Friends of the Bay
Volunteer Water Quality Monitoring Program
2000 Annual Report

Friends OF THE Bay
Working to keep the oyster in Oyster Bay

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Acknowledgements

Friends of the Bay would like to thank the individuals and organizations that make our water quality monitoring program possible.

The McAllister Family - Donald Jr., Maureen and Liane McAllister, residents of Centre Island, generously offered to fund the purchase of our boat Baywatch II in memory of their parents Donald Sr. and Betty.

Carolina Skiff - Carolina Skiff provided the brand new 19' Carolina Skiff Semi-V Hull boat at a 50% discount. The "semi-v" hull provides a stable work platform for volunteers to conduct water quality monitoring, education programs, harbor clean-ups, and for members of the press to photograph events.

Evinrude - Evinrude through its government sales office enabled Friends of the Bay to purchase the 70 horsepower 4-stroke engine for 40% off the regular price. The more environmentally friendly 4-stroke engine, which burns 31% less fuel than a 2-stroke engine, does not discharge oil into the bay and meets the EPA 2006 emissions regulations.

Frank M. Flower and Sons Oyster Company – Dwight and Dave Relyea and Joseph Zahtila, owners of Frank M. Flower and Sons Oyster Company, have provided dock space, boats and logistical support for Friends of the Bay's monitoring program since 1992.

Oyster Bay Marine Center –Donated fuel for the 2000 season.

Bay Marine Services – John Hickey and his staff prepared the boat for launching.

Bridge Marina - Richard Valicenti provides discounted parts and service to Baywatch II.

Tow/Boat US and North Shore Diving Services – Mitch Kramer has graciously agreed to support "Baywatch II" in "any way he can."

Nassau County Department of Health - Working with John Jacobs and the county laboratory staff enabled us to collect bacteria samples at all our testing sites and have them analyzed by the county laboratory.

Water Quality Monitoring Work Group - As a participant in the Water Quality Monitoring Work Group, Friends of the Bay's program has benefited from the collective knowledge of numerous individuals and organizations from around Long Island Sound especially Carol DiPaolo from the Coalition to Save Hempstead Harbor and, Jenifer Thalhauser from Save the Sound.

Volunteers -

Cass Chomicz	Nora Chomicz	Caroline Dubois
Scott Gurney	Judith Hershon	Pam Karches
Vincent Lofaro	AudieO'Connor	Susie Theroux
Michael Weiss		

Table of Contents

Executive Summary

Friends of the Bay volunteer water quality testing program is an important component of our efforts to preserve the Oyster Bay –Cold Spring Harbor ecosystem, and serves to increase public awareness of local threats to water quality. This program was developed in cooperation with the United States Environmental Protection Agency, New York State Department of Environmental Conservation, local governments and other volunteer monitoring groups around Long Island Sound.

Friends of the Bay monitors dissolved oxygen, salinity, temperature, and water clarity at six sites, and coliform bacteria at nine sites, throughout Oyster Bay and Cold Spring Harbor. Each of the sites is tested one day each week (just after sunrise). The sites tested include: Mill Neck Creek; Oyster Bay (West Harbor, Roosevelt Beach, and Plum Point); and two sites in Cold Spring Harbor. Dissolved oxygen is important because all aquatic life depend upon the availability of dissolved oxygen. Coliform bacteria is used as an indicator of potential human pathogens (disease causing organisms) in the water.

The 2000 monitoring season will be remembered as the season of unusual weather patterns. In July the temperature never reached above 90 degrees Fahrenheit. This relatively cool weather was followed by high winds and heavy rain in late July and August. Although the amount of precipitation for the year was normal, we received the precipitation differently. The impact of this weather pattern was that the low dissolved oxygen in July was alleviated by the rain in the later half of the month and into August. This effectively shortened the duration of low dissolved oxygen, which typically occurs in July and August.

Overall, water quality in Oyster Bay and Cold Spring Harbor is very good. Applying the Bathing Water Quality Standards used by the Nassau County Department of Health in their annual water quality assessments to Friends of the Bay's coliform data indicates that seven of the nine monitoring locations are very good or excellent. Two trouble spots, however are the branches of Mill Neck Creek where the bacteria levels are only passable (see full report for a complete description).

Dissolved oxygen data however shows that every site failed to meet the New York State Dissolved Oxygen Standard of 5.0 mg/L at least once during the monitoring season and three of the six stations were hypoxic (dissolved oxygen less than 3.0 mg/L) at least once. Cold Spring Harbor conformed to the NYS Standard 54% of the sampling days while Oyster Bay conformed 74% of the time. This is comparable to Friends of the Bay's 1999 results and to Nassau County Department of Health's average conformance for the period 1982-1991 which was 60% for Cold Spring Harbor and 68% for Oyster Bay.

Friends of the Bay looks forward to working with volunteers, government agencies and fellow not-for-profit organizations in the 2001 monitoring season. Together we will be able to continue to improve and expand our monitoring program. We hope that these efforts will provide the link to show how investment in water quality protection is improving Oyster Bay and Cold Spring Harbor.

Introduction

Exciting things are happening around Oyster Bay and Cold Spring Harbor. The Village of Bayville, as part of their *Local Waterfront Revitalization Program*, is aggressively implementing measures to prevent contaminated run-off from entering the Bay in the Bayville Park Boulevard neighborhood and elsewhere. The New York State Clean Water/Clean Air Bond Act is enabling Nassau County to install a small sewage treatment plant in Mill Neck Creek by fall 2001. The Oyster Bay Sewage Treatment Plant has also received Clean Water/Clean Air Bond Act funding to upgrade its facility to remove nitrogen. How will these changes affect water quality? Friends of the Bay monitors water quality once a week from April through October to find out.

The Long Island Sound Study (LISS), a cooperative effort of the federal, state and local governments concluded that low dissolved oxygen (hypoxia) is the most serious threat to the health of the ecosystem. As part of budgetary cutbacks, the Nassau County Department of Health eliminated all dissolved oxygen and bacterial testing from their water-testing program that was not required to monitor bathing beaches in 1992. The New York State Department of Environmental Conservation still monitors bacteria to ensure the safety of shellfishing areas.

Started in 1987 as a small group of citizens concerned about the impact of a proposed massive development on Oyster Bay's waterfront, Friends of the Bay has grown into a powerful voice representing over 3,000 area residents and businesses. "Working to keep the oyster in Oyster Bay", we are committed to the preservation of Oyster Bay and Cold Spring Harbor and our surrounding upland communities. Specifically, our mission is to promote community awareness of the need to preserve water quality and marine life in the Bay, assure the aesthetic, economic and recreational value of Oyster Bay and Cold Spring Harbor and to ensure that development in the watershed is compatible with the needs of a healthy ecosystem. As a representative of the local citizenry, we have developed a wide range of programs that expand public knowledge concerning issues in the bay. One of our most important programs is the volunteer water quality monitoring program.

Friends of the Bay has initiated a volunteer water quality testing program to fill the void left by county cutbacks. This program was developed in cooperation with the United States Environmental Protection Agency, New York State Department of Environmental Conservation, local governments and other volunteer monitoring groups around Long Island Sound. Friends of the Bay considers the program a necessary component in the effort to preserve the Oyster Bay –Cold Spring Harbor ecosystem, and hopes to increase public awareness of local threats to water quality. The water quality program of Friends of the Bay is being conducted to:

1. Provide high quality data to continue the dissolved oxygen-testing baseline established by the Nassau County Department of Health in 1972
2. Screen for water quality impairments
3. Educate and involve citizens in surface water quality protection
4. Acyt as a watchdog for harbor activities
5. Assist local, state and federal agencies in harbor management

This program enables trained volunteers working along side environmental scientists to monitor various components of the marine ecosystem. Volunteers track a number of features in the bay including water temperature, clarity, salinity, dissolved oxygen and coliform bacteria. Measuring these parameters enables Friends of the Bay to better understand changes within the local marine ecosystem.

Methods

The parameters measured by Friends of the Bay include dissolved oxygen, salinity, water temperature, water clarity, and coliform bacteria. Dissolved oxygen, salinity, and water temperature are measured using a Yellow Springs Instruments (YSI) Model 85. Water clarity is measured using a Secchi Disk. Coliform bacteria samples are collected by Friends of the Bay and analyzed by the Nassau County Department of Health (NCDH) laboratory. The following is a summary of a water quality testing methods, a more complete description can be found in our Standard Operating Procedures or Draft Quality Assurance Project Plan.

Dissolved Oxygen - All aquatic life depend upon the availability of dissolved oxygen. The level of dissolved oxygen present in a body of water determines the diversity of life that can be sustained. Most dissolved oxygen found in the water is provided by the atmosphere through the action of waves and wind. A secondary (but no less important) source of dissolved oxygen is aquatic plants, which provide oxygen through the process of photosynthesis. Dissolved oxygen is consumed by all aquatic life. Many factors influence the amount of dissolved oxygen found in a particular body of water including:

- Cooler water holds more oxygen, so the warm summer waters can be particularly stressful for marine organisms.
- More saline water(s) also result(s) in lower DO capacity.
- Poor water clarity prevents sunlight from reaching oxygen producing aquatic plants lower in the water column or at the bottom of the bay.
- Excess nutrients can cause an algal bloom, which blocks sunlight from aquatic vegetation lower in the water column. When the algae dies and sinks to the bottom the bacteria involved in decay of the plant material consumes a significant amount of dissolved oxygen reducing the amount available for fish and other benthic (bottom dwelling) organisms.

Dissolved oxygen readings are taken at each station one half-meter above the bay bottom, one-half meter below the water's surface, and at one meter intervals between the top and bottom. It is measured in milligrams per liter (mg/L), which is equivalent to parts per million (ppm). Table 1 explains the consequences of low dissolved oxygen levels.

Table 1: Consequences of Low Dissolved Oxygen

Dissolved Oxygen	Consequences
> 5.0 mg/L	**Meets NYS Standard** for dissolved oxygen – few adverse effects on marine life
4.0 mg/L	Reduces survival of crab and lobster larvae by 30%
3.0 mg/L	**Hypoxia** – affects the growth of crabs and lobsters. Fish avoid the area.
2.5 mg/L	Growth reduced in grass shrimp, summer flounder and lobster.
2.0 mg/L	Sharply reduced growth. Lowest safe dissolved oxygen level for many juvenile organisms
1.5 mg/L	Very high lethal effects on fish, shrimp and lobster.
0.0 mg/L	**Anoxia** – Intolerable environment for nearly all marine organisms (Zimmer 1996)

Salinity - Salinity is the measurement of the concentration of dissolved salts in the water. Salinity is expressed in parts per thousand (ppt). The waters of Oyster Bay and Cold Spring Harbor typically range from 24 to 27 ppt; by comparison the open ocean averages about 35 ppt. Salinity is another important factor in determining the diversity of a marine environment. Higher saline waters are more dense, causing them to sink to the bottom, producing a stratification of the water column referred to as a halocline.

Water Temperature - During the warmer summer months the increase in water temperature can result in a temperature stratification of the water column. In a thermocline, the cooler more dense waters sink to the bottom and the warmer less dense waters rise to the surface. Depending upon the depth of the water the difference in surface and bottom temperatures can be quite dramatic. The temperature of water has a direct affect upon the amount of dissolved oxygen that water can contain. Cooler water has a higher capacity for dissolved oxygen than warm water. Temperature can also have a wide reaching affect on physical processes and rates of chemical and biological reaction.

Water Clarity - The clarity of water can be affected by a variety of sources including suspended solids, such as silt from runoff; plankton; and, in shallow areas, wind generated waves and boating activity can churn up bottom sediments. Water with poor clarity can block sunlight from reaching aquatic vegetation on the bay bottom or lower in the water column, which need the sunlight for photosynthesis. Friends of the Bay measures water clarity with a Secchi disk, which is an 8-inch diameter disk divided into four alternating black and white quadrants. The disk is lowered (on the shaded side of the boat), the point at which the disk becomes completely obscured is noted, the disk is raised and the point at which the disk becomes visible again is noted. The average of these two numbers is the Secchi Depth - recorded to the nearest tenth of a meter (decimeter).

Coliform Bacteria - The Nassau County Department of Health and the New York State Department of Environmental Conservation use coliform bacteria levels to certify swimming beaches and shellfish beds respectively. Coliform bacteria are not by themselves harmful, but levels are used as an indicator of the possible presence of human pathogens (disease causing organisms) to gauge sanitary quality.

Water samples are collected by Friends of the Bay in plastic Wh*irl-Packs*, stored in a cooler with ice and transported immediately to the Nassau County Department of Health's laboratory in Hempstead where they are analyzed. Information collected at the time of each sample includes: time sample was taken; water temperature (degrees Celsius); air temperature (degrees Celsius); wind direction (1 of 8 directions); wind speed (estimate in 5 mph increments); wave height (.5' increments); weather conditions (on a predetermined 1-6 scale); and, any unusual conditions (i.e. odors, fish kills, water color). The NCDH uses the process of "Multiple Tube Fermentation" in determining the level of total and fecal coliform bacteria in a water sample expressed as most probable number (MPN).

Oyster Bay and Cold Spring Harbor are classified as "SA" waters which means the best intended use for these waters is shellfishing. This is the highest classification established by New York State and means that these waters must have a logarithmic average (or geometric mean) total coliform concentration of 70 MPN/100 ml or less to meet the bacteria standards for this classification. Being held to the strictest classification means that if the waters conform to this standard or are "open" for harvesting shellfish all other uses such as swimming and boating will also be permitted.

Table 2: Coliform Bacteria Standards

	Shellfishing Open	Swimming Open
Total Coliform	LOG AVG 30 days < 70mpn/100ml or If < 10% of samples do not exceed 5,000 *mpn/100 ml*	LOG AVG 30 days < 2,400mpn/100ml
Fecal Coliform	LOG AVG 30 days <14 mpn/100 ml or if no one sample is > 1,000 *mpn/100 ml*	LOG AVG 30 days < 200mpn/100ml

Establishing baseline bacteria conditions will be particularly important to measure changes following the installation of a new package wastewater treatment plant for 23 homes in Oak Neck Creek and other efforts to improve water quality. The goal of this effort is to identify and correct pollution sources and thereby obtain a water quality level that supports a seasonally certified shellfishing area.

Monitoring Locations

Friends of the Bay monitors six sites throughout Oyster Bay and Cold Spring Harbor for dissolved oxygen, temperature, salinity, water clarity, and bacteria, and three more for bacteria only. Each site is monitored one day per week starting at 6 a.m. (7 a.m. after daylight savings time). The dissolved oxygen monitoring locations include two sites in

Cold Spring Harbor (FB-1 & FB-2); Buoy "4" near Plum Point at the entrance to Oyster Bay and Cold Spring Harbor (FB-3); Roosevelt Beach two hundred yards north off of the flag pole in Roosevelt Park (FB-4); West Harbor midway between the east and west shores (FB-5); and, the main channel of Mill Neck Creek (FB-6) (see Appendix 1).

Nine water samples are collected to test for bacteria including: one from each of the six dissolved oxygen monitoring sites mentioned above and, one at the confluence of the two branches of Mill Neck and Oak Neck Creek (FB-7), one as close to Beaver Dam (south) as possible to reach at low tide (FB-8) and one as far north in Oak Neck Creek as possible to reach at low tide(FB-9).

Results and Analysis

As stated in the introduction, one of the goals of the water quality program of Friends of the Bay is to provide high quality data to continue the dissolved oxygen-testing baseline established by the Nassau County Department of Health from 1972 - 1991. In this, Friends of the Bay's second annual water quality monitoring report, we are modifying how we report the results and analyze the data to make comparisons with historical county data simpler. It should be noted, that there are some important differences between the historical county data and Friends of the Bay data that prevent making direct comparisons. Using the same benchmarks however, such as the number of samples below the NYS Standard for Dissolved Oxygen (5.0 mg/L), provide a rationale for our analysis.

Overall

The 2000 monitoring season will be remembered as the season of unusual weather patterns. In July the temperature never reached above 90 degrees Fahrenheit. This relatively cool weather was followed by high winds and heavy rain in late July and August. Although the amount of precipitation for the year was normal, we received the precipitation differently. The impact of this weather pattern was that the low dissolved oxygen in July was alleviated by the rain in the later half of the month and into August. This effectively shortened the duration of low dissolved oxygen, which typically occurs in July and August.

Overall water quality in Oyster Bay and Cold Spring Harbor is very good. Table 3 applies the Bathing Water Quality Standards used by the Nassau County Department of Health in their annual water quality assessments to Friends of the Bay's data (see Appendix 2).

Table 3: Bathing Water Quality Standards

Location	Rating
Cold Spring Harbor South (FB-1)	Very Good
Cold Spring Harbor North (FB-2)	Excellent
Plum Point (FB-3)	Excellent
Roosevelt Beach (FB-4)	Excellent
West Harbor (FB-5)	Excellent
Mill Neck Creek - East (FB-6)	Very Good
Mill Neck Creek - West (FB - 7)	Very Good
Mill Neck Creek - South (FB - 8)	Passable
Mill Neck Creek - North (FB - 9)	Passable

Salinity, temperature and water clarity are important to measure in combination with dissolved oxygen, however since the 2000 results did show any significant trends their analysis was not explained in-depth.

Dissolved Oxygen

Dissolved oxygen is a good indicator of the overall condition of the water, although no single test can accurately give a complete picture of the health of this complex ecosystem. Friends of the Bay's monitoring indicates that the average bottom dissolved oxygen level was 5.24 mg/L in Cold Spring Harbor and 5.89 mg/L in Oyster Bay, while the average surface dissolved oxygen was 7.07 mg/L in Cold Spring Harbor and 6.13 mg/L in Oyster Bay.

The average bottom dissolved oxygen level for both Oyster Bay and Cold Spring Harbor was 5.69 mg/L. This is slightly lower than last year's average of 5.80 mg/L. More significantly, NCDH reported the average dissolved oxygen of Oyster Bay as 8.5 mg/L and Cold Spring Harbor as 9.0 mg/L from 1982-1991. The small difference in dissolved oxygen over the last two years may be attributed to a number of factors, the most of important of which may be differences in climate conditions between the two years. The difference in the average reported by NCDH and Friends of the Bay is likely to be attributable to the county factoring in sampling during winter months (November - March) when dissolved oxygen levels are normally significantly higher than warmer summer months.

Cold Spring Harbor North had the lowest average dissolved oxygen at 5.22 mg/L and the lowest single reading of 1.24 mg/L on July 17th. Expressed as a percentage of conformance to the NYS Dissolved Oxygen Standard, Cold Spring Harbor South appears to have the lowest dissolved oxygen levels (see Table 3). Another factor influencing the dissolved oxygen levels may be the time at which the samples are taken. As a routine, Cold Spring Harbor (South and North) are the first stations sampled (usually shortly after sunrise).

Every site failed to meet the New York State Dissolved Oxygen Standard of 5.0 mg/L at least once during the monitoring season and three of the six stations were hypoxic (dissolved oxygen less than 3.0 mg/L) at least once (see Table 3). Cold Spring Harbor conformed to the NYS Standard 54% of the sampling days while Oyster Bay conformed 74% of the time. This is comparable to Friends of the Bay's 1999 results and to Nassau County Department of Health's average conformance for the period 1982-1991 which was 60% for Cold Spring Harbor and 68% for Oyster Bay.

Table 4: 2000 Dissolved Oxygen Summary

Location	Total # of Samples	Average Surface (mg/L)	Average Bottom (mg/L)	#/% of 2000 Bottom Samples Above NYS Standard (5.0 mg/L)	#/% of 1999 Bottom Samples Above NYS Standard (5.0 mg/L)	#/% of Bottom Samples Above Hypoxia (3.0 mg/L)
Cold Spring Harbor South (FB-1)	25	6.37	5.36	13/52%	6/38%	19/76%
Cold Spring Harbor North (FB-2)	25	7.71	5.22	14/56%	7/44%	23/92%
Plum Point (FB-3)	25	6.57	6.27	20/80%	12/75%	24/96%
Roosevelt Beach (FB-4)	25	6.08	5.83	18/72%	12/75%	25/100%
West Harbor (FB-5)	25	6.08	5.72	18/72%	14/88%	24/96%
Mill Neck Creek (FB-6)	25	5.88	5.75	18/72%	14/88%	25/100%
Cold Spring Harbor Average (FB 1 & 2)		7.04	5.29	27/54%	13/41%	42/84%
Oyster Bay Average (FB 3 - 6)		6.15	5.89	74/74%	52/83%	98/98%
Overall Average		6.45	5.69			

Coliform Bacteria

Coliform bacteria levels are reported as logarithmic average (also known as the geometric mean). This lessens the impact of a few particularly high or low readings on the overall average. The geometric mean for total and fecal coliform bacteria in Cold Spring Harbor, Oyster Bay and Mill Neck Creek presented in Table 4 below highlights the elevated bacteria levels in Mill Neck Creek.

On a seasonal basis, the geometric mean in Mill Neck Creek is clearly higher than the shellfishing standard (total coliform geometric mean of 70 MPN/100mL and fecal coliform geometric mean of 14 MPN/100mL). These waters do however meet the standards to allow swimming. It appears Friends of the Bay's 2000 bacteria results are not significantly different from the ten-year average reported by Nassau County for the period between 1982-1991. Nassau County used to combine Mill Neck Creek with Oyster Bay. Since we have different and far fewer sampling points we have separated the two. This prevents the four Mill Neck Creek sampling points with elevated numbers from skewing the three sampling points within Oyster Bay.

Table 5: Geometric Mean of Coliform Bacteria

Embayment	2000 Geometric Mean for Total Coliform (MPN/100mL)	NCDH 1982-91 Total Coliform Average	2000 Geometric Mean for Fecal Coliform (MPN/100mL)	NCDH 1982-91 Fecal Coliform Average
Cold Spring Harbor	31	35	12	19
Oyster Bay	21	25	6	12
Mill Neck Creek	237		74	

Discussion and Program Recommendations

Continue to Invest in Equipment

Investment in the maintenance of Friends of the Bay's monitoring equipment is important to obtaining accurate readings. This year the salinity portion of the Model 85 was calibrated using a constant and compared with a hydrometer. In addition, the meters (Model 58 and Model 85) should be sent to YSI for periodic maintenance during the off-season.

Equipment on the Friends of the Bay water quality monitoring program "wish list" that would greatly assist the water quality monitoring program include:

- a hand-held global positioning system
- a hand-held marine ship-to-shore radio
- hydrometer
- water sampling bottle
- pH meter
- foul weather gear

Develop Partnerships

The Nassau County Department of Health, volunteers and Friends of the Bay's second college intern, Vincent Lofaro were invaluable this monitoring season. The partnership with Nassau County Department of Health made it possible to examine water quality at all our sites and has added more credibility to our efforts. Involving volunteers facilitated taking samples, and provided a fun, educational opportunity for individuals to get involved in protecting the bay.

Take Action

Providing data useful to a variety of users is paramount to Friends of the Bay's efforts to protect the bay and provides an incentive for volunteer monitors. Friends of the Bay will continue to look for opportunities to put our water quality monitoring data into action. For example, based on high coliform counts in Mill Neck Creek and previous studies indicating possible failing septic systems (e.g. Oyster Bay Outstanding Natural Coastal Area Draft Management Plan), we applied for and were awarded a United States

Environmental Protection Agency Long Island Sound Study education grant. This effort will promote maintenance of Onsite Wastewater Treatment systems surrounding Mill Neck Creek.

Look to the Future

To further refine our understanding of our local waters Friends of the Bay is considering additional parameters for testing. These include apparent color, pH and nutrients.

Apparent color - Apparent color is an easy way to get general information about what material is dissolved or suspended in the water. Water with very little dissolved or suspended material appears blue in color. The presence of dissolved organic matter such as decaying plant matter can result in water color of yellow or brown. The presence of dinoflagellates can produce a reddish or deep yellow color. Water that is rich in phytoplankton and algae appears green. Runoff can result in a variety of colors including yellow, red, brown or gray.

pH - pH is the measurement of how acidic or basic a body of water is. The scale of pH goes from 0 to 14; 0 to 7 is the acidic side and 8 to 14 is the basic side. A rise in pH into the alkaline range (above 9.0) can signify a large phytoplankton bloom. This happens because the phytoplankton consume carbon dioxide (a necessary component of photosynthesis) from the water and cause the pH to rise.

Nutrients - Nutrients, specifically Nitrogen which exists in several forms including ammonia (NH_3), nitrates (NO_3), and nitrites (NO_2), are important to the ecosystem. Nitrates are essential plant nutrients but in excess can be detrimental to water quality. A few of the possible sources of excess nitrates include wastewater treatment plants, failing on-site septic systems, animal wastes, and runoff from fertilized lawns. Excess nitrates can cause a dramatic increase in plant growth and change the types of plants and animals that can survive in a body of water.

Conclusion

The 2000 season was the longest, most consistent monitoring season Friends of the Bay has undertaken. In the process we learned many things that will help us improve the program in the future.

Friends of the Bay looks forward to working with volunteers, government agencies and fellow not-for-profit organizations in the 2001 monitoring season. Together we will be able to continue to improve and expand our monitoring efforts. Hopefully these efforts will provide the link to show how investment in water quality protection is improving Oyster Bay and Cold Spring Harbor.

For further information about Friends of the Bay's Volunteer Water Quality Monitoring Program or other Friends of the Bay activities, call (516) 922-6666 or e-mail: bay@friendsofthebay.org

Literature Cited

Dexter, Barbara L. and Richard B. Harris. 1992. *Water Quality Monitoring: A Guide For Concerned Citizens*. 99 pp.

DiPaolo, Carol. 2000. *Water-Monitoring Program for Hempstead Harbor 1999 Report*.

Fisher, Nina A. 1993. *Volunteer Estuary Monitoring: A Methods Manual*. United States Environmental Protection Agency. Washington, D.C. 176 pp.

New York Sea Grant Extension. 1990. Pathogens: Long Island Sound Study Fact Sheet #12, Stony Brook, NY. 4 pp.

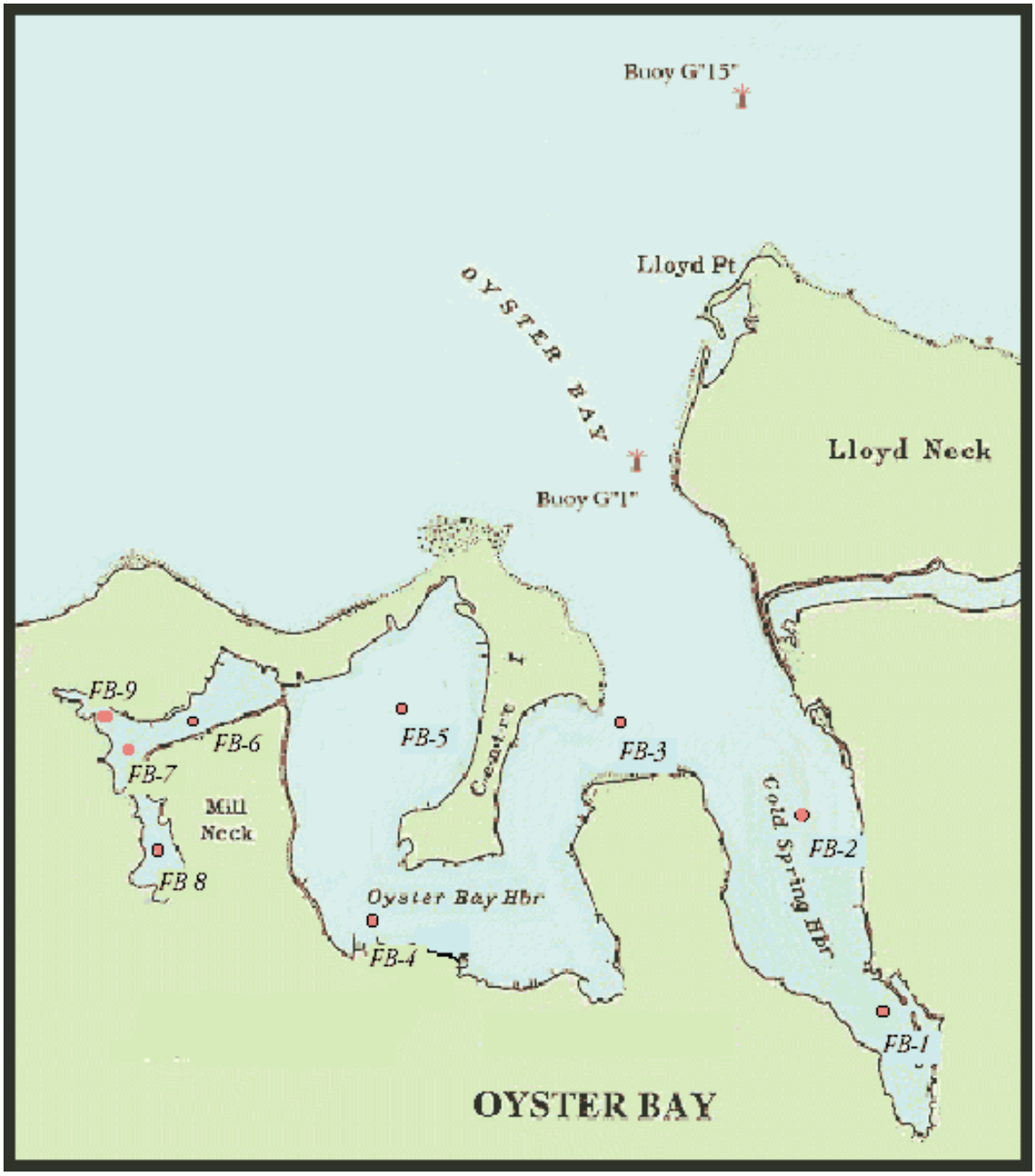
Save the Sound, Inc. 1998. Volunteer Procedures Manual: for Save the Sound, Inc.'s Water Quality Monitoring Program. Save the Sound, Inc. Stamford, CT 31 pp.

Yergeau, S. and J. Thalhauser. 1999. *1999 Long Island Sound Water Quality Report*. Save the Sound, Inc. Stamford, CT 74 pp.

Zimmer, Kimberly. 1996. *How Low Dissolved Oxygen Conditions Affect Marine Life in Long Island Sound*. Stony Brook, NY. 2 pp.

Cook Inlet Keeper. 1998. Volunteer Training Manual: Citizens Environmental Monitoring Program. Cook Inlet Keeper. Homer, AK 188pp.

Appendix 1: Map of Monitoring Locations



Appendix 2: Bathing Water Quality Standards

(from Nassau County Department of Health *1974 Surface Water Quality Assessment Report)*

The following rating criteria were applied to the bathing waters of Nassau County in 1974.

EXCELLENT - To obtain this rating a bathing beach must have a cumulative (seasonal) log average of total coliform not greater than 70, and individual total coliform counts of greater than 330 shall not have appeared in more than 10 percent of the total number of samples.

VERY GOOD - To obtain this rating a bathing beach must meet the following: (a) its cumlative (seasonal) log average of total coliform must not be greater than 240 - (b) no 30 day running log average result of total coliform shall be greater than 500 - (c) individual total coliform counts shall not be greater than 5,000 for more than 20 percent of the total number of samples.

GOOD - To obtain this rating a beach shall: (a) have a cumulative log average of total coliform not greater than 240 - (b) individualtotal coliform counts shall not be greater than 5,000 for more than 20 percent of the total number of samples.

*FAIR - To obtain this rating a beach must have the following: (a) no 30 day fecal coliform log average shall be greater than 200 (b) no 30 day total coliform log average shall be greater than 2,400 - (c) individual total coliform counts shall not be greater than 5,000 for more than 20 percent of the total number of samples.

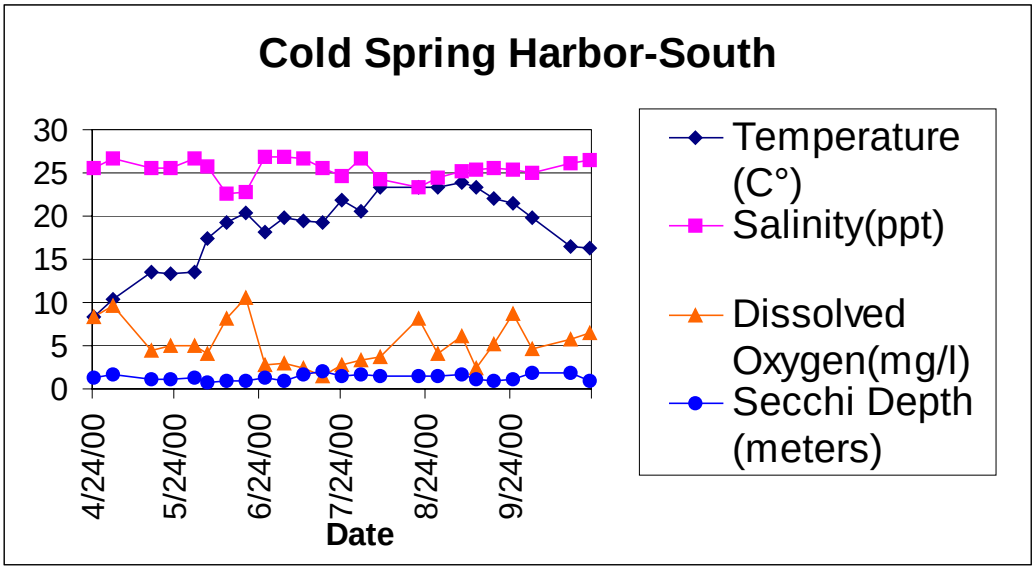
*PASSABLE - Meets "Fair" rating, but has a 30 day fecal coliform log average exceeding 200.

*EXCEEDS NEW YORK STATE HEALTH DEPARTMENT STANDARDS FOR BATHING WATER QUALITY - A beach receives this rating when the 30 day log average for total coliform goes over 2,400 at any time during the bathing season, or when more than 20 percent of the samples taken in the- season contain total coliform counts in excess of 5,000.

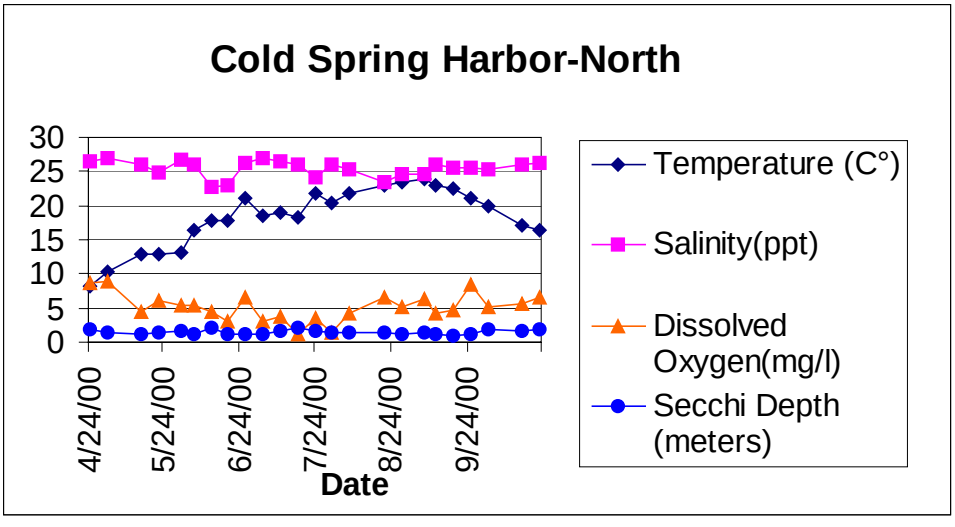
*Fecal coliform test used in evaluation of beaches not attaining at least "Good" water quality.

Appendix 3: Dissolved Oxygen Data & Graphs

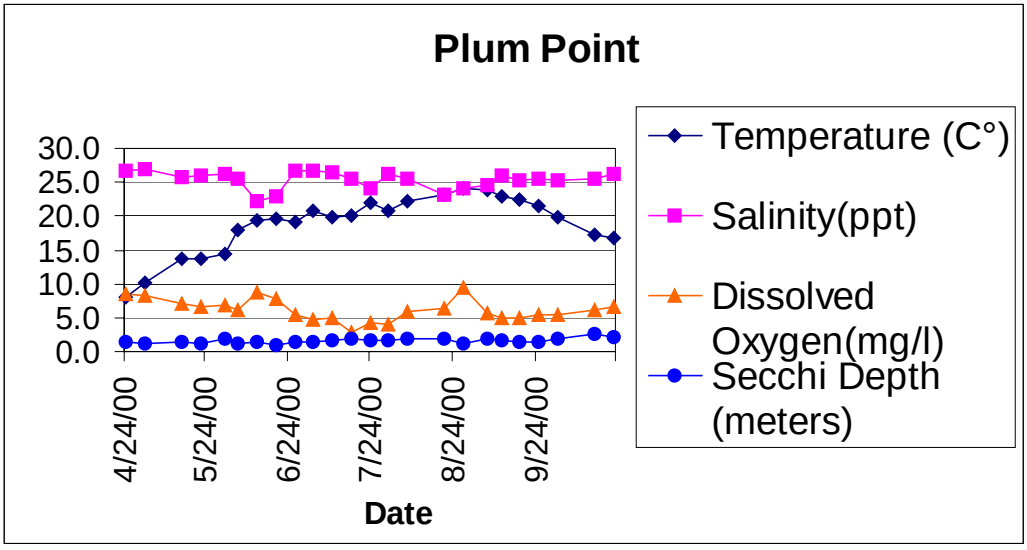
Cold Spring Harbor (South)-Bottom-FB-1				
Date	Temperature (C°)	Salinity (ppt)	Dissolved Oxygen(mg/l)	Secchi Depth (meters)
24-Apr	8.3	25.6	8.42	1.3
1-May	10.4	26.7	9.59	1.6
8-May	12.2	20.5	7.64	1.0
15-May	13.6	25.5	4.38	1.2
22-May	13.3	25.5	5.05	1.1
31-May	13.6	26.7	5.04	1.3
5-Jun	17.5	25.8	4.09	0.7
12-Jun	19.2	22.5	8.17	1.0
19-Jun	20.4	22.8	10.51	0.9
26-Jun	18.1	26.8	2.85	1.3
3-Jul	19.9	26.8	2.93	0.85
10-Jul	19.4	26.6	2.48	1.75
17-Jul	19.2	25.6	1.39	2.0
24-Jul	21.8	24.7	2.81	1.5
31-Jul	20.5	26.7	3.32	1.6
7-Aug	23.3	24.2	3.67	1.4
21-Aug	23.4	23.4	8.14	1.4
28-Aug	23.4	24.5	4.10	1.4
6-Sep	23.8	25.2	6.10	1.65
11-Sep	23.3	25.4	2.44	1.1
18-Sep	22.1	25.6	5.26	0.9
25-Sep	21.4	25.4	8.73	1.15
2-Oct	19.8	25.0	4.72	1.85
16-Oct	16.5	26.2	5.69	1.8
23-Oct	16.3	26.4	6.54	1.0
Average	18.4	25.4	5.36	1.31



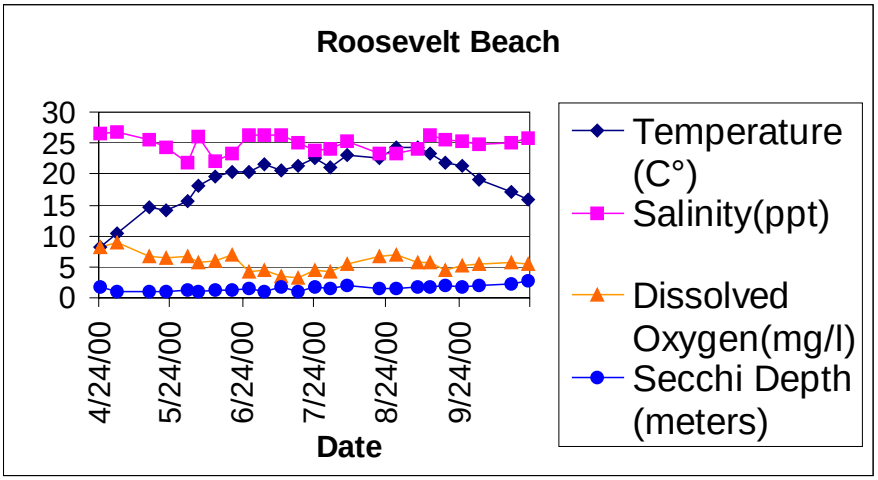
Cold Spring Harbor (North)-Bottom-FB-2				
Date	Temperature (C°)	Salinity (ppt)	Dissolved Oxygen(mg/l)	Secchi Depth (meters)
24-Apr	8.1	26.5	8.65	1.8
1-May	10.2	27.0	8.98	1.4
8-May	12.0	19.1	7.37	1.2
15-May	12.8	25.9	4.40	1.2
22-May	12.8	24.9	6.08	1.3
31-May	13.2	26.8	5.50	1.7
5-Jun	16.5	26.0	5.50	1.2
12-Jun	17.7	22.7	4.51	2.0
19-Jun	17.9	23.0	3.07	1.2
26-Jun	21.0	26.3	6.57	1.2
3-Jul	18.5	26.9	3.13	1.2
10-Jul	19.1	26.6	3.64	1.7
17-Jul	18.3	25.9	1.24	2.05
24-Jul	21.7	24.2	3.44	1.6
31-Jul	20.3	26	1.40	1.5
7-Aug	21.7	25.4	4.33	1.5
21-Aug	22.9	23.5	6.50	1.3
28-Aug	23.5	24.5	5.21	1.2
6-Sep	23.8	24.7	6.26	1.3
11-Sep	23.0	25.9	4.21	1.25
18-Sep	22.4	25.6	4.71	1.05
25-Sep	21.2	25.5	8.49	1.25
2-Oct	19.9	25.4	5.05	1.9
16-Oct	17.2	26.0	5.67	1.55
23-Oct	16.4	26.3	6.49	1.85
Average	18.1	25.5	5.22	1.46



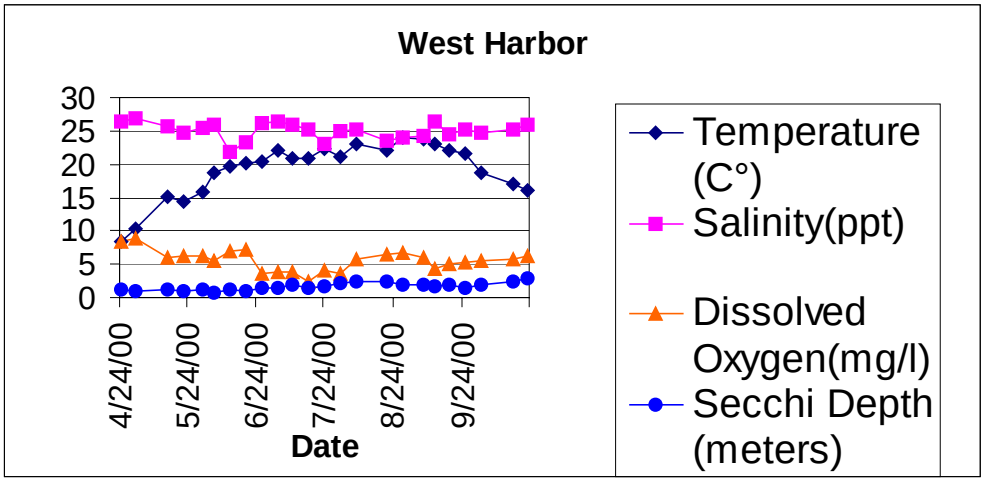
Plum Point-Bottom-FB-3				
Date	Temperature (C°)	Salinity (ppt)	Dissolved Oxygen(mg/l)	Secchi Depth (meters)
24-Apr	8.0	26.7	8.39	1.5
1-May	10.1	26.9	8.36	1.1
8-May	13.7	12.4	9.56	1.2
15-May	13.7	25.8	6.98	1.4
22-May	13.7	26.1	6.62	1.1
31-May	14.4	26.3	6.86	1.9
5-Jun	18.0	25.5	6.03	1.2
12-Jun	19.3	22.2	8.64	1.3
19-Jun	19.7	22.9	7.73	1.0
26-Jun	19.1	26.6	5.46	1.3
3-Jul	20.7	26.6	4.70	1.35
10-Jul	19.9	26.5	4.94	1.7
17-Jul	20.0	25.6	2.81	1.9
24-Jul	21.9	24.0	4.35	1.7
31-Jul	20.8	26.2	4.07	1.7
7-Aug	22.1	25.5	6.02	1.8
21-Aug	23.1	23.1	6.45	1.85
28-Aug	24.1	24.2	9.45	1.2
6-Sep	23.9	24.6	5.57	1.8
11-Sep	22.9	26.1	5.04	1.65
18-Sep	22.4	25.2	5.02	1.5
25-Sep	21.5	25.6	5.42	1.35
2-Oct	19.8	25.3	5.44	2.0
16-Oct	17.3	25.5	6.09	2.6
23-Oct	16.7	26.2	6.51	2.05
Average	18.7	25.4	6.26	1.57



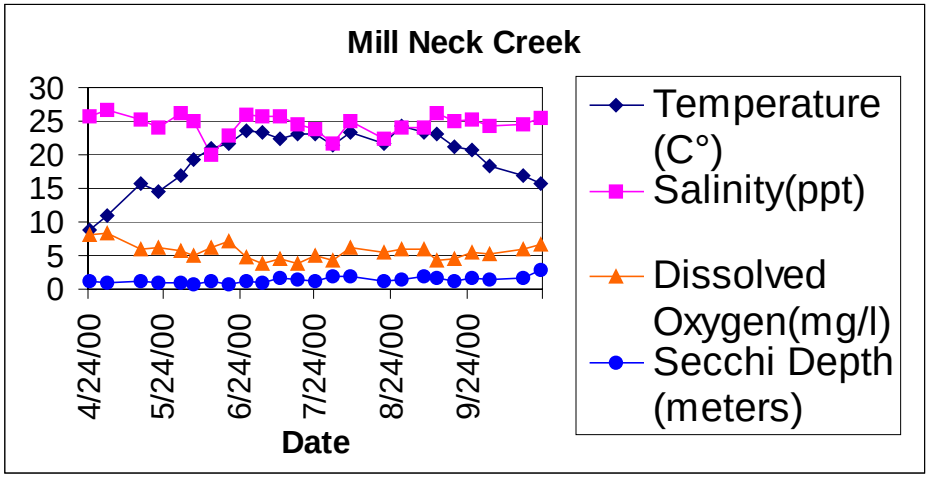
Roosevelt Beach-Bottom-FB-4				
Date	Temperature (C°)	Salinity (ppt)	Dissolved Oxygen(mg/l)	Secchi Depth (meters)
24-Apr	8.3	26.6	8.27	1.7
1-May	10.3	26.8	8.91	1.1
8-May	14.6	18.2	9.51	1.0
15-May	14.7	25.5	6.58	0.9
22-May	14.2	24.4	6.39	1.1
31-May	15.6	21.9	6.63	1.2
5-Jun	18.2	26.1	5.59	1.0
12-Jun	19.6	22.0	5.96	1.3
19-Jun	20.3	23.3	7.06	1.3
26-Jun	20.4	26.3	4.15	1.6
3-Jul	21.6	26.4	4.58	1.0
10-Jul	20.7	26.4	3.58	1.7
17-Jul	21.2	25.1	3.24	1.0
24-Jul	22.5	23.9	4.45	1.8
31-Jul	21.1	24.0	4.14	1.4
7-Aug	23.0	25.2	5.43	2.0
21-Aug	22.5	23.4	6.70	1.45
28-Aug	24.2	23.4	7.05	1.4
6-Sep	24.2	24.0	5.66	1.7
11-Sep	23.2	26.2	5.78	1.75
18-Sep	21.8	25.6	4.54	2.0
25-Sep	21.3	25.3	5.29	1.65
2-Oct	19.2	24.9	5.35	2.0
16-Oct	17.2	25.1	5.63	2.3
23-Oct	15.9	25.9	5.38	2.7
Average	19.0	24.9	5.83	1.52



West Harbor-Bottom-FB-5				
Date	Temperature (C°)	Salinity (ppt)	Dissolved Oxygen(mg/l)	Secchi Depth (meters)
24-Apr	8.4	26.4	8.35	1.2
1-May	10.4	26.8	8.82	1.0
8-May	15.4	12.4	9.58	0.9
15-May	15.2	25.6	6.06	1.1
22-May	14.3	24.6	6.15	0.9
31-May	15.9	25.4	6.14	1.2
5-Jun	18.8	25.8	5.49	0.8
12-Jun	19.7	21.9	6.90	1.3
19-Jun	20.2	23.4	7.31	0.9
26-Jun	20.5	26.2	3.64	1.5
3-Jul	22.1	26.4	3.74	1.4
10-Jul	20.9	25.9	3.73	2.0
17-Jul	20.9	25.3	2.37	1.35
24-Jul	22.4	23.0	4.11	1.6
31-Jul	21.1	24.9	3.61	2.2
7-Aug	23.0	25.2	5.70	2.4
21-Aug	22.2	23.5	6.52	2.3
28-Aug	23.9	24.1	6.82	1.9
6-Sep	23.8	24.3	5.96	2.0
11-Sep	23.0	26.4	4.20	1.65
18-Sep	22.2	24.5	5.06	2.0
25-Sep	21.5	25.1	5.32	1.35
2-Oct	18.6	24.8	5.47	1.85
16-Oct	17.1	25.2	5.81	2.35
23-Oct	16.1	25.9	6.25	2.85
Average	19.1	25.0	5.72	1.60



Mill Neck Creek-Bottom-FB-6				
Date	Temperature (C°)	Salinity (ppt)	Dissolved Oxygen(mg/l)	Secchi Depth (meters)
24-Apr	8.7	25.7	8.16	1.1
1-May	11.0	26.7	8.32	1.0
8-May	16.6	11.7	9.17	0.8
15-May	15.7	25.3	5.85	1.2
22-May	14.6	24.0	6.17	0.9
31-May	17.0	26.3	5.75	0.9
5-Jun	19.2	24.9	5.05	0.8
12-Jun	20.9	20.0	6.11	1.2
19-Jun	21.6	22.9	7.12	0.7
26-Jun	23.5	25.9	4.76	1.3
3-Jul	23.4	25.8	3.85	1.0
10-Jul	22.4	25.8	4.45	1.7
17-Jul	23.0	24.6	3.81	1.4
24-Jul	23.1	23.8	5.05	1.2
31-Jul	21.4	21.7	4.20	2.0
7-Aug	23.3	24.9	6.22	1.9
21-Aug	21.6	22.4	5.42	1.3
28-Aug	24.3	24.0	6.00	1.5
6-Sep	23.4	24.0	6.03	1.9
11-Sep	23.1	26.2	4.33	1.65
18-Sep	21.1	24.9	4.58	1.15
25-Sep	20.6	25.2	5.42	1.6
2-Oct	18.3	24.2	5.32	1.4
16-Oct	16.8	24.5	6.05	1.65
23-Oct	15.7	25.5	6.58	2.85
Average	19.6	24.6	5.75	1.36



Appendix 4: Coliform Bacteria Data