conditions in nearshore waters and harbors. These waters are most likely to be impacted by excessive nutrient loading originating from local land use. Because of the value of this data, it is very important that measurements are made using the protocol provided and that collections occur during the last three hours of an outgoing tide. Through training sessions, hands-on instruction and sampling tips, we will provide you with the information necessary to ensure efficiency and accuracy in the measurements. Please call (Roland Samimy 508-910-6314) if you have any questions and note any problems on the data sheet.

In addition to nutrient sample collection and filtering, the following measurements need to be taken at each station: dissolved oxygen (percent saturation and milligrams per liter), water temperature, salinity, water clarity (Secchi disk) and total depth. Samples collected for nutrients will be analyzed at the SMAST laboratory for:

Ammonium Nitrate+Nitrite Particulate Organic Nitrogen
Ortho-Phosphate Chlorophyll a & pheophytin a Particulate Organic Carbon
Dissolved Organic Nitrogen Total Phosphorus (as needed) Specific Conductance
Silicate

5.2 ARRIVING ON STATION:

The on-shore landmarks will be used to approximate sample station location. If there is any uncertainty, the GPS will be used to obtain location. It is anticipated that, for many stations, proximity to shore and landmarks and small size of the embayment will permit return to station location without the use of GPS. These are expected to include those stations in Poucha Pond, Farm Pond, Tashmoo Pond, Chilmark Pond and some of those in Lagoon Pond and Sengekontacket where the station is central in a cove or a long, narrow segment of the pond with good landmarks. All stations will be located by GPS so that future sampling programs can easily return to them. The boat will be anchored so that it remains in a fixed position while samples are collected and profile readings taken. The boat should approach the sample location at headway speed to minimize sediment disturbance for all sample stations but particularly for shallow stations (anticipated water depth less than 1 meter).

5.3 Order of data collection on station:

In order to avoid bottom disturbance, the following data collection order will be followed:

- Determine approximate depth with Solinst depth sounder or from amount of anchor line required.
- Collect meter data in vertical profile using depth information to collect data to within 0.5 meters of the bottom.
- Collect water samples.
- Use Secchi disk to determine light penetration and to determine exact depth.

5.4 GENERAL INFORMATION AND WEATHER CONDITIONS (MEP QAPP Appendix B-1, H) The following parameters will be recorded on the data sheet:

*Time of nearest low tide from tide table and whether the tide is ebbing (approaching low) or flooding (approaching high)

*Wave conditions - see Beaufort scale

*Wind direction - the direction the wind is coming from

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*Weather conditions
*Rainfall in last 24 hours.
* Any unusual natural or man-made conditions.
*Fill out each field data sheet with the pond, station number, time, cloud cover and wind direction and speed and wave height if it has changed from the previous station.
Data sheet sample is in Appendix A.

5.5 SECCHI DEPTH/TOTAL DEPTH (MEP QAPP Appendix B-1, H) These readings should be taken over the shaded side of the boat and without the aid of polarizing sunglasses.

Step 1. Lower Secchi disk into water slowly from shady side of a boat, dock or pier until it just disappears from view. Raise and lower slightly to insure the proper average depth of disappearance.

Step 2. Read depth on tape where it intersects the water surface, record on data sheet. *Note: Sometimes the Secchi disk will hit the bottom before it disappears — in this case write "visible on bottom" or "vis/btm" on disk depth on data sheet.*

Step 3. Lower Secchi disk slowly until it touches bottom, record station total depth.

5.6 Field Data Collection with YSI-85 Multi-parameter Meter:
The meter is calibrated each day on shore before starting the sampling. Calibration is described in Appendix B. Once calibrated, the meter should be left on throughout the course of the sampling day. If turned off, it must be re-calibrated for Dissolved Oxygen prior to proceeding with data collection. The meter provides readings of four parameters with six pieces of information: dissolved oxygen percent saturation, dissolved oxygen milligrams per liter, conductivity, specific conductivity, salinity and temperature. When arriving on station, once the boat is secured with the anchor, remove the probe from its protective housing and place it into the surface water to allow it to equilibrate with the surface water temperature. Water depth will initially be determined with a Solinst depth-sounding device to avoid disturbance of the sediment. After meter readings and water sample collection, the Secchi readings will be taken and the marked cable used to determine the exact depth.
The meter data should be collected in the same order as listed above at each depth interval. Record the data on the field data sheets. The meter cable is marked in one-meter intervals. At each depth, the probe should be moved in an up and down manner over a distance of several inches to circulate pond water over the probe. Wait to record data until the reading for each parameter has stabilized. Data should be collected at the surface (at a depth of 6 inches) and then at one-meter intervals to the bottom reading at less than one-half meter above the sediment. Use the Solinst depth-sounder information to avoid hitting the bottom with the probe. If the water depth is one meter or less, readings should be taken at the surface and at one-half meter and near the bottom. When the data collection is completed, retrieve the probe and insert it in the protective housing. Do not shut the meter off until the last station readings are completed.

5.7 NUTRIENT SAMPLE COLLECTION PROTOCOL (MEP QAPP Appendix B-1, H)
Sample collection should proceed in the up-current or up-wind direction from the meter readings and only after any suspended bottom sediments have settled. You will perform each of these steps at each station in your embayment beginning in the inner portion and moving outward (toward the inlet). Samples are collected by Sampling Pole or Niskin Bottle.

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A surface sample will be collected at every station at 15 cm below the surface at pre-selected depths where required with the bottom sample 50 cm above sediment surface (be sure not to hit the bottom).

<u>COLLECTION (MEP QAPP Appendix B-1, H)</u>

MAKE SURE **ICE** IS IN COOLER

1. a) Label one 1 liter nutrient (white) bottle and one 1 liter chlorophyll (brown) bottle with station I.D., date, depth, and time of collection).

b) Lower sampling pole with the 1-liter nutrient (white) sample bottle to 15 cm below the surface and pull stopper, bring to surface, shake and dump to rinse bottle; replace stoppers then repeat. If a sample is collected for dissolved oxygen Winkler analysis, that sample will be collected first.

c) Immediately cap nutrient (white) bottle, put in cooler, and shut cooler lid.

d) Use the water in the oxygen bottle to determine water temperature with thermometer.

e) Lower sampling pole again with 1 liter brown Chlorophyll bottle to 15 cm below surface, pull stopper, bring to surface, cap and put in cooler. Shut cooler.

******PUT NUTRIENT AND CHLOROPHYLL SAMPLES IN COOLER IMMEDIATELY*****

2. Take Secchi depth and total station depth.

3. If a bottom sample is required, repeat ***a*** through ***e*** at a depth of 30cm above the bottom. If water is >3 meters (depth of sampling pole) a Niskin Sampler should be used.

4. Move to next station, repeat.

Note: Surface samples can be taken by hand or with the sampling pole. If taking samples by hand you must hold the open bottle in an inverted vertical position while submerging to the desired depth and then tip upright to fill.

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6.0 Sample Processing

Samples will be prepared for dissolved nutrient analyses by filtration. This process will be done by MVC personnel prior to shipping as described in item 6.1. Processing for particulate and chlorophyll *a* analyses will either be done by MVC personnel or by SMAST lab personnel as described in items 6.2 and 6.3 below. Total Suspended Solids samples will be processed by SMAST personnel at their Lab.

6.1 On station (preferable) or back on shore

FILTERING: Dissolved Nutrient Analyses (MEP QAPP Appendix B-1, H)

Samples for dissolved nutrient analyses will be filtered through a 0.22-micron cellulose acetate filter 47 millimeters in diameter into a 60 cc acid-washed plastic bottle.

• TO BE DONE AS SOON AS POSSIBLE AFTER COLLECTION,

• Filtered samples are to be shipped in the small white 60 cc plastic bottle (these bottles are acid leached),

• Write label directly on plastic bottle with provided permanent marker (date, time, station, depth, embayment name)

Procedure **(MEP QAPP Appendix B-1, H)**:

1. Remove white 1 liter sample bottle from cooler, one station bottle at a time.
2. Label a 60cc bottle with identical station information:

a. Embayment abbreviation name
b. Station ID
c. Sample Depth (in meters)
d. Date (mo/dy/yr)

i. Place filter (using provided forceps) in clear plastic filter holder. (white filter, not the blue paper).

ii. Shake 1-liter nutrient (white) sample bottle (in case of particulate settling) and fill 60cc syringe with water from bottle by removing plunger and pouring in, replace plunger.

iii. Attach filter (cup side up) to syringe (most filter holders have an arrow drawn on side indicating the direction of flow) and push through and discard the first approx. 30 cc of water through the filter.

iv. Push next 20 cc – 30 cc of water through the filter into the small 60 cc sample bottle, replace cap, shake and discard water.

v. Now refill syringe, **attach to filter** (cup side up) and collect all water through the filter into the now rinsed bottle until bottle is full to shoulder, **taking care that no unfiltered water drips into sample**, Fill bottle to top leaving only a small (2-3 ml) bubble, cap and put on ice.

vi. Cap 1-liter nutrient (white) sample bottle with the remaining water, check label and put on ice. The bottle must be at least ¾ full to be used for analysis.

vii. Remove used white filter paper and discard.

viii. Repeat steps a) through h) for each 1 liter nutrient (white) sample bottle.

The samples must remain in the dark and cold. Keep cooler lid closed.

6.2 Filtering: Particulate Analyses Note: a Three-port vacuum filtration units is used for Particulate and chlorophyll filtrations. Rinse forceps tip with a squirt of distilled water between handling used filters and between handling used filters and extracting and placing new filters.

3. Remove white 1 liter sample bottle from cooler, one station bottle at a time.

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4. Apply label tape to a 47 mm, plastic, lab-cleaned petri dish and print on label tape the identical station information:
a. Embayment abbreviation name
b. Station ID
c. Sample Depth (in meters)
d. Date (mo/dy/yr)

Note: The label tape should be of sufficient length to extend across the bottom of the plastic petri and up onto the top, tying the two pieces together.

5. Place pre-combusted 25 mm Glass Fiber Filter (using provided forceps) in vacuum unit holder. Secure pre-rinsed funnel housing onto vacuum unit filter housing and turn funnel to engage.

6. Shake 1-liter nutrient (white) sample bottle (in case of particulate settling) and fill 250 cc pre-rinsed (distilled water) graduated cylinder with water from bottle. Attempt to filter at least 250 milli liters of sample but judge the amount that will probably be accommodated through the filter based on the difficulty of filtration of the dissolved nutrient sample. As the sample drains down the funnel, rinse the inside of the funnel with distilled water from a squirt bottle. Note the amount filtered on the petri dish.

7. The filter will be removed using forceps and placed into the petri dish and folded in half using the forceps rinsed in distilled water.

8. If shipping immediately to the lab, seal the petri dish and refrigerate. If the sample will not be shipped for 24 hours, leave the petri cracked open and place in a 60 degree C drying oven over night.

9. After first sample is filtered, graduated cylinders and funnel housing will be rinsed with distilled water and second sample water before proceeding to filter the second sample.

6.3 Filtering: Chlorophyll *a* Analyses

Note: Rinse forceps with a squirt of distilled water as described for Particulate Analyses above. Throughout processing, the sample must remain in the dark. Green lights may be used.

10. Remove brown 1 liter sample bottle from cooler, one station bottle at a time.

11. Apply label tape to a 47 mm, plastic, lab-cleaned petri dish and print on label tape the identical station information:
a. Embayment abbreviation name
b. Station ID
c. Sample Depth (in meters)
d. Date (mo/dy/yr)

Note: The label tape should be of sufficient length to extend across the bottom of the plastic petri and up onto the top, tying the two pieces together.

12. Place a 47 mm, 0.22*u*M nitrocellulose filter (using distilled-rinsed forceps) in vacuum unit holder. Secure pre-rinsed funnel housing onto vacuum unit filter housing and turn funnel to engage.

13. Shake 1-liter nutrient (brown) sample bottle (in case of particulate settling) and fill 250 cc pre-rinsed (distilled water) graduated cylinder to the 250 mark with water from bottle. Attempt to filter at least 250 milli liters of sample but judge the amount that will probably be accommodated through the filter based on the difficulty of filtration of the dissolved nutrient sample. As the sample drains down the funnel, squirt three drops of saturated magnesium

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carbonate solution onto the last 10 ml of sample and then rinse the inside of the funnel with distilled water from a squirt bottle. Take care that the sample does not run dry before the magnesium carbonate is added. Note the amount filtered on the petri dish label tape.
14. The filter will be removed using forceps and placed into the petri dish and folded in half and in quarters using the forceps.
15. If shipping immediately to the lab, seal the petri dish and freeze making sure that the sample remains in the dark during storage and transport.
16. Rinse equipment as for particulate analyses in item 8 above.

6.4 Total Suspended Solids Analysis
Total Suspended Solids or TSS is a measure of the amount of suspended particulate material per unit volume of water and is expressed as mg/L or µg/L of material passing through a GFF glass fiber filter. Samples will be collected in lab-clean 1-liter HDPE bottles provided by SMAST at the stations indicated in the summary Table on page 11. The samples will be collected at the surface as described for nutrient samples in Section 5.7 and put on ice until shipped to the Lab. The SMAST Lab will perform sample analyses.

1. Equipment

Convection oven (60 °C)

Muffle furnace (485 °C)

Vacuum filtration setup with filtering towers for 2.5 cm glass fiber filters.

Graduated cylinders (500 mL)

Plastic petri dishes (45 cm)

2. Consumable Supplies

GFF glass fiber filters (2.5 cm)

Deionized water

3. Procedure

3.1 *Preparation of Samples*

1. Pre-combust 2.5 cm glass fiber filters at 485 °C for 4 hrs.

2. Pre-weigh each filter to 4 decimal places, place in labeled petri dish and record weight. Vacuum filter a known volume of water sample (in graduated cylinders) through the combusted filter until sufficient organic material accumulates on the filter without clogging it. If a filter gets clogged with particulates, scrape the filter to let the remaining water run out, rinse the funnel, and start over.

** Be sure that samples are very well shaken before pouring**

3. Dry filters in petri dishes in the drying oven at 60_{o}C overnight. You will want enough for all your samples, 3 blanks, and a few extra in case the sample clogs a filter.

4. Cool in glass dessicator for about 15 minutes before weighing (until cool to touch).

5. Weigh each filter to 4 decimal places and record.

6. Be sure to include date, ID, volume filtered on the label, and make it clear that these are TSS.

7. Between samples, rinse funnel with DI and rinse the graduated cylinder with 2 rinses of the next sample.

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8. After all your samples have been filtered, make three blanks by rinsing the filtration funnels with DI.

3.2 Data Calculations

TSS = (weight of filter full –weight of filter empty)/volume filtered

3.3 Quality Assurance/Quality Control

Field duplicates are collected for 5% of the sample set.

3.4 References

Standard Methods for the Examination of Water and Wastewater, 17th edition, 1989. P 2-75.

6.5 SHIPPING and Handling:

SMAST will be notified at least 24 hours before a sampling round to assure that personnel can pick up samples and that the lab is able to handle the projected analysis load. Before actual shipment, SMAST will be notified by William Wilcox, MVC (contact Roland Samimy at 508.910.6314) that samples will be in transit. Samples will be shipped by William Wilcox either on the motor vessel Schamonchi or the Fast Ferry to the New Bedford dock for pick up by SMAST personnel. If ferry schedules are not workable in terms of sample collection and holding times, samples may be shipped by Cape Air flight to New Bedford Airport. The Cape Air schedule to New Bedford airport is not yet available however, samples will be shipped the same day as collection to arrive within 8 hours of collection in the case of morning sampling and the following morning within 12 hours of collection in the case of afternoon sampling. Samples collected by SMAST personnel will be carried back to the lab by those personnel on their boat. Samples collected by William Wilcox may be shipped back to SMAST by SMAST personnel where scheduling permits the transfer of samples to SMAST personnel.

After collection, samples will be kept continuously on ice or in refrigeration.

Samples will be shipped in heavy-duty Styrofoam coolers with ice or cold packs adequate to maintain cold internal temperatures. All shipments will be accompanied by a Chain of Custody (sample in Appendix A). COC will be copied before shipping to maintain an in-house copy. Samples will be collected always on the ebb tide or at dead low water and in the morning unless the need for a sampling round requires afternoon sampling.

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7.0 YSI 85 METER Dissolved Oxygen Confirmation:

In order to assure the Quality of the dissolved oxygen data collected in the field with the meter, bi-weekly samples will be collected for Winkler method analyses. Dissolved oxygen as recorded by the meter will be checked for a subset of 10 percent of the samples to be collected during that week. The samples will be collected as follows:

7.1 Dissolved Oxygen WATER SAMPLE ANALYSIS (MEP QAPP Appendix B-1, J)

First: Fill glass O2 reagent bottle from blue oxygen kit:

Step 1. Remove glass stopper.

Step 2. Lower rubber tube from oxygen bottle on pole to the bottom of the glass reagent bottle from the blue oxygen kit.

Step 3. Drain ¾ of the poles plastic oxygen (0.5 liter) bottle through the glass bottle, overflowing the glass bottle.

Step 4. Gently tap glass bottle to insure that no bubbles stick to sides.

Step 5. As volume reaches ¾ of the 0.5 liter plastic bottle, slowly remove the rubber tube from the glass bottle and then carefully insert glass stopper so as not to trap any bubbles. Dropping glass stopper in from above works best.

Step 6. Set sample aside in the shade for now.

Next: Put thermometer in the salinity/temperature bottle on pole, let stabilize, record this as "water temperature". Remove thermometer and cap the salinity bottle and set it aside till after the dissolved oxygen is tested.

Now: Continue the dissolved oxygen analysis instruction below….

7.2 DISSOLVED OXYGEN (MEP QAPP Appendix B-1, J)

i. Open Reagent packet #1 (use the scissors in your kit);

ii. Open Reagent packet #2

iii. Remove glass stopper from glass oxygen reagent bottle;

iv. Pour Reagent #1 into bottle and then add reagent packet #2 to bottle.

v. Replace glass stopper, careful not to trap bubbles.

vi. Shake bottle vigorously holding bottle and stopper (some reagent may stick to bottom of bottle…this is O.K.).

vii. Let stand 2 minutes, shake again.

After a total of 5 minutes (when the chemical floc has settled the second time and there is a clear division), open Reagent packet #3, remove glass stopper, add powder to bottle, replace stopper (no bubbles), shake vigorously until water in bottle becomes clear (no #3 particles). *THE SAMPLE IS FIXED NOW AND WILL BE TRANSPORTED TO THE LABORATORY– IN THE ICE CHEST AND DARK.*

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8.0 Data Review

The lab data will be reviewed by Dr. Brian Howes to assure that the data meets SMAST Quality Assurance requirements. At this stage, the source identity of blind duplicate samples will reside solely with William Wilcox at the Martha's Vineyard Commission.

The resulting data will then be evaluated by William Wilcox to compare blind duplicate results with their source samples to assess the accuracy of the lab analyses. The goal of this screening is to determine that there are no obvious errors in the lab analyses. When completed, Jo-Ann Taylor, QA Officer, will examine this review, to assure that the blind duplicates are appropriately attributed to the matching stations and to determine precision based on the coefficient of variation (Relative Percent Difference or RPD). This evaluation rather than Relative Standard Deviation will be used due to the limited number of repetitions available from the sampling program.

RPD will be determined using this formula:

$$RPD == \frac{(X_1 - X_2)100}{(X_1 + X_2)/2}$$

In addition, both Jo-Ann Taylor and William Wilcox will independently screen the entire data set to assure that sample identification numbers and sampling dates are correct; to seek out decimal point errors; and to identify questionable data on the basis of values outside the expected range from previous surveys at those locations.

Lab results will be scrutinized both for each station over the course of the sampling program and for all stations within the pond during each sampling round. The data will be compared to identify suspicious outliers that will be assessed first by examining the lab accuracy for that date and then by considering the setting at the sample site to determine any unique conditions that might cause the observed results. Possible causative factors for data outliers are anticipated to include: proximity to a fresh water discharge; location within a poorly circulated recess of the estuary; recent rainfall; handling or collection errors; and lab error as indicated by blind duplicate results for that date.

These evaluations will be included in the Final Report.

The data will be graphed to display the trend through the sampling period and to compare the data collected in 2005 with previous years. Ratios of inorganic nitrogen and silica to orthophosphate will be calculated to determine limiting nutrient(s).

APPENDIX A

Field Data Sheet
Chain of Custody

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MV COMMISSION Field Data Sheet

Station # ___________
Time: ______________
Date: ______________
Wind Dir: __________
Wind Speed: ________
Rain Last 24 Hours:Y N
Cloud Cover: _____%
Wave height (Beaufort scale):_

Secchi Disk Depth: Shaded Side of Boat or Pier

Depth Down: _____
Depth Up: _______
Total Depth to Bottom: ______

METER READINGS: The Meter(s) in Use Are: ________________________________

Depths:

DO % SAT.	______	______	______	______	______
DO mg/l	______	______	______	______	______
Cond.	______	______	______	______	______
Sp. Cond.	______	______	______	______	______
Sal.	______	______	______	______	______
Temp.	______	______	______	______	______
PH	______	______	______	______	______
Turb.	______	______	______	______	______

Observations: E.g. floating weed, debris, oil, jellyfish or other animals, rafts of waterfowl, presence and distance to overnight boats, current direction, speed etc.

Samples Taken: Indicate bottle number if different than Station number. For deeper samples indicate depth.

	Nutrient	POC	Bacteria	Phyto.	Chlor.A	Other
SURFACE	______ ______	______ ______	______	____		
DEEP(show depth)______		______ ______	______	______	______	

Device used for deep sample______________________

Other Notes: ____

Pond Watchers Identity: ____

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CHAIN OF CUSTODY

Laboratory samples Are Shipped to: ______________________________

FROM: Martha's Vineyard Commission
P.O. Box 1447
Oak Bluffs, MA 02557
508.693.3453

***CONTACT:*________________________________**

Project Name:____Number:__

Project Site:______________________________ Samples Collected By:_______

Special Notes:____

____

NUMBER OF SAMPLES ENCLOSED: Dissolved __ Tot. P______
Particulate___ Chlorophyll______
Other______

Check Analyses Required for Each Sample

Sample ID NH4 NO2/NO3 PO4 TDN HCN TSS CHLA TP Sal. PH Alk. SiO2 Cond.

Collected By:_________________ Date:___________ Time: ____________

Received By:_________________ Date:___________ Time:____________

Received By:_________________ Date:___________ Time:____________

Received By:_________________ Date:___________ Time:____________

APPENDIX B:
Equipment to be Used and Calibration of Same

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GPS Station Location:

A Trimble Geo-explorer 3 Global Positioning System will be used to locate all sample stations. Location measurements will proceed only with at least 5 satellites available to assure accuracy. The goal will be a minimum of six satellites using the High Precision setting. Station locations will be corrected with the download data available at the National Geodetic Survey CORS site (continuously operating reference system). Corrected station locations are expected to be accurate within 3 meters and probably within 1 meter.

YSI85 Field Meter:

The YSI-85 model field monitoring equipment will be maintained and checked as per manufacturers' instruction. The probe is a non-detachable, combination sensor that reads conductivity, dissolved oxygen and temperature. As suggested, the probe and its storage cell will be rinsed with clean tap water after each use.

Equipment Calibration and Frequency

The preparation and expiration dates of standard solutions will be clearly marked on each of the containers to be used in calibration. It will be the responsibility of William Wilcox to check the calibration status of any meter prior to using the instrument and to check its calibration periodically during use. A log documenting problems experienced with the instruments and corrective measures taken will be maintained by the Sampling Coordinator.

All equipment to be utilized during the field analysis and laboratory analysis will be checked, prior to its use, to see that it is in operating condition. This includes checking the manufacturer's operating manuals and the instructions with each instrument to ensure that all maintenance items are being observed.

William Wilcox will assume responsibility for quality control checks and calibration of field measurement equipment. The laboratory manager will assume responsibility for all lab quality control checks, maintenance and calibration of laboratory equipment as per the SMAST SOP and QA Plan.

The meter will be auto-calibrated for dissolved oxygen before each sampling event following manufacturers recommended procedures. The accuracy of dissolved oxygen readings will be checked by collection of samples for Winkler method DO determination at two-week intervals.

The accuracy of the instrument will be checked with a standard conductivity solution each week and the instrument will be calibrated by two-point calibration using lab standard solutions should the instrument error reading of the standard solution exceed 5 percent. Any deviation from these recommendations due to specific peculiarities with certain instruments will be documented in the field logbooks and the monitoring program of the grant work plan. Instruments will be left on for the duration of the sampling round, at station and en route. All

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standards will be traceable to a nationally recognized standard and documented in field logbooks. A monthly two-point calibration will be performed for the dissolved oxygen probe. Temperature will be calibrated quarterly, by validating the temperature in a known temperature water bath.

AUTO-CALIBRATION OF DISSOLVED OXYGEN PROBE

The probe is equipped with a polargraphic Clark-type sensor. A new dissolved oxygen membrane will be installed at the beginning of the field season and at 8-week intervals as per the manufacturer's recommendations outlined below.

1. Before departing from the shore, turn the meter on by pressing the ON/OFF button, and then press MODE button until dissolved oxygen is displayed in mg/l or %. Allow the readings of dissolved oxygen and temperature to stabilize for 15 minutes.

2. The meter has two buttons with arrows; one pointing up and the other pointing down. Push both buttons simultaneously. The screen will read "0", press "enter" if at sea level to set altitude. If above sea level, use the arrow keys to set the altitude in units of 100 feet (i.e. 12 is 1200 feet). For work on all coastal ponds the altitude will be set at zero. When correct altitude is shown, press ENTER.

3. The YSI 85 will now display CAL in the lower left of the display screen. The calibration value should be displayed in the lower right of the screen and the current % reading shows in the main display of the screen. This reading should be within the range of 99 to 101 percent. When the current reading display is stable, press ENTER button. The display will then read SAVE and return automatically to the Normal Operation Mode.

CALIBRATION OF CONDUCTIVITY METER

1. Turn the instrument on and allow it to go through its self-test procedure.
2. Select a calibration standard appropriate to the expected conductivity in the pond to be sampled:
    a. For seawater a 50 mS/cm will be used.
    b. For fresh water, a 1mS/cm standard will be used.
    c. For brackish water, a 10mS/cm standard will be used.
3. Place at least three inches of calibration fluid in a clean glass beaker.
4. Use the MODE button to advance the display to conductivity.
5. Insert the probe deep enough into the standard solution so the oval hole on the side of the probe is completely covered. Suspend the probe ¼ inch from the bottom of the beaker. Do not rest it on the bottom of the beaker.
6. Allow at least 60 seconds for the temperature reading to stabilize.
7. Move the probe vigorously from side to side to dislodge any air bubbles from the

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electrodes.

8. Press the UP and DOWN arrows simultaneously. The CAL symbol will appear.
9. Use the UP or DOWN arrow buttons to adjust the reading on the display to match the value of the calibration standard.
10. Once the display reads the exact value of the calibration solution, press the ENTER button once. The display screen will then read SAVE indicating the calibration has been accepted.

The YSI 85 is designed to retain its last conductivity calibration permanently. Before each use, the instrument will be checked against the appropriate standard and corrected as needed to maintain accuracy within +/- 5 percent.

DISSOLVED OXYGEN MEMBRANE CAP REPLACEMENT

The membrane cap will be replaced annually at the beginning of field season and again at 8-week intervals or as needed based on inspection of the membrane for defects.

1. Unscrew and remove the probe sensor guard.
2. Unscrew and remove the old membrane cap.
3. Thoroughly rinse the sensor tip with distilled water.
4. Prepare the KCl electrolyte according to the directions provided by the manufacturer with the solution .
5. Hold the membrane cap and fill at least ½ full with electrolyte solution.
6. Screw the membrane cap onto the probe moderately tight. A small amount of electrolyte should overflow.
7. Screw the probe sensor guard on moderately tight.

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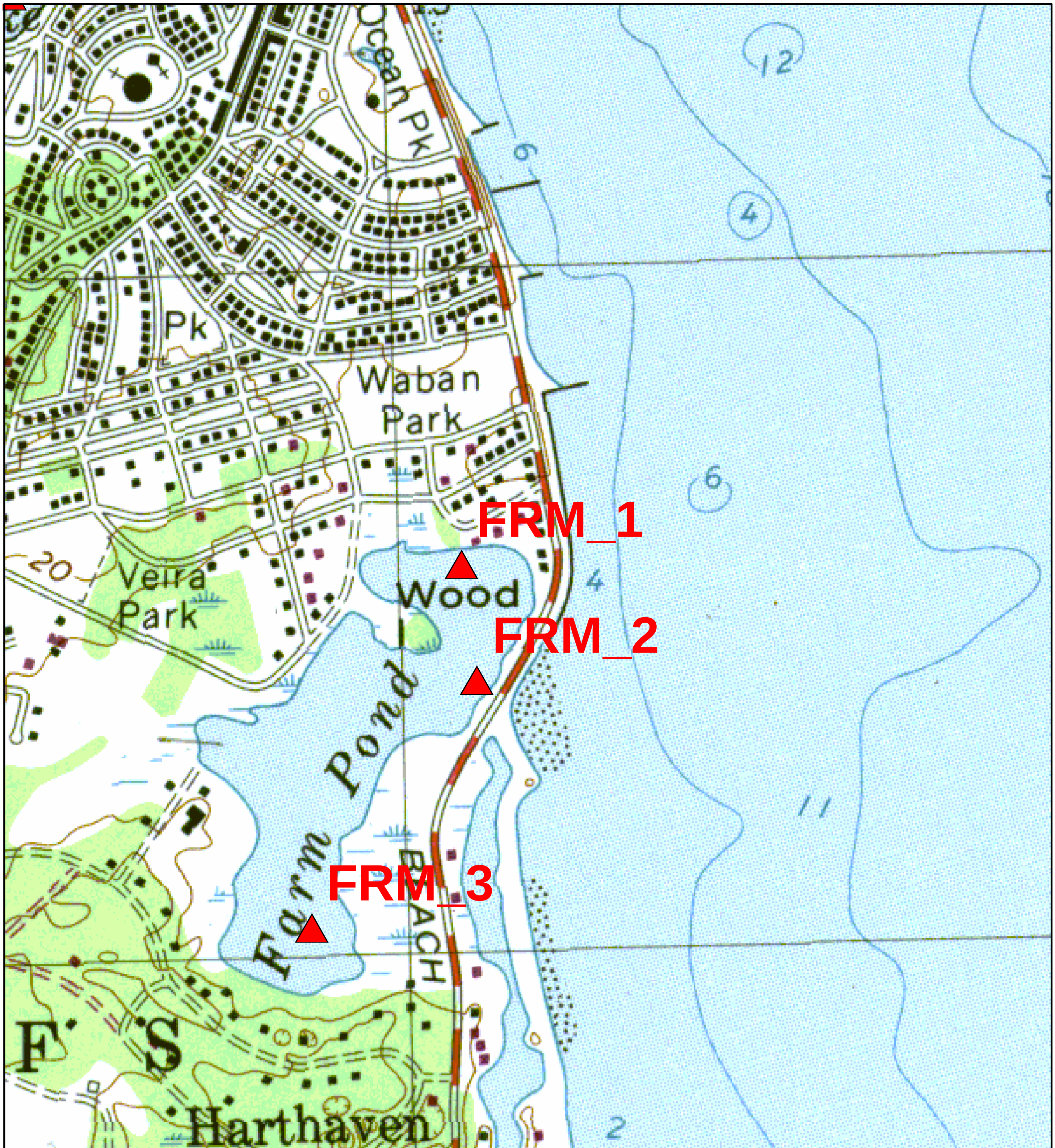

Figure 2. FARM POND WATER RESOURCE ASSESSMENT STATIONS

Prepared by: The Martha's Vineyard Commission
Date: June, 2003
Data: MassGIS, 2003. MVC, 2003.
Scale: 1:8,000
Coordinate Reference: Massachusetts State Plane Meters (NAD 83)

N S W E

POND STATION

0 250 500 1,000 Feet

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NOTE: The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.