2022 Annual Water Quality Report

Water Quality Monitoring Program

FUSS & O'NEILL

Prepared in 2023 for
Friends of the Bay • 2 Townsend Square • Oyster Bay, New York 11771
www.friendsofthebay.org

This *2022 Annual Water Quality Report* was produced in 2023. It presents and describes data and observations that were recorded by the Friends of the Bay Water Quality Monitoring Program during the 2022 monitoring seasons as well as information regarding other activities and accomplishments since 2021.

Who We Are

Friends of the Bay (FOB)–a widely respected, not-for-profit organization with thousands of supporters –is dedicated to the protection of the Oyster Bay/Cold Spring Harbor Estuary and the surrounding watershed. FOB's advocacy efforts enable the estuary to continue as an unsurpassed scenic, ecological and economically-productive resource.

Our Mission

FOB's mission is to protect, preserve and restore the ecological integrity and productivity of the Oyster Bay/Cold Spring Harbor Estuary and the surrounding watershed.

What We Do

- Help to maintain clean waters that sustain a vital ecosystem, a wide range of recreation and a shellfishing aquaculture business.
- Monitor water quality within the estuary.
- Create awareness of the need to preserve water quality and marine life.
- Confront unsound development proposals.
- Promote responsible development and land use planning.
- Partner with residents, organizations, and local businesses.
- Work with government at all levels.

Major Initiatives and Accomplishments

2022

In 2022 Friends of the Bay started working on its grant from the National Fish and Wildlife Foundation (NFWF) titled "Expanding Oyster Spawner Sanctuaries in Oyster Bay and Cold Spring Harbor (NY)" with partners Adelphi University and Cornell Cooperative Extension of Suffolk County and the support of the Oyster Bay/Cold Spring Harbor Protection Committee and the Town of Oyster Bay.

We were supporting partners for Citizens Campaign for the Environment's NFWF grant "Mentoring Youth to Protect Long Island Sound," working with two local schools on projects related to water quality and marine debris.

Our advocacy efforts included working with the Town of Oyster Bay to launch their Shell Recycling Program and raising the alarm about unusual fish kill incidents to *Newsday* and other media outlets. We also joined with dozens of other environmental groups to support the NYS Bond Act for Clean Air, Water and Jobs.

We continued our monthly beach cleanup program begun in 2019, including Biannual Harbor and Beach Cleanups with the Town of Oyster Bay, International Coastal Cleanup Day with the Theodore

Roosevelt Sanctuary/Audubon and a street cleanup and native planting event with the Oyster Bay Main Street Association.

We also continued our free Speaker Series with topics ranging from seaweed aquaculture, oyster gardening to horseshoe crabs. Presenters included *New York Times* bestselling author Douglas Brinkley, The Nature Conservancy and Seatuck Environmental Association, among others. Our "Did You Know" educational campaign kicked off with informative posts on social media and in a local newspaper.

Outreach events included rain garden maintenance training for the Western Waterfront Rain Garden Project as part of a grant from the Long Island Sound Stewardship Fund at the Long Island Community Foundation (LICF), co-hosting Kayak Conservation Cruises with The WaterFront Center and a diamondback terrapin monitoring day with the Town of Oyster Bay. We also hosted Atlantic Marine Conservation Society (AMSEAS) for a Marine Mammal Rescue presentation at Theodore Roosevelt Park.

New in 2022 was our participation in a kelp pilot study project sponsored by Lazy Point Farms by deploying kelp lines in Oyster Bay and Bayville.

Our History

FOB was formed in 1987 by a group of engaged citizens concerned with the proposed development of the Jakobsen Shipyard site on Oyster Bay's western waterfront. Friends of the Bay successfully led a broad-based community effort to replace high-impact commercial development with an environmentally friendly, publicly accessible recreational complex accommodating passive use, community sailing, rowing, fishing, boat launching, maritime preservation and marine education.

Since our founding, we have grown into a powerful voice representing approximately 3,000 members. *The New York Times* has identified Friends of the Bay as one of the most effective environmental organizations around Long Island Sound. Today, FOB continues to monitor water quality in the estuary, while actively advocating for policies and programs to maintain and improve water quality and habitat throughout the watershed. Consistent with the priorities established in the Watershed Action Plan, FOB has been integral to the founding and function of the Oyster Bay/Cold Spring Harbor Protection Committee, formed by inter-municipal agreement among 14 of the 18 local government entities having jurisdiction over portions of the watershed.

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Acknowledgements

Friends of the Bay thanks the individuals and organizations that make our Water Quality Monitoring Program possible.

Bridge Marina continuously provides support to Friends of the Bay through repairs, parts, service and advice for our vessel.

Nassau County Department of Health donates laboratory testing services for bacteria samples that we collect.

Oyster Bay/Cold Spring Harbor Protection Committee helps fund the program through an annual donation.

Oyster Bay Marine Center donates fuel for the sampling boat each year.
And all the donors who support us throughout the year.

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Citizen Scientists:
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Evie Sarles
Ayanna Vazbaker
Lou Volpato

Executive Summary

Background

Friends of the Bay's Water Quality Monitoring Program is an important component of our efforts to protect the Oyster Bay/Cold Spring Harbor Estuary and the surrounding watershed while serving to increase public awareness of local threats to water quality. This program was developed in cooperation with the United States Fish and Wildlife Service, 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 (FOB) conducts water quality monitoring in accordance with a Quality Assurance Project Plan (QAPP) approved by the Environmental Protection Agency (EPA). The QAPP establishes standard operating procedures and quality assurance for data collection, ensuring that data we provide is acceptable to EPA, other environmental agencies and academic researchers. The QAPP was developed in 2006 and has undergone several revisions since its approval.

FOB has been conducting routine water quality monitoring since 2000. The monitoring results are documented in annual or biennial (once every two years) water quality monitoring reports. This report describes the results of water quality monitoring conducted in 2022.

2022 Monitoring Events

During 2022, FOB continued data collection in support of the long-term open water body monitoring program. Between 2003 and 2021, FOB has monitored 19 stations throughout the harbor, generally once a week from April to October. In 2022, FOB reconfigured the monitoring program to complement its participation in Save the Sound's Unified Water Study Water Quality Monitoring Program for Oyster Bay and Cold Spring Harbor. Monitoring now occurs on a bi-weekly basis between May through October at eight total locations. The eight monitoring locations are located in three distinct areas: two within Cold Spring Harbor (FB-1 and FB-2), four in Oyster Bay Harbor (FB-3 through FB-6), and two in Mill Neck Creek (FB-7 and FB-8).

Please note that as part of this reconfiguration of the monitoring program, the sites were renamed in 2022 compared to prior years. Therefore, the Site ID's from previous monitoring seasons are not consistent with the same Site ID referenced for the 2021 monitoring season. This report references all sites using their new Site ID (FB-1 through FB-8). Refer to the table in Appendix B which matches the 2022 Site IDs to the former Site IDs referenced in previous reports, including the 2020/2021 Annual Water Quality Report.

In 2022, samples were collected during thirteen (13) monitoring events between May 3, 2022 and October 18, 2022. Samples were analyzed for bacteria (101 samples for fecal coliform and 101 for enterococci) and measurements were recorded for dissolved oxygen, temperature, pH, and salinity (averaging 87 measurements per variable), as well as water clarity (97 measurements).

Compared to the 2021 monitoring season, two additional Cold Spring Harbor sites, four additional Oyster Bay Harbor sites, and five additional Mill Neck Creek sites were not sampled in 2022.

Each site was monitored in the morning or early afternoon every other week, weather and tide permitting, for dissolved oxygen, bacteria pollution, salinity, temperature, pH, and clarity. Nitrogen samples were not collected during the 2022 monitoring season due to a lack of funding.

Open Water Body Monitoring Results

Two major water quality parameters were monitored in 2022: bacteria and dissolved oxygen. Analysis of this open water body monitoring data provides useful insights into the estuary's water quality.

Bacteria

The majority of shellfishing in the estuary occurs in Oyster Bay Harbor. Unlike previous years, in 2022, fecal indicator bacteria (fecal coliform and enterococci) levels in Cold Spring Harbor were generally lower than in Oyster Bay Harbor. The sites excluded from the 2022 monitoring events may have played a role in these results compared to previous years; two locations in Cold Spring Harbor (South Cold Spring Harbor Cove and Cove North Mooring Field) with documented fecal indicator bacterial exceedances over the most recent years between 2018-2021 were excluded from the 2022 monitoring event. Elimination of these sites in 2022 resulted in the exclusion of two sites in Cold Spring Harbor that have historically had the highest fecal indicator bacteria results. Consistent with previous years, the highest levels of fecal indicator bacteria observed in the estuary complex were measured from Mill Neck Creek.

On a seasonal average basis across sites (FB-3 through FB-6), Oyster Bay Harbor met state shellfish standards for fecal coliform for all four of four sites monitored during the 2022 monitoring season. The 2022 seasonal geometric mean (also called "geomean" in this report) fecal coliform concentrations in Oyster Bay Harbor are typically among the lowest recorded since the monitoring program began. The fecal coliform seasonal geomean averaged for all sites in Oyster Bay Harbor has generally been decreasing since 2000.

Analysis of the seasonal geomean for individual sites in Cold Spring Harbor and Oyster Bay Harbor indicated fecal coliform remained below state shellfish standards during the 2022 monitoring seasons for all six sites monitored. In 2022, the lowest seasonal fecal coliform geomean recorded was 2 MPN/100 mL—this value was observed for both Cold Spring Harbor and Oyster Bay Harbor. The fecal coliform seasonal geomean for both Mill Neck Creek sites (FB-7 and FB-8) exceeded the state shellfish standard of 14 MPN/100 mL by 343 % and 14%, respectively.

The 30-day geometric mean fecal coliform levels exceeded the shellfish standard for some portion of the season at three out of four Oyster Bay Harbor sites in 2022, primarily at the latter half of the monitoring season. Exceeding the shellfish standard for a portion of the season has been observed over previous years. Fecal coliform levels exceeded the shellfish standard for five sites in 2021, two sites in 2020, one site in 2018, and five sites in 2017. For enterococci, none of the four sites at Oyster Bay Harbor exceeded the State swim standard of 35 MPN/100 mL over the 2022 monitoring period. This observation is similar to previous years; none of the stations exceeded this standard between 2018 and 2021, and only one exceeded the standard in 2017.

One of the two monitoring stations in Cold Spring Harbor exceeded the fecal coliform shellfish standard for a portion of the 2022 season. This result indicated an improvement compared to the 2020 season where three of four Cold Spring Harbor monitoring stations exceeded the fecal coliform shellfish standard. Similar to results in 2021 and 2020, all the Cold Spring Harbor stations remained below the swim standard for both fecal coliform and enterococci in 2022. This is consistent with previous years. The highest levels of fecal indicator bacteria have generally occurred at FB-7, FB-8, and one more site not sampled in 2022. These locations are characterized by limited circulation or flushing during low tide.

The fecal coliform and enterococci seasonal geomean averaged for all sites monitored in Mill Neck Creek has generally been decreasing since 2000. These reductions are an early indicator of the water quality improvements that have resulted from sewage infrastructure upgrades at The Birches. However, fecal coliform and enterococci 30-day geomean continue to exceed their respective shellfish standard, which suggests other sources of fecal indicator bacteria to Mill Neck Creek. Additional monitoring data is needed to further assess water quality in Mill Neck Creek and the remaining pollutant sources.

Nitrogen

Due to limited funding, nitrogen sampling did not occur in 2022.

A $10.6 million advanced wastewater treatment facility serving the Oyster Bay Sewer District has been fully operational since March 2006. As of the 2015-2016 Friends of the Bay Water Quality Report, the facility is achieving the 2014 nitrogen limits imposed by the New York State Department of Environmental Conservation—the upgrade reduced daily nitrogen discharges by as much as 75%.

Dissolved Oxygen (DO)

DO measurements throughout the 2022 monitoring dates indicated that hypoxic conditions (DO less than 3 mg/L) were not observed in the bottom of the water column for Cold Spring Harbor, Oyster Bay Harbor, or Mill Neck Creek; DO was recorded above 3 mg/L throughout the monitoring dates. Similar to 2020 and 2021, Cold Spring Harbor had the lowest DO in the bottom of the water column compared to Oyster Bay Harbor and Mill Neck Creek.

Although hypoxic conditions were not measured in Cold Spring Harbor, dissolved oxygen was near hypoxic conditions (between 3.4 mg/L and 3.7 mg/L) at FB-1 for three monitoring dates (August 8, 22 and September 8). Similar to previous years, dissolved oxygen was generally observed above 4 mg/L in Oyster Bay Harbor and Mill Neck Creek in 2022.

Cold Spring Harbor stations generally showed the greatest variability and lowest dissolved oxygen values compared to Oyster Bay Harbor and Mill Neck Creek. Measurements of dissolved oxygen near or at hypoxic conditions in 2022 and previous years continue to indicate that the waters of the estuary are enriched with nutrients. Long-term reductions in nitrogen inputs should reduce the occurrence of low dissolved oxygen conditions in bottom waters.

Stream and Outfall Monitoring

In 2007, Friends of the Bay implemented a stream and outfall monitoring program to establish baseline water quality conditions, identify water quality impacts from potential point and non-point pollution sources, develop a water quality database for the watershed to guide environmental decision-making, and measure the progress toward meeting water quality goals in the estuary watershed. The monitoring program includes sampling of 10 or 11 major discharges (OBS 1-10) into the Oyster Bay/Cold Spring Harbor estuary. These discharges include streams, ponds, a formerly untreated sewage discharge ("The Birches"), and a 'rotating' outfall location that can change for each event in an effort to identify other pollutant sources. Due to limited resources, stream and outfall monitoring was not conducted in 2022.

Water Quality and Watershed Management

In June 2011, Friends of the Bay completed a Watershed Action Plan for the Oyster Bay/Cold Spring Harbor Estuary and surrounding watershed. The Watershed Action Plan is a comprehensive management plan to protect and restore water resource conditions. The plan recommends continuation of the ongoing monitoring programs to monitor changes in harbor conditions as a result of changing watershed conditions and implementation of plan recommendations. Additional data collection is also recommended to refine the current understanding of water quality impairments in the estuary complex, particularly pollutants for which previous monitoring results have demonstrated the potential for water quality impairment but which are not currently identified by the New York State Department of Environmental Conservation (NYSDEC) as a listed cause of impairment (e.g., sediment, nutrients, and dissolved oxygen).

Friends of the Bay will continue to work with citizen scientists, government agencies, and other non-governmental organizations in future monitoring seasons. Together, FOB and its partners will continue to improve and enhance the monitoring program, with the ultimate objective of protecting and improving the quality of water in the Oyster Bay/Cold Spring Harbor estuary complex.

Friends OF THE Bay
PROTECTING OYSTER BAY & COLD SPRING HARBOR

1 Introduction

Friends of the Bay (FOB) is a widely-respected non-profit environmental organization located on the North Shore of Long Island. The mission of FOB is to protect, preserve, and restore the ecological integrity and productivity of the Oyster Bay/Cold Spring Harbor estuary and the surrounding watershed[1]. *Appendix A* presents a fact sheet for the estuary.

The Oyster Bay/Cold Spring Harbor estuary complex consists of a unique ecosystem in close proximity to New York City. Consider:

- Oyster Bay (Mill Neck) is among the 33 Inaugural Stewardship Areas listed within the Long Island Sound Stewardship Initiative 2006 Atlas.[2]
- The U.S. Fish & Wildlife Service maintains a 3,209 acre National Wildlife Refuge (NWR) within the Oyster Bay/Cold Spring Harbor Estuary Complex.[3]
- Two State-designated Significant Coastal Fish and Wildlife Habitat areas exist within the Oyster Bay/Cold Spring Harbor Estuary Complex.[4]
- The Harbor Complex is home to the Cold Spring Harbor Fish Hatchery & Aquarium. The Hatchery is proud to have the largest living collection of New York State freshwater reptiles, fish, and amphibians.
- Oyster Bay is a designated New York State "historic maritime area."
- Oyster Bay is designated as an Important Bird Area by the National Audubon Society.

The FOB Water Quality Monitoring Program was initiated to continue data collection efforts that were originally established by the Nassau County Department of Health that were terminated due to county budget cuts. This program was developed in cooperation with the United States Environmental Protection Agency (EPA), New York State Department of Environmental Conservation (NYSDEC), local governments and other volunteer monitoring groups around Long Island Sound. Friends of the Bay considers this 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.

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[1] Friends of the Bay Mission Statement as of 2005

[2] The Stewardship Initiative identifies places with significant biological, scientific, or recreational value throughout Long Island Sound and works to develop a strategy to protect and enhance those special places. The Stewardship Initiative has five specific goals: 1) Preserve native plant and animal communities and unique habitat types; 2) Improve recreation and public access opportunities; 3) Protect threatened and endangered species in their natural habitats; 4) Preserve sites that are important for long-term scientific research and education; and 5) Promote efforts to plan for multiple uses. For additional information, visit http://longislandsoundstudy.net/stewardship/stewardship_atlas06.pdf

[3] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563

[4] http://www.nyswaterfronts.com/waterfront_natural_narratives.asp; For almost two decades, there have been three State designated Significant Coastal Fish and Wildlife Habitats within the Oyster Bay/Cold Spring Harbor Estuary: Cold Spring Harbor, Oyster Bay Harbor, and Mill Neck Creek Wetlands (these habitat designations originated in 1987). On October 15, 2005, The New York State Department of State recommendations to consolidate these designations became effective. The two habitats now include 1) Mill Neck Creek, Beaver Brook, and Frost Creek, and 2) Oyster Bay and Cold Spring Harbor.

3. Monitor the estuary in support of the Total Maximum Daily Load (TMDL) for pathogens that has been established for Oyster Bay and Mill Neck Creek[5].
4. Determine long-term water quality trends.
5. Document effects of water quality improvements.
6. Educate and involve citizens and public officials about water quality protection.
7. Act as a watchdog for activity within the watershed and harbor.
8. Assist local, state, and federal agencies in harbor management by providing data.

This program enables trained citizen scientists working alongside Friends of the Bay staff to monitor various components of the marine ecosystem. Friends of the Bay citizen scientists participate in collecting samples, recording data, and related activities. Individually, they bring intellectual curiosity, diverse backgrounds and skills, and a passion for the environment. They come from as far as the south shore of Long Island and as close as Bayville and Oyster Bay. Friends of the Bay's Water Quality Monitoring Program is also made possible by supporting members, businesses, and other partners including the Bridge Marina, Nassau County Department of Health, Oyster Bay/Cold Spring Harbor Protection Committee and Oyster Bay Marine Center.

The program monitors a number of water quality parameters in the estuary including water temperature, pH, clarity, salinity, dissolved oxygen, enterococci bacteria, and fecal coliform bacteria. Measuring these parameters enables Friends of the Bay to better understand changes within the local marine ecosystem. The design of the program was reviewed and approved by the EPA in May of 2006 through Friends of the Bay's *Open Water Body Water Quality Monitoring Program Quality Assurance Project Plan* (QAPP). The QAPP has undergone several revisions since its approval in 2006.

A Memorandum of Understanding exists between Friends of the Bay and the U.S. Fish and Wildlife Service as well.[6] In this agreement, Friends of the Bay supplies collected data to the Fish and Wildlife Service. The objectives of this cooperative effort are to support long-term water quality monitoring within Oyster Bay Harbor, Mill Neck Creek, and Cold Spring Harbor, and waterways contained within the Oyster Bay National Wildlife Refuge in addition to cooperative efforts on environmental education, interpretation and outreach projects.

This Annual Water Quality Report summarizes the data collected during the 2022 monitoring season. This report was produced in 2023 as part of Friends of the Bay's continuing commitment to study the complex factors that impact water quality within the estuary and the surrounding watershed.

[5] *Pathogen Total Maximum Daily Loads for Shellfish Waters in Oyster Bay Harbor and Mill Neck Creek*. NYSDEC (2003). In November 2018, NYSDEC withdrew the pathogen TMDLs for Shellfish Waters in Oyster Bay Harbor and Mill Neck Creek, with DEC stating "the withdrawal was necessary because recent data has shown that implementation of the TMDLs would not have caused water quality standards to be achieved." Oyster Bay and Mill Neck Creek is included in Part 2c (*Multiple Segment/Categorical Waterbody Segments due to Shellfishing Restrictions)* of the New York 2018 Section 303(d) list of impaired/TMDL waters.

[6] Under the authority of the *U.S. Fish and Wildlife Coordination Act,* as amended, (16 U.S.C. Section 661) and Section 7 of the *Fish and Wildlife Act of 1956* [16 U.S.C. 742F(a)(4)], and the *Interior and Related Agencies Appropriation Act of 1992* (PL 102-154, Title 1, 105 Stat. 995.)

2 Watershed Management

In June 2011, Friends of the Bay completed a watershed management plan for the Oyster Bay/Cold Spring Harbor Estuary and surrounding watershed. The watershed management plan was developed in two phases—a State of the Watershed Report and a Watershed Action Plan—following an approach endorsed by the U.S. Environmental Protection Agency (EPA), the NYSDEC, and the New York State Department of State (NYSDOS) Division of Coastal Resources for developing watershed-based plans.

The State of the Watershed Report, prepared on behalf of Friends of the Bay in November 2009 (Fuss & O'Neill, Inc.), summarized existing environmental and land use conditions within the Oyster Bay/Cold Spring Harbor watershed. The State of the Watershed Report integrated a variety of environmental indicators to assess the current health of the watershed and potential future threats. The report provided a baseline assessment of watershed conditions, which can be updated periodically to evaluate changes in the watershed and help direct watershed management planning. The State of the Watershed Report therefore serves as the basis for the Watershed Action Plan.

The Watershed Action Plan identifies prioritized action items to protect and improve the health of the Oyster Bay/Cold Spring Harbor watershed and estuary. The plan recommends continuation of the ongoing water quality monitoring program to monitor changes in harbor conditions as a result of changing watershed conditions and implementation of plan recommendations. Additional data collection is also recommended to refine the current understanding of water quality impairments in the estuary complex, particularly pollutants for which previous monitoring results have demonstrated the potential for water quality impairment but which are not currently identified by NYSDEC as a listed cause of impairment (e.g., sediment, nutrients, and dissolved oxygen).

3 Monitoring Program

3.1 Open Water Body Monitoring

Friends of the Bay's Water Quality Monitoring program began in 1999 with six stations. Nine total stations were monitored between 2000 and 2002. Between 2003 and 2021, FOB has monitored 19 stations throughout the harbor, typically from April to October. In 2022, FOB reconfigured the monitoring program to complement Save the Sound's Unified Water Study (UWS) program for Oyster Bay and Cold Spring Harbor. Friends of the Bay has participated in the UWS program since its inception in 2017. Monitoring occurred on a bi-weekly basis between May 2022 through October 2022 at eight total locations. The eight monitoring locations are located in three distinct areas: two within Cold Spring Harbor (FB-1 and FB-2), four in Oyster Bay Harbor (FB-3 through FB-6), and two in Mill Neck Creek (FB-7 and FB-8).

Please note that as part of this reconfiguration of the monitoring program, the sites were renamed in 2022 compared to prior years. Therefore, the Site ID's from previous monitoring seasons are not consistent with the same Site ID referenced for the 2021 monitoring season. This report references all sites using their new Site ID (FB-1 through FB-8). Refer to the table in Appendix B which matches the

2022 Site IDs to the former Site IDs referenced in previous reports, including the 2020/2021 Annual Water Quality Report.

In general, on Monday and Tuesday[7] mornings staff and citizen scientists collected data on water quality and ambient conditions at eight open water body sites throughout the estuary complex. The parameters measured by Friends of the Bay included dissolved oxygen, salinity, water temperature, pH, water clarity, and enterococci and coliform bacteria.

Dissolved oxygen, salinity, pH, and water temperature were measured using the Manta 35+, which was first used for the 2020 season. The instrument includes a probe that is lowered within the water column to analyze the water's attributes in-place and a handheld data-logger that interprets the probe measurements and displays them for the sampler.

Water clarity was measured using a Secchi disk, a circular disk with opposing white and black quadrants that is lowered into the water column to the depth at which it can no longer be distinguished by an observer at the surface.

Water samples for enterococci and coliform bacteria measurements were also collected by Friends of the Bay and analyzed by the Nassau County Department of Health (NCDH).

Field measurements collected and observations made at the time of sampling were recorded on field water quality monitoring sheets, which are presented in *Appendix C*. The following is a summary of the water quality testing locations and methods. These methods are consistent with the Standard Operating Procedures and Quality Assurance Project Plan that was approved by the EPA in May 2006.

3.1.1 Monitoring Locations

Friends of the Bay monitored a total of 8 open water body sites throughout the Oyster Bay/Cold Spring Harbor estuary, including locations FB-1 and FB-2 in Cold Spring Harbor, FB-3 through FB-6 in Oyster Bay Harbor, and FB-7 and FB-8 in Mill Neck Creek.

The Oyster Bay/Cold Spring Harbor estuary station locations and identifiers were revised in 2003 and 2022. This should be taken into consideration when comparing results in this 2022 report with results prior and when comparing results from 2003 through 2021 to results presented in the 2002 report.

A map identifying the approximate location of each site and a table of coordinates (latitude/longitude) for each station, including 2022 and 2020/2021 identifiers are included in *Appendix B*.

[7] Monitoring was conducted on six Mondays, four Tuesdays, two Thursdays, and one Friday.

3.1.2 Monitoring Methods

Friends of the Bay monitored each open water body site for the following water quality parameters:

- **Dissolved Oxygen, Water Temperature, and pH** – Dissolved oxygen (DO), water temperature, and pH were measured at 8 monitoring sites using the Manta 35+ data-logger and multiparameter sonde. At each station, dissolved oxygen readings were taken at approximately one half-meter above the bay bottom, one-half meter below the water surface, and one meter below the water surface (depth permitting). The DO data was measured and recorded in milligrams per liter (mg/L), which is equivalent to parts per million (ppm). The measured values are then compared to ranges that describe the effect of dissolved oxygen on aquatic life, which are well established. In general, dissolved oxygen levels above 5 mg/L are preferred. Levels between 4 and 5 mg/L can cause harm to some species of organisms, especially the larvae of crustaceans such as lobster and crabs. Levels between 2 and 4 mg/L can cause harm to many organisms if exposure is prolonged. When dissolved oxygen levels decline below 2 mg/L, many organisms can be harmed quickly, and 3 mg/L is the concentration below which water is termed hypoxic. Few organisms can survive exposure to levels below 1 mg/L for more than very short periods.
- **Salinity** – Salinity is the measurement of the concentration of dissolved salts in the water. Friends of the Bay monitored salinity with the Manta 35+, which measures specific conductivity (a direct measurement of the ease with which electricity passes through water) and converts that measurement to salinity. In earlier years, Friends of the Bay monitored salinity with a hydrometer, an instrument used to measure the specific gravity of liquids.
- **Water Clarity** – Friends of the Bay measured water clarity with a Secchi disk. The 8-inch diameter disk is divided into alternating black and white quadrants. The disk is lowered into the water with the sun at the citizen scientist's back. The depth at which the disk becomes completely obscured is recorded. The disk is then raised and the point at which the disk becomes visible again is recorded. The average of these two numbers is the Secchi depth, recorded to the nearest tenth of a meter (decimeter).
- **Bacteria** – Water samples were collected by Friends of the Bay in sterile bottles approximately one foot below the water surface. The bottles, supplied by NCDH, are then stored in a cooler with ice and transported immediately to the NCDH laboratory in Hempstead for analysis. The NCDH uses the SM-9222D-2006 method (Membrane Filter Technique for Members of the Coliform Group: 9222D. Fecal Coliform Membrane Filter Procedure. 9222G. MF Partition Procedures) for testing for fecal coliform and EPA Method 1600 (EPA Method 1600: Enterococci in Water by Membrane Filtration Using membrane-Enterococcus Indoxyl-β-D-Glucoside Agar [mEI], 2002) for enterococci. The level of fecal coliform bacteria and enterococci in a water sample is expressed as colony forming unit per 100 ml (CFU/100mL). CFU/100ml are considered equivalent to most probable number per 100ml (MPN/100mL) for the purposes of this data. A trip blank, supplied by the NCDH laboratory, is used to ensure that proper temperature standards are met. It is placed in the cooler with the ice and, upon arrival at the NCDH laboratory; the trip blank temperature is immediately recorded. If the trip blank exceeds 6°C, NCDH laboratory personnel flag the results on the chain of custody form and then Friends of the Bay flags the data in the electronic database.

- **Other Parameters** – Other information collected at the sites include: the time the sample was collected; qualitative description of rainfall in the previous 24 hours; tidal stage (scale of 1-4), air temperature (°C); wind direction (Cardinal and Semi-cardinal directions); wind speed (MPH from wind meter); wave height (feet to the nearest 0.5); weather conditions (on a predetermined 1-6 scale); water color (on a predetermined 1-5 scale), cloud cover (0-4 scale) and any unusual conditions (i.e., odors, fish kills, debris).

3.1.3 Quality Assurance and Quality Control

The 2006 season was the first in which Friends of the Bay implemented a QAPP that was prepared for the open water body monitoring project. The QAPP was prepared with assistance from Fuss & O'Neill, approved by the EPA, and was implemented by Friends of the Bay in June 2006—the document has been revised several times since its approval. Friends of the Bay performed many of the tasks required by the QAPP in earlier years, but the QAPP provides a procedural framework to ensure that the data collected meets EPA standards. Friends of the Bay continued to follow procedures outlined in the QAPP during the 2022 monitoring season. The QAPP includes:

- Formalized monitoring locations and standard parameter list.
- Defined sampling analysis procedures.
- Required collection of duplicate samples.
- Validation of field data through calibration checks and validation with other measurement methods.

Duplicate samples were not collected during the 2022 monitoring season. The QAPP can be viewed at Friends of the Bay's office in Oyster Bay and is posted on their website at www.friendsofthebay.org.

3.2 Stream and Outfall Monitoring Program

A stream and outfall monitoring program was initiated in 2007 to establish current baseline water quality conditions in the watershed, identify water quality impacts from potential point and non-point pollution sources, develop a water quality database for the watershed to guide environmental decision-making, and measure the progress toward meeting water quality goals in the Oyster Bay/Cold Spring Harbor estuary watershed.

Friends of the Bay did not conduct stream and outfall monitoring in 2022.

4 Results, Analysis, and Discussion

4.1 Open Water Body Monitoring

With the help of citizen scientists, Friends of the Bay monitored water quality at a total of 8 open water body locations on 13 monitoring dates from May through October 2022.

Two sites are located in Cold Spring Harbor (FB-1 and FB-2), four are located in Oyster Bay Harbor (FB-3 through FB-6), and two (FB-7 and FB-8) are located in Mill Neck Creek (see Monitoring Locations Map in *Appendix B)*. Data collected during the 2022 monitoring season were analyzed both spatially (differences between areas in the estuary) and temporally (changes throughout the season) and compared to results recorded during previous seasons. The estuary was considered both as a whole, and in terms of the three primary water bodies (not including Laurel Brook) that comprise the estuary: Cold Spring Harbor, Oyster Bay Harbor and Mill Neck Creek.

These major water bodies are distinguished by hydrographic separations and differ in terms of physical characteristics, land use, watershed features, and tidal influence (see Monitoring Locations Map in *Appendix B* and Tide Charts in *Appendix D*). Relatively narrow constrictions separate each water body. Plum Point separates Oyster Bay Harbor from Cold Spring Harbor, and the narrows at the Bayville Bridge divide Oyster Bay Harbor from Mill Neck Creek. Mill Neck Creek is shallow and likely to be more influenced by tributary inflows than the other hydrographic areas. Oyster Bay Harbor contains a large mooring area and industrial facilities, is more densely developed on its south shore, and is somewhat separated from Long Island Sound by Centre Island and the landmass that includes incorporated and unincorporated parts of Bayville. Cold Spring Harbor is open to Long Island Sound and is likely to be most rapidly impacted by tidal inflows and water quality within the Sound. Tributaries flowing into the estuary include White's Creek, Mill River, Beaver Brook, Spring Lake, Tiffany Creek, Cold Spring Brook and others.

A long-term data analysis was performed in January 2009. This analysis evaluated the open water body water quality monitoring data that was collected by the Friends of the Bay from 2000 to 2006. The data were evaluated for spatial and temporal trends in order to identify how water quality in the Oyster Bay/Cold Spring Harbor Estuary has changed and the progress that has been made as a result of management efforts to address water quality problems in the estuary.

4.1.1 Physical Parameters

4.1.1.1 Temperature and Precipitation

Salinity, water temperature, pH, air temperature and water clarity were measured at each open water body sampling station throughout the 2022 monitoring season. These physical parameters can impact environmental and ecological conditions within the estuary. *Figure 1* shows average air temperature and total rainfall for the sampling season (April through October) in Long Island from 2000 through 2022.[8]

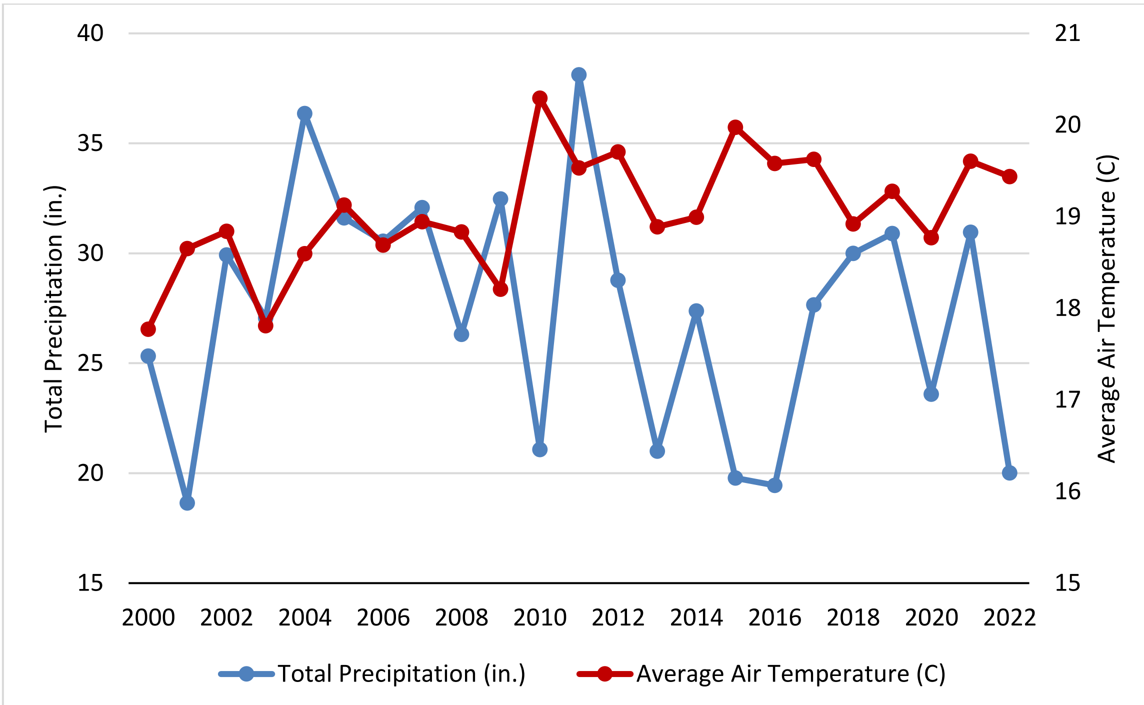

Figure 1. Physical conditions on Long Island, 2000 – 2022 (April through October).

From 2000 to 2021, the average total precipitation during the monitoring season (April through October) was 27.7 inches. The total precipitation during the 2022 monitoring season was less than the average, at 20 inches. The total precipitation during the 2022 monitoring season was a 55% and 15% decrease compared to 2021 and 2020 total precipitation, respectively.

From 2000 to 2021, the average air temperature in Long Island was approximately 19.0 degrees Celsius, ranging from a low of 17.8 in 2001 to a high of 20.3 in 2010. The average air temperature during the 2022 monitoring season was 19.4 degrees Celsius. Visual inspection of average air temperature during the monitoring season shows a general increase since 2000 as depicted in *Figure 1*.

4.1.1.2 Water Clarity

Secchi disk depth is an indication of water clarity. Light that penetrates the surface of the water passes through the water column, reflects off the disk, and passes back through the water column to the eye of the observer. Secchi disk depth is the depth where enough light is scattered (by objects, such as sediment particles) or absorbed (by being converted to heat or chemical energy, such as by algae) within the water column that the light reflected by the disk can no longer return to the surface. Dissolved solids,

[8] Temperature data from the National Weather Service for JFK International Airport in Queens, New York. Precipitation data from the NOAA National Centers for Environmental Information for the station at JFK International Airport in Queens, New York.

particulate solids, algae, and other biota can impact clarity in a water column. Secchi disk depths in the Oyster Bay/Cold Spring Harbor complex are generally between 2.5 and 0.6 m (the range was 3.7 to 0.5 m in 2022).

Figure 2 presents 2022 Secchi disk depth results, as averaged for Cold Spring Harbor, Oyster Bay Harbor, and Mill Neck Creek. Average Secchi disk depths (in meters) in 2022 for these areas were 1.7, 1.7, and 0.8, respectively. As was the case in past years, Mill Neck Creek had lower water clarity than Oyster Bay Harbor and Cold Spring Harbor, possibly a result of increased biological activity due to the shallow depth, marshy area, and close proximity to tributary discharges. In addition, Sechi disk data from six monitoring events were not reported because of shallow conditions.

Average Secchi disk depths were generally consistent with previous years exhibiting the lowest water clarity in Mill Neck Creek. Oyster Bay Harbor typically has the highest water quality, but very similar to Cold Spring Harbor during the 2022 monitoring event. Similar to 2021 and 2020, the lowest clarity levels seem to occur during early through later summer (generally June through August) in Oyster Bay and Cold Spring Harbor. Although the cause has not been studied in detail, lowest clarity levels during summer are likely caused by algal growth fueled by nitrogen inputs to the Bay. See *Appendix E* for additional physical data.

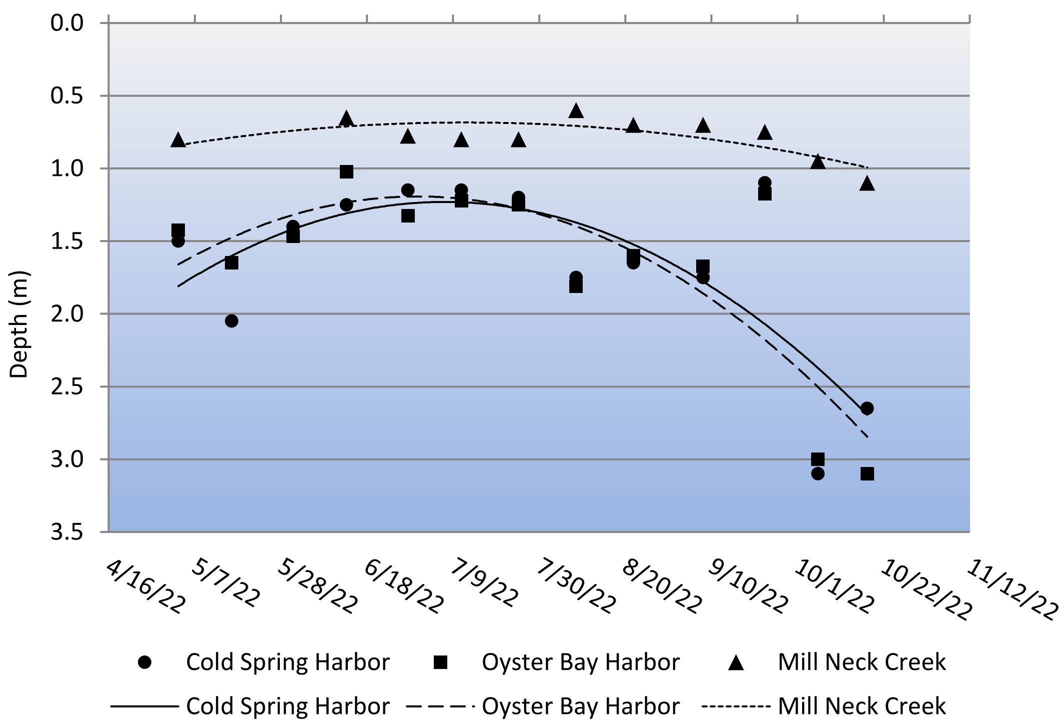

Figure 2. 2022 Secchi disk results, averaged locationally, with moving average lines

4.1.2 Bacteria

Bacteria are widespread in the environment. Certain types can be used to indicate the possible presence of human pathogens. Common fecal indicator bacteria include fecal coliform and enterococci. Bacteria are introduced in the marine environment through various point and non-point sources such as surface water runoff, industrial and agricultural discharges, or wastewater discharges. The New York Code of Rules and Regulations (NYCRR) specify levels of fecal coliform bacteria that should be met in bodies of water designated for different purposes. Waters used for shellfish cultivation and harvest must meet the most stringent bacteriological criteria.

Coliform bacteria levels are reported as logarithmic averages with a 30-day averaging period (also known as the geometric mean, or geomean). Geomeans are often used for regulatory thresholds as they are less prone to be influenced by outlier values which frequently result during bacterial analysis.

Friends of the Bay collected bacteria monitoring data during 13 weeks monitored in 2022. The completeness of monitoring runs, calculated by dividing the number of runs performed by the number of possible runs (15) and expressed as a percent, is 87% for 2022. Fifteen runs are based on the planned bi-weekly monitoring schedule in 2022.

Table 1 summarizes shellfish standards for fecal coliform bacteria that are enforced by New York State (NYS). In 2004, revised beach closure standards were implemented that are based on measured levels of enterococci, an alternate indicator bacteria, and fecal coliform. The standards are summarized in *Table 2*.

Table 1. NYS Coliform Bacteria Standards

	Shellfishing *
Fecal Coliform	LOG AVG <14 MPN/100 mL and If < 10% of samples do not exceed 43 MPN/100 mL

* 6 NYCRR §47.3

Table 2. NYS Coliform Bacteria Standards, effective 2004

	Swimming †
Fecal Coliform	LOG AVG 30 days < 200 MPN/100mL, and no sample greater than 1,000 MPN/100 mL
Enterococci	LOG AVG 30 days <35 MPN/100 mL, and no sample greater than 104 MPN per 100 mL

†10 NYCRR Section 6-2.15 - Water quality monitoring

Fecal coliform and enterococci levels were measured and reported at eight (8) locations during the 2022 monitoring season. Fecal coliform has been measured by Friends of the Bay since the inception of the monitoring program, while enterococci has been measured since 2004.[9]

Table 3 presents a summary of the season's bacteria results compared to the New York State Shellfishing Standards in *Table 1*. The shaded cells in *Table 3* indicate that the seasonal geomean and/or the 90th percentile value at that station exceeded the State standard. Bolded values indicate which value exceeded the State standard. Although only fecal coliform data and not total coliform were collected in 2022, in earlier years of the monitoring program, fecal coliform exceedances were generally accompanied by exceedances in total coliform as well.

In 2022 seasonal geometric mean fecal coliform bacteria levels exceeded the shellfish standards for fecal coliform at FB-7, and FB-8, both which are located in Mill Neck Creek. No stations monitored in Cold Spring Harbor or Oyster Bay Harbor in 2022 exceeded the shellfish standards for fecal coliform.

These exceedances at Mill Neck Creek were also documented at the same stations during the 2021 and 2020 monitoring seasons. During the previous monitoring seasons, including 2020 and 2021, Mill Neck Creek consistently exceeded the shellfish standards.

Only two stations were sampled in Cold Spring Harbor in 2022, while during previous years sampling occurred at four stations at Cold Spring Harbor. Although no stations exceeded the shellfish standards for fecal coliform in 2022 in Cold Spring Harbor, the two stations not sampled in Cold Spring Harbor in 2022 exceeded the shellfish standards in previous years (2020 and 2021). Cold Spring Harbor exceeded the shellfish standards for three out of four, and two out of four stations monitored in 2020 and 2021, respectively.

Shellfish standards were met at all stations monitored in 2022 within Oyster Bay Harbor, which is where the majority of shellfishing occurs in the estuary. This result is generally consistent with previous years where the majority or all of stations in Oyster Bay Harbor met the shellfish standards. All eight stations in Oyster Bay Harbor met shellfish standards in 2021, and the majority of stations (six of eight stations) met shellfish standards in 2020. It should be noted that only four stations were monitored in 2022, which is half of stations that have been monitored in previous years.

[9] The NCDH laboratory, which performs bacterial analysis for Friends of the Bay, changed analysis methods between the 2004 and 2005 seasons. The earlier method resulted in elevated values compared to the later method. As such, data from 2004 is not comparable to data from later years and not included in this report.

Table 3. Comparison of 2022 Monitoring Results to State Shellfishing Standards

Fecal Coliform			
Station	Seasonal Geomean	90th Percentile	Location
FB-1	6	17	CSH
FB-2	2	5	CSH
FB-3	2	7	OBH
FB-4	6	19	OBH
FB-5	6	16	OBH
FB-6	11	23	OBH
FB-7	**62**	**299**	MNC
FB-8	**16**	**49**	MNC
Shellfish Standards	14	43	

Bolded numbers indicate the value exceeds the shellfish standard
Greyed cells indicate stations that exceeded the shellfish standard for the seasonal geomean and/or the 90th percentile

In 1983, NYSDEC closed Mill Neck Creek to shellfishing due to the elevated coliform bacteria levels found there, which was likely the result of the sewage overflows from "The Birches" (also known as Continental Villa) housing development in Locust Valley that have plagued Mill Neck Creek. This subdivision historically operated its own sewage treatment system, which suffered chronic problems due to cesspool overflows and inadequate treatment of waste, impacting low-lying wetlands and the adjacent creek. Failing and/or low-functioning individual on-site sewage disposal systems located in this area are also believed to have contributed to these chronic problems. As of April 2011, sewage infrastructure upgrades were completed, and all the homes in "The Birches" residential subdivision were connected to the Glen Cove sewage treatment plant.

The average bacteria levels recorded at Mill Neck Creek monitoring locations have decreased substantially from the 2011 sampling season to 2022 (60% and 76% for fecal coliform and enterococci, respectively). These reductions are an indicator of water quality improvements resulting from the sewage infrastructure upgrades. However, seasonal geometric mean fecal coliform levels at the Mill Neck Creek monitoring stations continue to exceed the fecal coliform standard, which suggests other sources of fecal indicator bacteria to Mill Neck Creek. Additional monitoring data is needed to further assess water quality in Mill Neck Creek and the remaining pollutant sources.

Figure 3 and *Figure 4* present seasonal geometric means (i.e., May through October 2022, but typically April through October) for fecal coliform and enterococci, respectively, for each of the estuary's embayments. From 2000 to 2022, seasonal geometric mean levels of fecal coliform exhibit a decreasing trend for Cold Spring Harbor, Oyster Bay Harbor, and Mill Neck Creek. The seasonal fecal coliform geometric means for Oyster Bay Harbor and Cold Spring Harbor measured below the State shellfish standard for fecal coliform. The seasonal fecal coliform geometric means at Mill Neck Creek in 2022 were comparable to those same stations in 2021. In both years, the State shellfish standard was exceeded. Overall, since 2000, geometric mean fecal coliform levels exhibit a decreasing trend in Cold Spring Harbor, Oyster Bay Harbor and Mill Neck Creek. The geometric mean concentrations for Oyster

Bay Harbor have remained low and relatively constant since 2008, with greater fluctuations in Mill Neck Creek and Cold Spring Harbor within the same time period.

Between 2005 and 2022, the seasonal geometric means for enterococci have generally been decreasing for all three areas (i.e., Cold Spring Harbor, Oyster Bay Harbor and Mill Neck Creek), especially in Mill Neck Creek and Cold Spring Harbor. Compared to 2021, the seasonal geometric mean for enterococci in 2022 decreased at Cold Spring Harbor and Mill Neck Creek and stayed the same at Oyster Bay Harbor. In general, the seasonal geometric mean has remained relatively constant in Oyster Bay Harbor since 2013, with greater fluctuations in Cold Spring Harbor and Mill Neck Creek. In 2022, with reduced sampling effort (two of four sites) compared to prior years, enterococci seasonal geometric mean was among the lowest recorded levels since monitoring began in 2005.

Although the shellfish and swimming standards are included on the figures below for reference, the locationally-averaged geomeans cannot be used to directly assess compliance with the standards—instead, the 30-day running geometric means (see *Figures 6* through *11*) should be used.

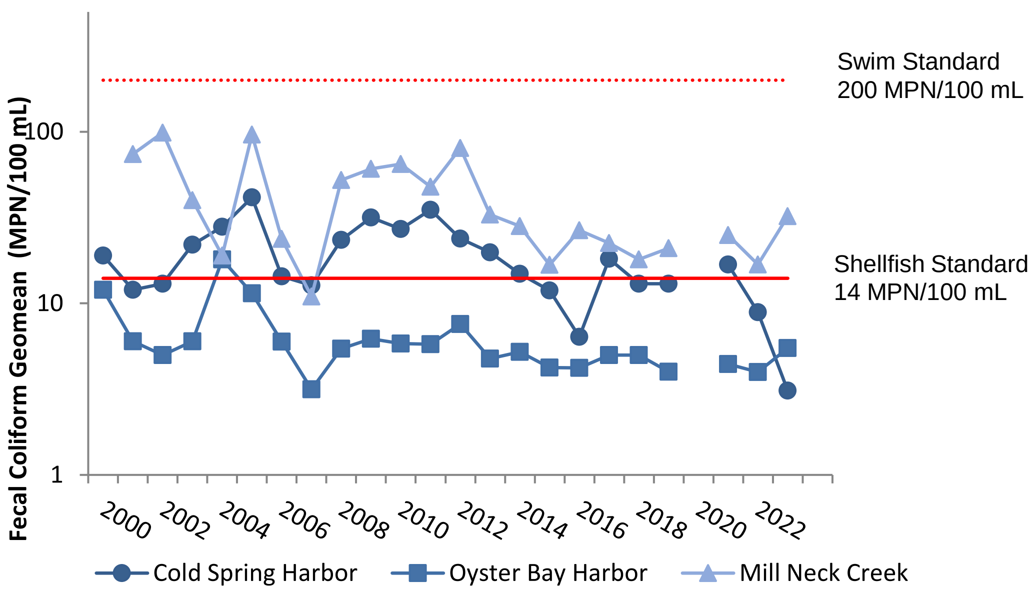

Figure 3. Seasonal geomeans of fecal coliform data by location, 2000-2022

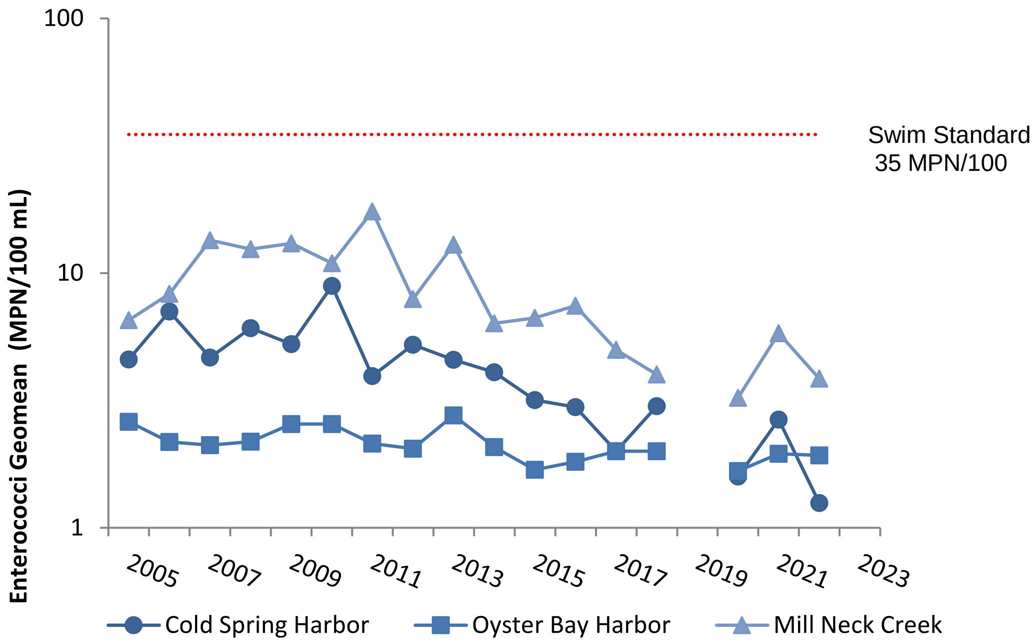

Figure 4. Seasonal geomeans of enterococci data by location, 2005-2022

Figure 5 presents total monthly precipitation as recorded at a NOAA precipitation station at JFK International Airport in Queens during the 2022 monitoring season. In 2022, the monthly precipitation ranged from a low of 0.85 inches in August to a high of 5.61 inches in October, with a monthly average of 2.9 inches, a 20% decrease compared to 2021. Less than two inches of rain were documented monthly between July through September 2022, a substantial reduction in monthly precipitation compared to 2021. The distribution of precipitation through the monitoring season is important because stormwater runoff can transport bacteria pollution to receiving waters. See *Appendix E* for additional bacteria data.

According to the U.S. Drought Monitor, drought conditions during the monitoring season on Long Island were first reported on the July 26, 2022 map and persisted through October 2022, with conditions ranging from Abnormally Dry, to Moderate Drought, to Severe Drought. These drought conditions resulted in a lower monthly average in 2022 compared to 2021 and 2020.

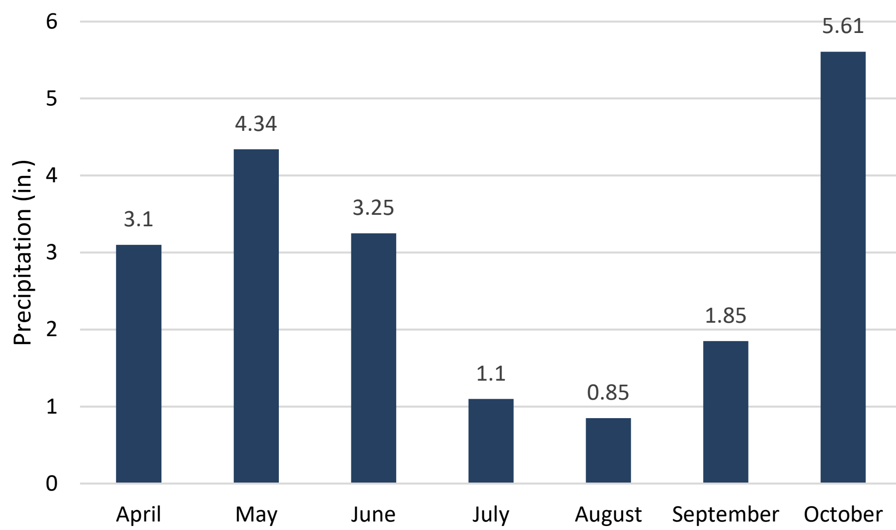

Figure 5. Precipitation monthly totals, JFK International Airport, NY 2022

4.1.2.1 Cold Spring Harbor Results

Two stations were monitored for fecal coliform and enterococci bacteria in Cold Spring Harbor in 2022. *Figure 6* and *Figure 7* present the 2022 fecal coliform and enterococci 30-day running bacteria geometric means for each station monitored.

The compliance of the 30-day geometric means for fecal coliform bacteria for shellfishing standards are consistent with the seasonal geometric means presented in *Table 3*. FB-1 met the fecal coliform NYS shellfish geometric mean standard (14 MPN/100 mL) for the majority of the season, but exceeded the standard during one sampling event (July 11, 2022). FB-2 met the standard for the entirety of the 2022 season.

The fecal coliform geometric mean swim standard (200 MPN/100 mL) and enterococci geometric mean swim standard (35 MPN/100 mL) were not exceeded by any Cold Spring Harbor stations in 2022.

During the 2022 season, no fecal coliform samples exceeded the 1,000 MPN/100 mL single sample swimming standard. The highest fecal coliform value (35 MPN/100 mL) was measured at FB-1 on June 28, 2022. The 104 MPN/100 mL single sample swim standard for enterococci was not exceeded at any Cold Spring Harbor stations in 2022. The highest enterococci value (7 MPN/100 mL) was measured at FB-1 on October 18, 2022. See *Appendix E* for bacteria data.

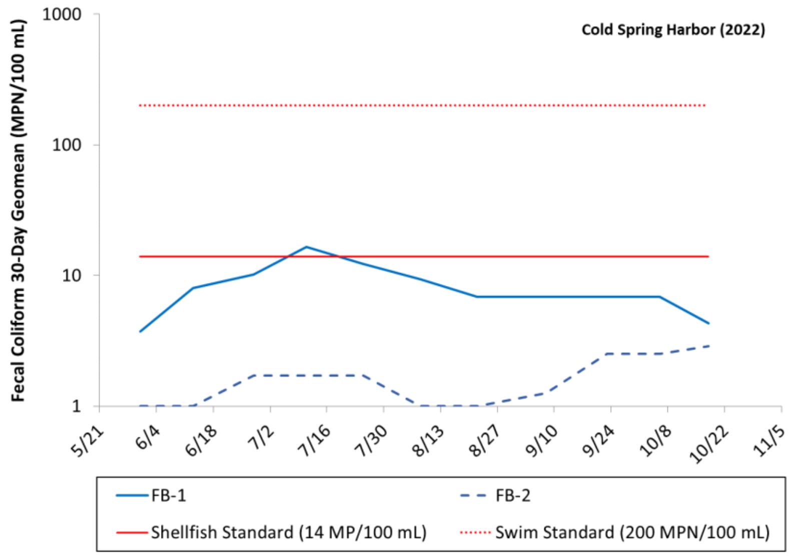

Figure 6. 30-day running geometric mean of 2022 Cold Spring Harbor fecal coliform samples

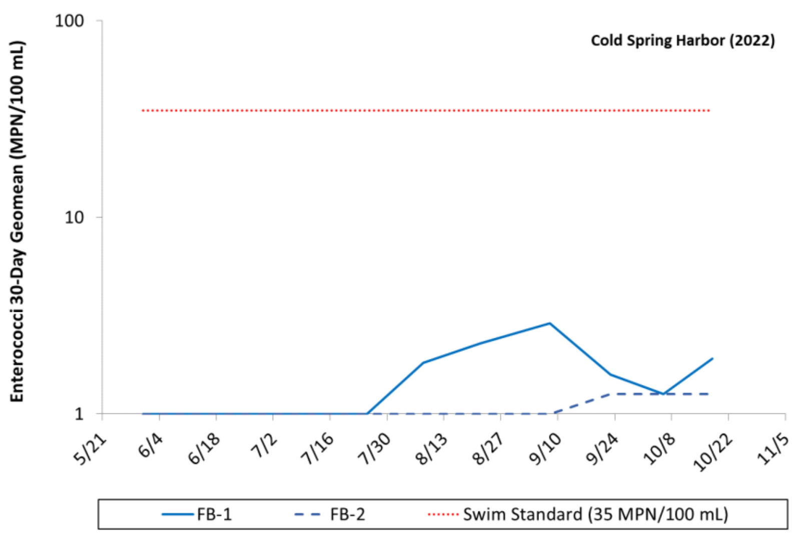

Figure 7. 30-day running geometric mean of 2022 Cold Spring Harbor enterococci samples

4.1.2.2 Oyster Bay Harbor Results

Four stations were monitored for fecal coliform and enterococci bacteria in Oyster Bay Harbor in 2022, as depicted in *Figure 8* and *Figure 9*. As shown, the fecal coliform geometric mean values at three out of four Oyster Bay Harbor sites (FB-4 through FB-6) exceeded the shellfish standard for some portion of the season in 2022. The exceedances occurred primarily in September and October.

The 30-day fecal coliform geometric mean standard for swimming (200 MPN/100 mL) and enterococci standard for swimming (35 MPN/100 mL) were not exceeded for any Oyster Bay Harbor stations during the 2022 sampling season.

In 2022 the single sample swimming standard (1,000 MPN/100 mL) for fecal coliform and the enterococci swimming standard (104 MPN/100 mL) were not exceeded. These results are consistent with the 2020 and 2021 sampling seasons. The highest fecal coliform value (170 MPN/100 mL) and highest enterococci value (33 MPN/100 mL) were both sampled from FB-6 on September 8, 2022. See *Appendix E* for bacteria data.

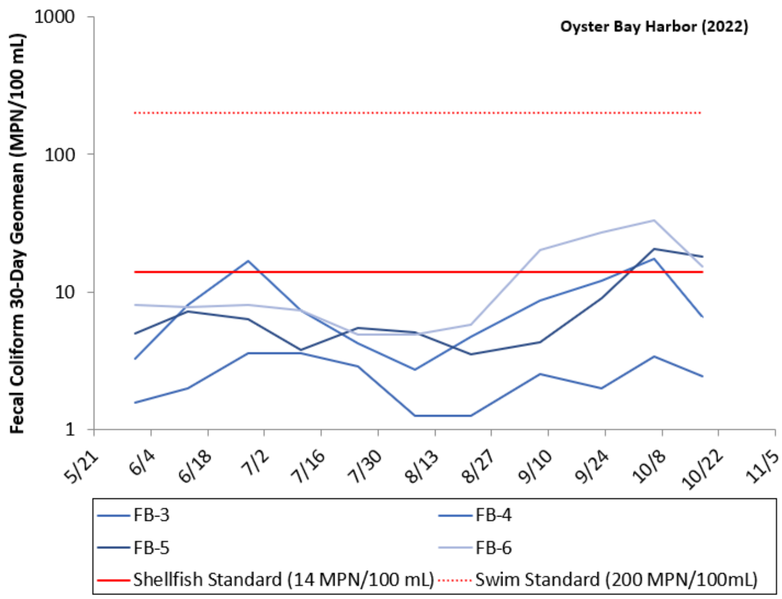

Figure 8. 30-day running geometric mean of 2022 Oyster Bay Harbor fecal coliform samples

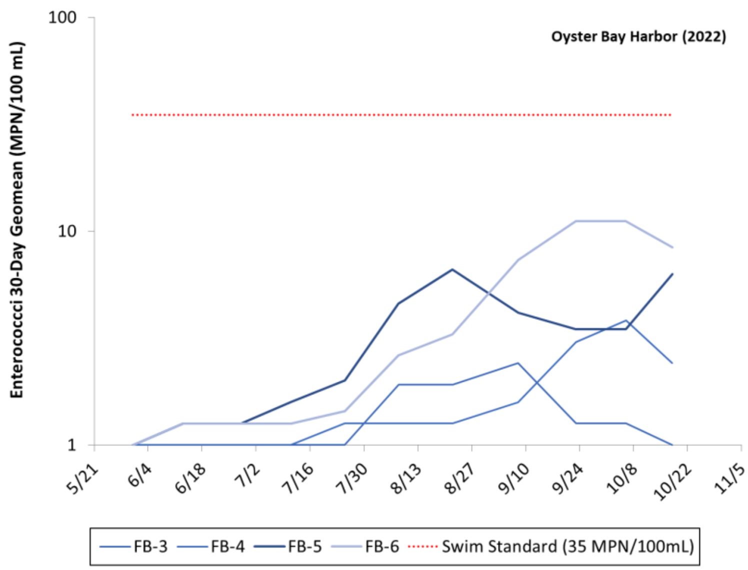

Figure 9. 30-day running geometric mean of 2022 Oyster Bay Harbor enterococci samples

4.1.2.3 Mill Neck Creek Results

Two stations were monitored in Mill Neck Creek for fecal coliform and enterococci, and monthly geometric means were calculated for the data. *Figure 10* and *Figure 11* present the results of this analysis. Similar to previous years, FB-7 and FB-8 were difficult to monitor due to low tidal/shallow conditions preventing access or collection of adequate data. Although bacteria parameters at FB-7 and FB-8 were both successfully sampled on 92% and 85% of the monitoring events during 2022, other parameters like water temperature, salinity, pH, and dissolved oxygen had a much lower success rate.

None of the Mill Neck Creek locations met the fecal coliform 30-day geomean shellfish standards (14 MPN/100 mL) for the 2022 monitoring seasons. The two stations in Mill Neck Creek, FB-7 and FB-8 remained above the shellfish standard for the majority of the monitoring season. Although FB-7 and FB-8 exceeded the shellfish standard, neither station exceeded the fecal coliform swim standard of 200 MPN/100 mL.

The single sample fecal coliform standard (1,000 MPN/100 mL) and single sample enterococci swimming standard (104 MPN/100 mL) were not exceeded in 2022. The highest fecal coliform value (350 MPN/100 mL) and highest enterococci value (52 MPN/100 mL) were both sampled from FB-7 on September 8, 2022, and August 18, 2022, respectively. The highest value of fecal coliform and enterococci in Oyster Bay Harbor were also sampled on September 8, 2022, which is two days after a 0.87-inch rain event (NOAA Online Weather Data, JFK International Airport, NY). These high bacteria levels are likely associated with high precipitation events, as stormwater runoff can transport bacteria pollution to receiving waters.

Similar to previous years, fecal coliform exceeded shellfish standards most frequently at FB-7. In 2022, FB-8 also exceeded the fecal coliform shellfish standards the majority of the season. It is notable that FB-7 is located in tidal flats with limited circulation or flushing during low tide and FB-8 is at the northern-most tidal location sampled in Mill Neck Creek (second closest to "The Birches"). As indicated previously, the average bacteria levels recorded at Mill Neck Creek monitoring locations decreased substantially (60% and 76% for fecal coliform and enterococci, respectively) from the 2011 to the 2022 sampling seasons. These reductions are an indicator that water quality has improved following the sewage infrastructure upgrades. However, seasonal geometric mean fecal coliform and levels at Mill Neck Creek monitoring stations continue to exceed their respective standards, which suggest other sources of fecal indicator bacteria to Mill Neck Creek. Additional monitoring data is needed to further assess water quality in Mill Neck Creek and the remaining pollutant sources.

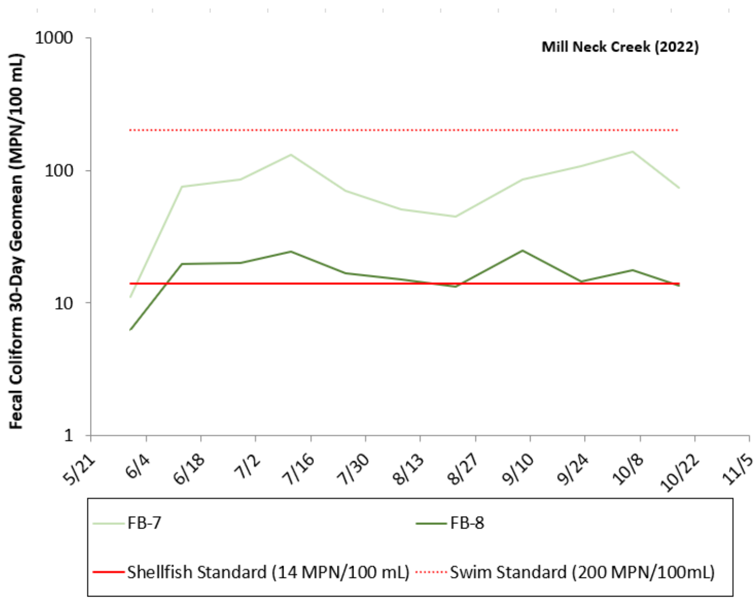

Figure 10. 30-day running geometric mean of 2022 Mill Neck Creek fecal coliform samples

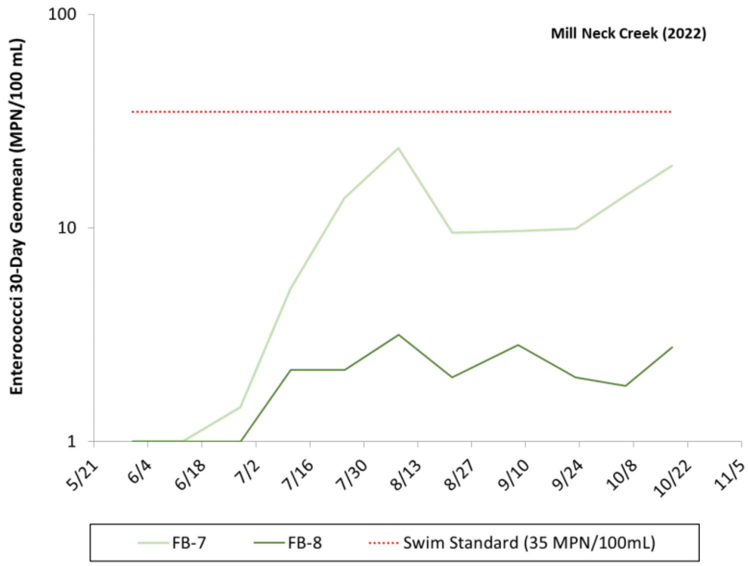

Figure 11. 30-day running geometric mean of 2022 Mill Neck Creek enterococci samples

4.1.3 Nutrient Enrichment by Nitrogen

4.1.3.1 The Nitrogen Cycle

The nutrients nitrogen and phosphorus, as well as other minerals, are essential components for marine organisms. Nitrogen and phosphorus are typically the limiting factor in the quantity of biomass (organisms, such as algae, bacteria, fish, and plants) that can grow in a water body. When nutrient inputs to a water body increase, microorganism populations also increase. These increases are generally first seen in the density of algae, resulting in an algal bloom.

A common rule of thumb is that the ratio of nitrogen to phosphorus in biomass is approximately 7 to 2. This means that, if the nitrogen concentration divided by the available phosphorus is less than 3.5, biological growth will be limited by the amount of nitrogen (Chapra, 1997) in the water. If this ratio is greater than 3.5, then phosphorus will limit biological growth (other nutrients, such as silica, are known to limit growth as well in less common instances).

In marine ecosystems, such as the Oyster Bay/Cold Spring Harbor complex, phosphorus is generally abundant. The amount of biological growth that occurs is directly related to the amount of nitrogen that is present in the water. For this reason, Friends of the Bay has monitored nitrogen in the estuary since nitrogen is typically the "limiting" nutrient in the marine environment.

Algal blooms may occur during the year, depleting the nutrient concentrations within the water column. When the nutrients are depleted, phytoplankton populations die off and sink to the bottom, contributing to large amounts of organic matter in the water column. This organic matter decays while sinking and is further decomposed by bacteria in the estuarine sediments.

Bacteria consume oxygen while decomposing dead phytoplankton. This depletion of oxygen may result in hypoxia (DO less than 3 mg/L) at the harbor bottom. Typically, hypoxia occurs in summer, when the water column stratification hinders oxygen replenishment in deep water.

Four nitrogen species are common in marine waters: ammonia, nitrate, nitrite and organic nitrogen. *Figure 12* presents a schematic of the interrelationships between these species, showing the processes that impact nitrogen in the marine environment.

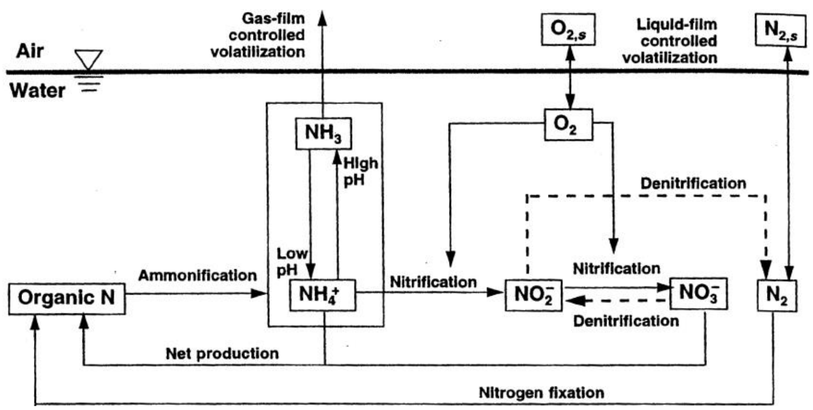

Figure 12. Nitrogen species and processes in marine environments
(Source: Chapra 1997)

Organic nitrogen is present in the form of urea, amino acids, proteins and other compounds (LISS, 1994). It can be bound to organic matter such as plants or algae. Dissolved forms of organic nitrogen come from sewage plants effluent, sewer overflow, failing septic systems and stormwater runoff. Dissolved forms of organic nitrogen are available to bacteria and phytoplankton populations and promote their growth.

Phytoplankton also utilize inorganic forms of nitrogen, including ammonia, nitrate, and nitrite. Organic nitrogen decays through ammonification to ammonia. Nitrates and nitrites are carried into the marine waters by stormwater runoff or result from nitrification of ammonia within the water body. Nitrates and nitrites can be converted to nitrogen gas by bacteria under anoxic conditions, and thus removed from the aqueous environment. High levels of ammonia may pose a danger to aquatic life. With rising temperatures and pH, ammonia ions (NH_4^+) change at increased rates into an un-ionized form of ammonia (NH_3). This form of ammonia is toxic to fish and aquatic plants.

4.1.3.2 Nitrogen Criteria and Standards

In 1989, the U.S. EPA proposed ambient water quality criteria for ammonia (NH_3) in salt water. The criteria are influenced by pH, salinity, and temperature. The EPA recommends that continuous total ammonia levels should not exceed 0.72 mg/L for waters having the following conditions: salinity 20 ppt, temperature 2°C, and pH 8. However, for slightly more alkaline conditions (pH 8.4), the criterion decreases to 0.30 mg/L.

The 1994 Long Island Sound Study (LISS) identified several major sources of nitrogen. These sources include deposition from air pollution, delivery from large tributaries, sewage treatment plants, failing septic systems, and storm water runoff. LISS presented several management options for controlling the nitrogen load into the Sound. Two of these options, including sewage treatment plant upgrades for nitrogen removal and reduction of nitrogen from non-point sources, could potentially result in a 55% reduction of nitrogen load to Long Island Sound.

Nitrogen water quality standards vary across the U.S. Some States follow total maximum daily load (TMDL) criteria. Others use site-specific or waterbody-based ambient nutrient levels (National Research Council, 2000). New York State adopted a revised aquatic life standard for ammonia level in marine waters in 2008. For estuarine waters such as Oyster Bay, the chronic, or long-term aquatic standard for ammonia (un-ionized ammonia as NH_3) is 35 μg/L (0.035 mg/L). The acute ammonia standard is 230 μg/L (0.23 mg/L), meaning that the estuary is considered impaired if measurements exceed this level.

In addition, the NYSDEC has adopted a total nitrogen (TN) guideline of 0.5 mg/L for the Peconic Bay estuary surface water (Suffolk County Department of Health Services, 1999). This guideline is based on the 1988-1990 summer data correlation of the mean TN levels with an occurrence of dissolved oxygen standard violations. The 1999 Comprehensive Conservation and Management Plan for the Peconic Bay Estuary proposed a change of this guideline to 0.45 mg/L based on more recent data (1994-1996). A more stringent criterion of 0.4 mg/L TN is being considered for shallow waters in order to protect eelgrass habitat areas.

LISS established a target of 58.5% nitrogen reduction from the 1990 baseline for cumulative point and non-point in-basin sources (NYSDEC, 2000). This target is to be achieved through maintaining maximum annual loads of nitrogen at 11 management zones. As of 2002, sewage treatment plant upgrades decreased nitrogen loads to the Sound by 28% (EPA 2006). An additional 12% reduction was targeted for completion by August 2004 (it is unknown if this goal was accomplished).

To address this water quality problem, NYSDEC imposed limits to reduce nitrogen discharged from the municipal treatment plants located on the north shore of Long Island. NYSDEC issued a revised discharge permit that required the Oyster Bay Sewer District (OBSD) to reduce nitrogen discharged to Oyster Bay from the treatment plant by 63.8 percent in three 5-year increments by August 2014. With the intent of reducing nitrogen discharges into Oyster Bay and Long Island Sound, the OBSD upgraded its plant in 2006 to provide advanced treatment for nitrogen removal. The OBSD advanced treatment facility is achieving the 2014 nitrogen limits imposed by the NYSDEC permit, and the upgrade has reduced the daily nitrogen discharged by as much as 75%.

4.1.3.3 Monitoring Results

FOB began monitoring nitrogen in 2002 with the goal of establishing a baseline of data and identifying possible areas of concern in the estuary. Due to lack of available funding, nitrogen sampling has not occurred since 2016.

4.1.4 Dissolved Oxygen

All aquatic life larger than bacteria depends on oxygen availability in the water column. Low levels of oxygen have multiple effects on the marine ecosystem such as changes in species behavior, sensitive species growth impairment and, in severe conditions, death of large populations of fish and other species. LISS summarized the effects of different oxygen impairment levels on some organisms of Long Island Sound. An excerpt of these findings is presented in *Table 4*. LISS (1994) concluded that low dissolved oxygen (hypoxia) poses the most serious threat to the health of the Sound ecosystem. The waters of the western and central portions of the Sound generally exhibit hypoxia during the months of July, August and September.

In bodies of water, oxygen is replenished from the atmosphere and by plant and algal photosynthesis. While aquatic plants and algae produce oxygen during the day, throughout the night photosynthesis does not occur, and consumption of oxygen by bacteria through decay of dead biomass consumes residual oxygen. Thus, the lowest levels of the daily cycle occur in the early morning hours. Several other factors influence the amount of dissolved oxygen found in a particular body of water:

- **Water temperature** - cooler water holds more oxygen; therefore, warm summer waters can be particularly stressful for marine organisms.
- **Salinity** - with increasing salinity the capacity of water to hold oxygen diminishes.
- **Water turbidity** - poor water clarity prevents sunlight from reaching oxygen-producing aquatic plants lower in the water column.
- **Nutrients** - excess nutrients can cause an algal bloom which blocks sunlight from aquatic vegetation lower in the water column. When algae dies and sinks to the bottom, the bacteria involved in decay of the plant material consume a significant amount of dissolved oxygen.
- **Mixing of the waters** - stagnant waters and waters that are stratified hinder transport of oxygen into lower levels of the water column.

Table 4. Effect of Dissolved Oxygen Concentrations on Selected Organisms (LISS, 1994)

Dissolved oxygen concentrations above the pycnocline (top of the water column)	
4-5 mg/L	Suitable for many species and life stages, may result in limited biological consequences
3-4 mg/L	25-50% mortality of larval lobsters (based on 4-day long experiments)
2-3 mg/L	50-95% mortality of larval lobsters (based on 4-day long experiments)

Dissolved oxygen concentrations below the pycnocline (bottom of the water column)	
4-5 mg/L	Protective for most biological consequences
3-4 mg/L	Protective for many biological consequences, reduced growth of juvenile Am. Lobster, grass shrimp, summer flounder (12-day experiments)
2-3 mg/L	Impaired finfish habitat (reduced abundance), mortality of larval grass shrimp and mud crabs (12-day experiments)
1-2 mg/L	Impaired lobster and finfish habitat, 10-90% mortality of some non-larval species (4-day experiments)
0-1 mg/L	Many severe consequences, even at short exposures

Previously, DO levels above 5.0 mg/L were considered healthy; DO levels below 5.0 mg/L were considered to cause various adverse impacts (related to growth, reproduction, and survival of organisms). The severity of impacts, and threshold DO levels where impacts occur, are strongly species dependent. A revised dissolved oxygen standard was implemented by NYSDEC in 2008. For estuarine waters such as Oyster Bay/Cold Spring Harbor Estuary, the chronic, or long-term DO standard is 4.8 mg/L. The standard allows levels to fall below 4.8 mg/L for short periods of time; the lower the level, the shorter the time interval allowed (as defined by the equation below).

$$DO_i = \frac{13.0}{2.80 + 1.84e^{-0.1t_i}}$$

where DO_i = DO concentration in mg/L between 3.0 - 4.8 mg/L and t_i = time in days. This equation is applied by dividing the DO range of 3.0 - 4.8 mg/L into a number of equal intervals. DO_i is the lower bound of each interval (i) and t_i is the allowable number of days that the DO concentration can be within that interval. The actual number of days that the measured DO concentration falls within each interval (i) is divided by the allowable number of days that the DO can fall within interval (t_i). The sum of the quotients of all intervals (i …n) cannot exceed 1.0:

$$\sum_{i=1}^{n} \frac{t_i(actual)}{t_i(allowed)} < 1.0$$

The DO concentration shall not fall below the acute standard of 3.0 mg/L at any time.

The acute DO standard is 3.0 mg/L, meaning that the estuary is considered impaired if DO measurements fall below this level. For DO concentrations that are equal to or greater than 3.0 mg/L and less than 4.8 mg/L, the growth and abundance of certain marine species will be affected. The impact of hypoxia on marine life depends on the duration and area over which low DO levels occur; water temperature, salinity, and distribution and behavioral patterns of resident species also play a role in how marine organisms react to hypoxic conditions.

In 2022, Friends of the Bay monitored DO levels at the top and bottom of the water column at eight open water body sites in the estuary. Dissolved oxygen concentrations at the top of the water column averaged 7.1 mg/L, ranging from 4.2 to 10.5 mg/L. At a depth of one meter below the surface, DO averaged 7.1 mg/L, ranging from 3.7 to 11.0 mg/L. DO averaged 7.0 mg/L at the bottom of the water column, ranging from 3.4 to 12.0 mg/L. The 2022 data follow the general patterns observed in past years, with the highest dissolved oxygen values occurring in the spring, declining levels through the early summer, and then rising again in late summer and into the fall. Bottom DO for Mill Neck Creek was only measured for 26% of sampling dates. Therefore, *Figure 15* does not have enough data to show a general trend in DO throughout the 2022 monitoring season at Mill Neck Creek. Refer to *Figures 13* and *14* for DO data collected at the bottom of the water column at Cold Spring Harbor and Oyster Bay Harbor in 2022.

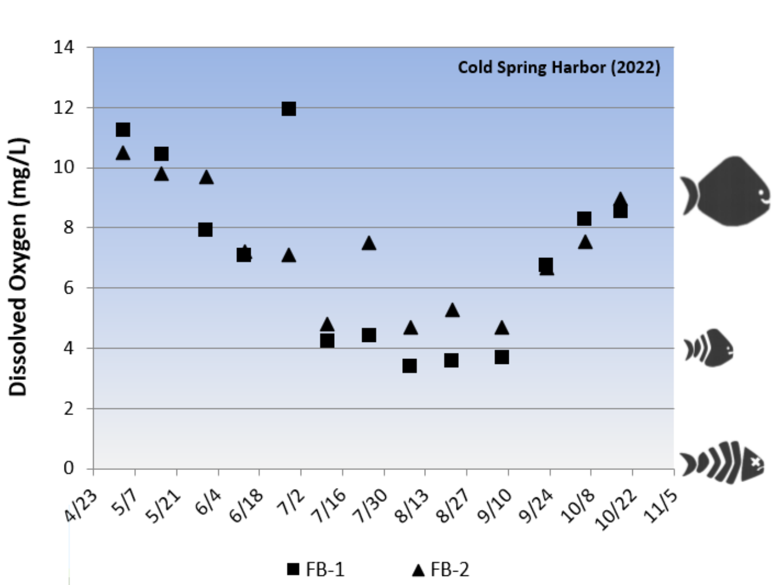

Figure 13. Dissolved oxygen at the bottom of the water column for Cold Spring Harbor monitoring locations, 2022

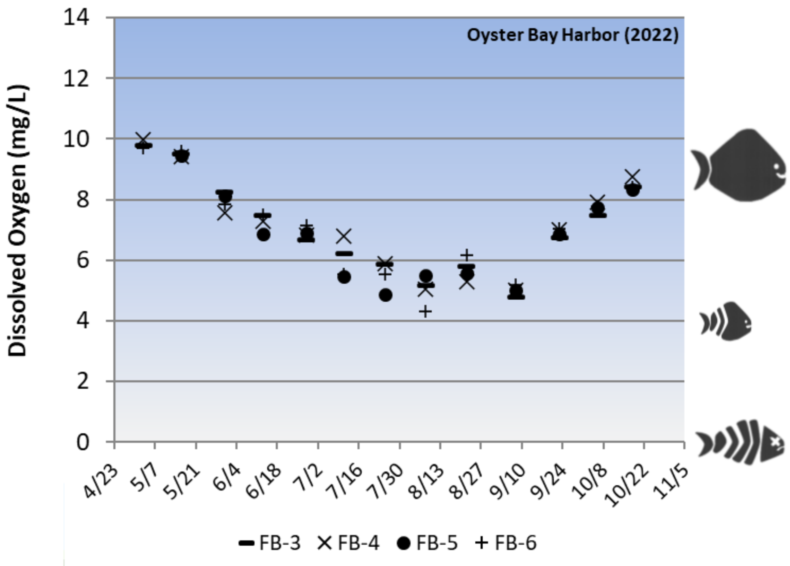

Figure 14. Dissolved oxygen at the bottom of the water column for Oyster Bay Harbor monitoring locations, 2022

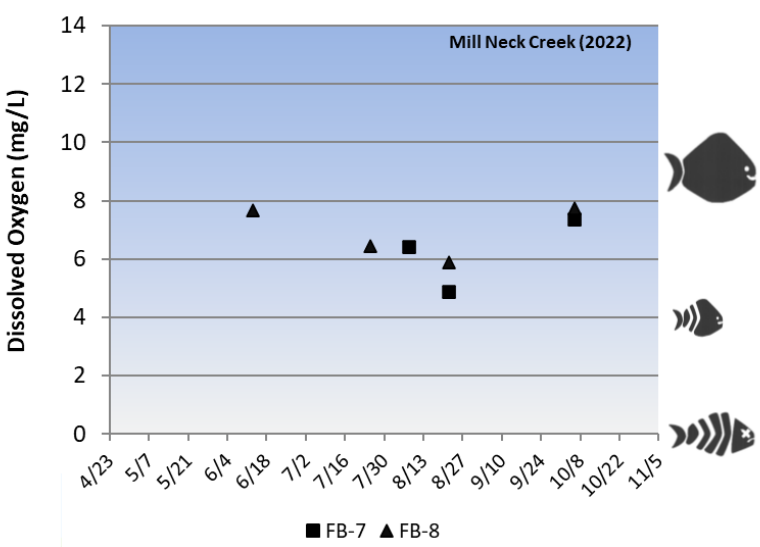

Figure 15. Dissolved oxygen at the bottom of the water column for Mill Neck Creek monitoring locations, 2022

Figure 17 presents a boxplot to graphically summarize the DO data collected at the bottom of the water column throughout the 2022 season. Boxplots provide a succinct, graphical summary of water quality data to allow comparison of water quality conditions at different monitoring stations; each plot consists of a box, "whiskers", and outliers. As shown in *Figure 16*, the top of the box is the 75th percentile, the bottom of the box is the 25th percentile, the line dividing the box is the median value (50th percentile), and the diamond is the average. The vertical lines, or "whiskers" above and below the box represent the minimum and maximum values of the observed data.

That mean and median DO values across sites in 2022 were around 7 mg/L which is generally consistent with previous years. Dissolved oxygen across monitoring sites decreased between May and August, remained at the lowest concentrations through August, and generally increased between the end of August and November. Similar to 2021, in 2022 the Cold Spring Harbor stations (FB-1 and FB-2) generally showed the greatest variability and lowest DO values of all stations monitored. No stations in Cold Spring Harbor, Oyster Bay Harbor, or Mill Neck Creek fell below the acute standard of 3.0 mg/L in 2022. DO was measured at the lowest levels at Cold Spring Harbor, and dipped below 4.0 mg/L for three monitoring dates (August 8, 2022, August 22, 2022, and September 9, 2022).

Although DO appears to have improved since 2021, the number of sampling locations and sampling frequency was reduced in 2022 compared to 2021. In 2021, four stations in Cold Spring Harbor fell below the acute standard (two of these stations were sampled in 2022). See *Appendix E* for additional dissolved oxygen data.

In Cold Spring Harbor, dissolved oxygen concentrations ranged from 3.4 mg/L to 12.0 mg/L. 12.0 mg/L was observed at site FB-1 on June 28. This measurement is uncharacteristically high for this time of year and may be a data discrepancy. The highest dissolved oxygen concentration in Cold Spring Harbor, excluding the 12 mg/L, was measured on May 5 at 11.2 mg/L.

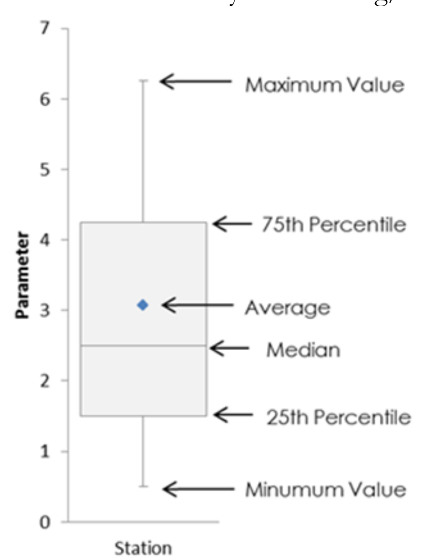

Figure 16. Boxplot Elements

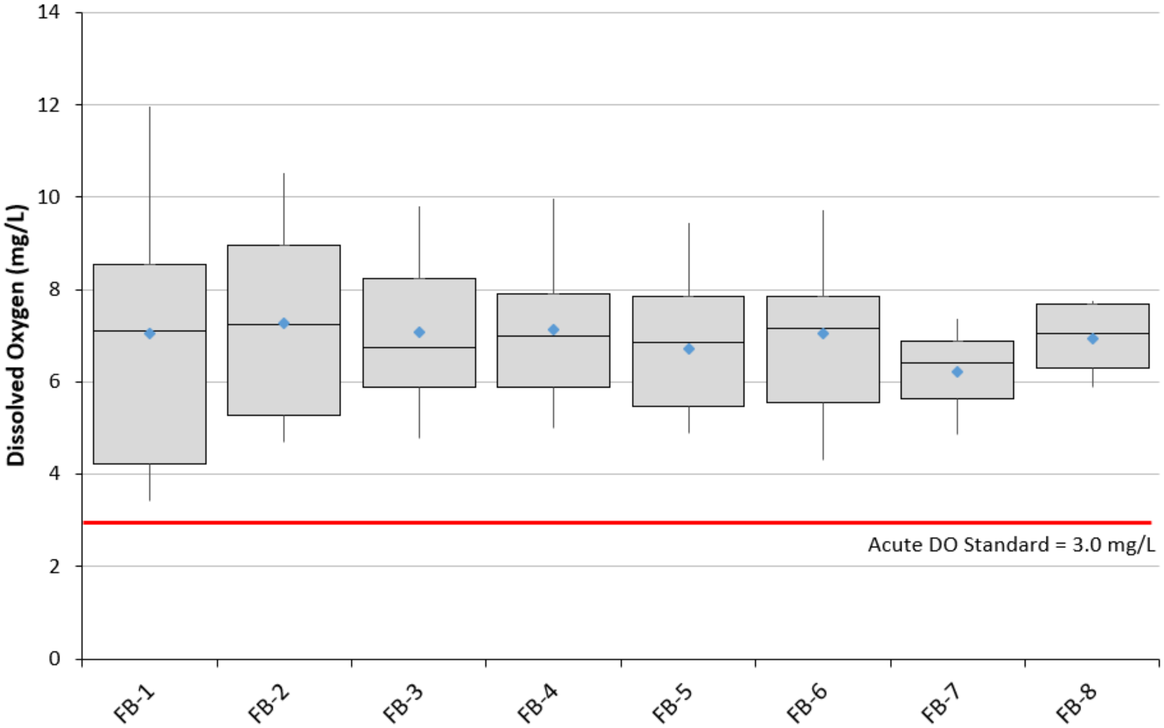

Figure 17. Dissolved oxygen at the bottom of the water column at all monitoring locations, 2022

4.2 Stream and Outfall Monitoring

The Friends of the Bay stream and outfall monitoring program is intended to identify potential upland sources of pollutants and causes of water quality impacts in the Oyster Bay Harbor, Cold Spring Harbor, and Mill Neck Creek estuary complex. No samples were collected during the 2022 sampling season following upgrades to septic systems near previous monitoring stations. Analysis and discussion of data collected up until 2014 monitoring data can be found in the previous Water Quality Reports.

5 Program Recommendations

5.1 Proposed Short-Term Changes

- **Measure DO Profiles –** Prior to 2003, FOB recorded DO at one-meter intervals throughout the water column. This practice ceased in 2003 due to the excessive number of measurements recorded each week. However, stratification data can be useful in tracking conditions within the estuary. FOB should consider measuring DO profiles at one of the open water monitoring locations to track the development of stratification throughout the season. If temperature and salinity profiles were also recorded at that location, then the pycnocline (depth interval of steep density gradients) could be tracked via the halocline (depth interval of steep salinity gradients) and thermocline (depth interval of steep temperature gradients).
- **Stream and Outfall –** Resume the Friends of the Bay stream and outfall monitoring program, as funding allows, focusing on priority outfalls and discharges to the estuary complex. Both dry- and wet-weather sampling is useful in identifying pollutant sources. Re-evaluate the locations of the stream and outfall monitoring to reflect new information about pollutant sources, MS4 outfall sampling data, and other related information.
- **QAAP Update –** Update the QAPP to reflect changes to the monitoring program.

5.2 Potential Future Changes

To further refine the understanding of water quality in Cold Spring Harbor, Oyster Bay Harbor and Mill Neck Creek, Friends of the Bay is considering the following additions to the monitoring program:

- **Improve Understanding of Estuary and Watershed Conditions** – As stated in the Watershed Action Plan, Friends of the Bay would like to:
    - Continue the current Friends of the Bay citizen water quality monitoring program at the in-harbor monitoring locations to continue collecting baseline water quality information and to assess the effectiveness of plan implementation over time.
    - Although many users of the harbor have a working knowledge of the various types of marine habitats within portions of the estuary complex, information is limited regarding the actual quality and distribution of benthic (i.e., bottom-dwelling) communities and habitats throughout Oyster Bay/Cold Spring Harbor. A benthic habitat mapping survey is recommended to identify and assess the quality of benthic habitats and biological

communities, including those habitats and biological communities that are threatened, missing, or have been extirpated by human activity. This type of information would be used to identify and guide restoration projects such as a shellfish sanctuary, eelgrass restoration, and restoration of diamondback terrapin nesting areas.

- o Current efforts at improving water quality focus on reducing pathogen loads to the estuary complex, based on the pathogen loading in Oyster Bay and Mill Neck Creek (the NYSDEC recently revoked Total Maximum Daily Load (TMDL) requirements for five waterbodies in these areas). While pathogens are a major threat to water quality, as well as to recreation and the shellfish industry, they are just one of many. Water quality monitoring data collected by Friends of the Bay indicates that lower dissolved oxygen and elevated nitrogen concentrations are common in areas of the estuary complex during the summer. Additionally, sediment from stormwater runoff can smother otherwise productive shellfish beds and contain nutrients such as phosphorus which can result in harmful algal blooms. Specific recommended actions to evaluate other water quality issues include:
    - Coordinate with NYSDEC regarding the potential inclusion of Oyster Bay/Cold Spring Harbor for water quality impairments other than pathogens (i.e., low dissolved oxygen, nutrients, sediment) during future listing of impaired waters (303d list).
    - Coordinate with NYSDEC regarding the potential revised TMDL for Oyster Bay and Mill Neck Creek and to specify the suspected source of impairment in the 303d list.
    - As a long-term project, develop a linked hydrodynamic and water quality model of the estuary complex to assess the relative influence of watershed sources and Long Island Sound circulation on the water quality of the estuary. In addition to pathogen load reductions, the model could be used to predict the effect of reduced nutrient loads from the watershed on harbor water quality, focusing on specific water quality concerns, such as dissolved oxygen. The model could also be used to predict the impact of other changes on water quality, such as increased rainfall resulting from climate change.
    - Ensure that future management efforts address the full range of water quality parameters and potential sources of water quality impairments.
- o Additional study of the Cold Spring Harbor inner harbor area and the Beaver Lake and Oak Neck Creek areas in Mill Neck Creek is recommended to further assess potential pollution sources in these areas.

- **Bacteria Source Tracking** – Friends of the Bay would like to include Bacteria Source Tracking as part of its water quality monitoring program in future years. FOB continues to monitor grant opportunities to fund the collection of samples for Bacteroides as an indicator of recent human fecal pollution. The QAPP will be modified if funding is acquired to accommodate the additional sampling.
- **Chlorophyll a and/or Algal Enumeration** – In addition to measuring apparent color, it would benefit the monitoring program to measure chlorophyll levels within the estuary. A chlorophyll test would measure the concentration of algae in the water column, helping to identify if algal blooms are influencing water clarity. Alternatively, algal enumeration can identify the quantity of specific algal species that are present. Varying algal species can be an indicator of changes in a water body from year to year.

6 Conclusions

In 2022, the monitoring program was reconfigured to reduce the overall sampling effort. Monitoring occurred on a bi-weekly basis between May through October at eight locations: two in Cold Spring Harbor, four in Oyster Bay Harbor, and two in Mill Neck Creek. Analysis of the 2022 water quality monitoring data provides the following insights:

- Overall, seasonal geometric mean fecal coliform concentrations have been decreasing in Cold Spring Harbor, Oyster Bay Harbor and Mill Neck Creek since the program's inception in 2000.
- On a seasonal average basis (*Figure 3*), Cold Spring Harbor and Oyster Bay Harbor met the State shellfish standards for fecal coliform in 2022. Oyster Bay Harbor is where the majority of shellfishing occurs in the estuary. The 2022 seasonal geomean for fecal coliform also met the State shellfish standards in Cold Spring Harbor and Oyster Bay Harbor; Mill Neck Creek exceeded this standard (*Table 3*).
- Although seasonal geometric mean fecal coliform levels in Cold Spring Harbor and Oyster Bay Harbor were below the shellfish standard, which is consistent with previous years, the 30-day geometric mean fecal coliform levels exceeded the shellfish standard for some portion of the season at one out of two Cold Spring Harbor sites and three out of four Oyster Bay Harbor sites monitored in 2022. Fecal coliform levels exceeded the shellfish standard in Oyster Bay Harbor for five sites in 2021, two sites in 2021, one site in 2018, five sites in 2017, and six sites in 2016.
- As observed in previous years, fecal indicator bacteria levels in Mill Neck Creek were higher than in Oyster Bay Harbor. Unlike previous years, in 2022 fecal indicator bacteria was slightly higher in Oyster Bay Harbor compared to Cold Spring Harbor. Similar to 2021 and 2020, only one of the monitoring stations (FB-2) in Cold Spring Harbor met the fecal coliform shellfish standard for the entirety of the 2022 seasons. Both of the Cold Spring Harbor stations remained below the swim standard for both 30-day geomean fecal coliform and enterococci in 2022. Both Mill Neck Creek stations exceeded the 30-day geomean fecal coliform shellfish standard in 2022 for the majority of the monitoring season. Mill Neck Creek consistently has the highest levels of fecal indicator bacteria observed in the estuary complex. In the past, the highest levels of fecal indicator bacteria have generally occurred at FB-7, FB-8, and one more site not sampled in 2022. FB-7 and FB-8 are characterized by limited circulation or flushing during low tide.
- Compared to 2011, the 2022 average bacteria levels recorded at Mill Neck Creek monitoring locations have decreased substantially (60% and 76% for fecal coliform and enterococci, respectively). These reductions are an indicator of the water quality improvements that have resulted from sewage infrastructure upgrades at The Birches. However, seasonal geometric mean fecal coliform levels at the Mill Neck Creek monitoring stations continue to exceed the fecal coliform standard, which suggests other sources of fecal indicator bacteria to Mill Neck Creek. This could be the result of stormwater pollution and other point and non-point sources.
- In 2022 the single sample swimming standard for fecal coliform and the enterococci swimming standard were not exceeded at any stations. This is an improvement compared to previous

years, although the frequency of monitoring and number of monitoring sites was reduced in 2022 compared to previous years, which could have precluded detection of exceedances that would have been observed under the prior monitoring program configuration. The highest enterococci and fecal coliform values were generally observed after a rainfall event greater than 0.25 inches, further indicating spikes in bacteria-impaired water quality could be a result of stormwater pollution. However, additional monitoring data is needed to further assess water quality in Mill Neck Creek and further characterize the remaining pollutant sources.

- Nitrogen monitoring did not occur due to funding challenges. Since nitrogen plays an important ecosystem role in the estuary, its monitoring is important and should be restarted if feasible.
- A $10.6 million advanced wastewater treatment facility serving the Oyster Bay Sewer District has been fully operational since March 2006. It is believed that the facility is achieving the 2014 nitrogen limits imposed by the New York State Department of Environmental Conservation. The upgrade has reduced daily nitrogen discharges by as much as 75%. Nitrogen monitoring can provide valuable information for evaluating the effects of reduced nitrogen loading on estuary water quality.
- Hypoxic conditions (dissolved oxygen less 3 mg/L) were not measured at any sampling stations throughout the 2022 monitoring season. Although DO appears to have improved since 2021, less data was available to analyze in 2022 because of the reduced monitoring effort.
- In Cold Spring Harbor, dissolved oxygen concentrations at the bottom of the water column were the lowest compared to Oyster Bay Harbor and Mill Neck Creek. DO dipped below 4.0 mg/L for three monitoring dates in Cold Spring Harbor, while DO was not measured below 4.0 mg/L for any other stations. Dissolved oxygen data continue to indicate that the waters of the estuary are enriched with nutrients, and increases in ambient temperatures (*Figure 1*) will tend to further decrease DO concentrations since DO is also a function of water temperature. Long-term reductions in nitrogen inputs should reduce the occurrence of extremely low dissolved oxygen conditions in bottom waters.
- Stream and outfall monitoring was discontinued in 2015. Friends of the Bay is currently researching options to revive stormwater outfall monitoring to further assess point and nonpoint source pollutant contributions and sources in the watershed.
- As recommended in the 2011 Watershed Action Plan, ongoing water quality monitoring is essential for evaluating changes in harbor water quality as a result of land use activities in the watershed and implementation of the watershed plan recommendations. Additional data collection is also recommended to refine the current understanding of water quality impairments in the estuary complex, particularly pollutants for which previous monitoring results have demonstrated the potential for water quality impairment but which are not currently identified by NYSDEC as a listed cause of impairment (e.g., sediment, nutrients, and dissolved oxygen).
- Friends of the Bay will continue to work with citizen scientists, government agencies, and other non-governmental organizations in future monitoring seasons. Together, FOB and its partners will continue to improve and enhance the monitoring program, with the ultimate objective of protecting and improving the quality of water in the Oyster Bay/Cold Spring Harbor estuary complex.

7 References

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Appendix A

Oyster Bay/Cold Spring Harbor Estuary Complex Fact Sheet

Oyster Bay/Cold Spring Harbor Estuary Complex

Background Information

Located on the north shore of Long Island, the Oyster Bay/Cold Spring Harbor Estuary Complex – approximately 6,000 acres in size – is recognized as a vital natural, economic, cultural, historical and recreational resource.

And there is so much more to know about the Oyster Bay/Cold Spring Harbor Estuary Complex:

- The Oyster Bay/Cold Spring Harbor Estuary Complex is an embayment of Long Island Sound. (In 1987, the Sound was officially designated an Estuary of National Significance under the National Estuary Program.)

- The U.S. Fish & Wildlife Service maintains a National Wildlife Refuge (NWR) within the Oyster Bay/Cold Spring Harbor Estuary Complex. In fact, the Oyster Bay NWR which was renamed to Congressman Lester Wolff NWR in 2020 – which encompasses part of Cold Spring Harbor – is the largest of the Long Island Complex's eight refuges. The NWR consists of 3,209 acres of bay bottom, saltmarsh, and a small freshwater wetland. Nationally, Oyster Bay NWR is one of the few bay bottom Refuges owned and managed by the U.S. Fish and Wildlife Service.[1]

  The Oyster Bay NWR – which was established in 1968 via land donation from the Town of Oyster Bay and several local villages under the Migratory Bird Conservation Act – consists of high quality marine habitats that support a variety of aquatic-dependent wildlife. The refuge's waters and marshes surround Sagamore Hill National Historic Site, home of Theodore Roosevelt - father of the National Wildlife Refuge System.[2]

  Subtidal (underwater up to mean high tide line) habitats are abundant with marine invertebrates, shellfish and finfish.[3] The Refuge is located off of the Long Island Sound and the sheltered nature of the bay makes it extremely attractive as winter habitat for a variety of waterfowl species, especially diving ducks.[4]

  In 2005, Defenders of Wildlife included the Oyster Bay NWR on their list of the ten most endangered Refuges in the country. The *Refuges at Risk: America's Ten Most Endangered National Wildlife Refuges 2005* report explains that the Oyster Bay NWR has become threatened by polluted stormwater runoff; non-sustainable development; habitat destruction; and human sewage associated with failing sewer infrastructure, inadequate on-site septic systems, and boat discharge. (Since 2005,

[1] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[2] http://refuges.fws.gov/profiles/index.cfm?id=52563
[3] http://refuges.fws.gov/profiles/index.cfm?id=52563
[4] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563

both Oyster Bay and Long Island Sound have been declared "no discharge zones." Discharge of sewage from boats is now illegal.)

- For almost two decades there have been three State-designated Significant Coastal Fish and Wildlife Habitats within the Oyster Bay/Cold Spring Harbor Estuary: Cold Spring Harbor, Oyster Bay Harbor, and Mill Neck Creek Wetlands (these habitat designations date back to 1987).[5] The New York State Department of State recently concluded a review involving proposed revisions to 25 designated Significant Coastal Fish and Wildlife Habitats (SCFWH) on the North Shore in Nassau and Suffolk counties. The habitat designations went into effect on October 15, 2005. Among the 25 habitats that have been revised are areas that fall within the OB/CSH Estuary. The three Habitats will now be consolidated into two: 1) Mill Neck Creek, Beaver Brook, and Frost Creek and 2) Oyster Bay and Cold Spring Harbor. [See end of document for more info regarding SCF&W Habitat areas.]

- OB/CSH Fish and Wildlife Facts:
    - More than 126 bird species have been documented at the Oyster Bay National Wildlife Refuge, including 23 species of waterfowl.[6]
    - Oyster Bay National Wildlife Refuge has the heaviest winter waterfowl use of any of the Long Island National Wildlife Refuges.[7]
    - According to the U.S. Fish and Wildlife Service (USFWS), species that rely on this ecosystem include Federal and State designated endangered and threatened species such as the bald eagle, peregrine falcon, osprey, northern harrier, and least tern.[8]
    - The northern diamondback terrapin is common at the Oyster Bay National Wildlife Refuge, particularly in the Frost Creek and Mill Neck Creek sections. The Refuge is considered to have one of the largest populations of diamondback terrapins on Long Island.[9]
    - The Harbor Complex hosts a productive marine finfishery. Oyster Bay has been designated by the National Marine Fisheries Service (NMFS) as Essential Fish Habitat (EFH) for 15 species of finfish across multiple life stages. The harbor serves as a nursery and feeding ground from early spring to late fall for these species and, as a result, contributes to the abundance of fisheries resources that are of regional significance.[10]

- New York State's 1999 Long Island Sound Coastal Management Program, prepared by the NYS Department of State, identifies the Oyster Bay-Cold Spring Harbor area as a Regionally Important Natural Area.[11] [See end of document for more info regarding RINA.]

- The Oyster Bay/Cold Spring Harbor Estuary Complex is also considered one of the most important shellfish producing areas in New York State.[12] The majority of Oyster Bay is certified for commercial shellfish harvest, with economically important shellfisheries including oyster (*Crassotrea virginica*) and hard clam (*Mercinaria mercinaria*). The waters of Oyster Bay are classified SA - the highest and best water quality determination for shellfishing. This is an unusual

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[5] http://www.nyswaterfronts.com/waterfront_natural_narratives.asp
[6] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[7] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[8] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[9] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[10] National Marine Fisheries Service and Mid-Atlantic Fishery Management Council. 2000. *Guide to Essential Fish Habitat Designations in the Northeastern United States*. http://www.nero.noaa.gov/hcd/webintro.html
[11] http://www.nyswaterfronts.com/downloads/pdfs/lis_cmp/Chap6.pdf
[12] https://www.nrc.gov/docs/ML0712/ML071270097.pdf

distinction given the harbor complex's proximity to New York City and the fact that harbors to the west have been closed for more than 30 years.

- A section of the surrounding watershed is located within the Oyster Bay Special Groundwater Protection Area – a Critical Environmental Area[13] – on the spine of the deep flow water recharge area. Virtually all of Long Island's drinking water is drawn from a system of underground reservoirs or aquifers. The Island's drinking water system was designated as the nation's first Sole Source Aquifer, requiring special protection. The Oyster Bay Special Groundwater Protection Area is one of two such state-designated areas in Nassau County designed for the purpose of maintaining open space to recharge the aquifer.

- The Harbor Complex is home to the Cold Spring Harbor Fish Hatchery & Aquarium. The Hatchery is proud to have the largest living collection of New York State freshwater reptiles, fish and amphibians which are housed in the Julia F. Fairchild Building, the Walter L. Ross II Aquarium Building and in eight outdoor ponds. Brook, Brown and Rainbow trout are raised to stock private ponds.

- Renowned for its maritime legacy, Oyster Bay has been designated a "historic maritime area" by New York State.

What is a Significant Coastal Fish & Wildlife Habitat?

The New York State Department of Environmental Conservation evaluates the significance of coastal fish and wildlife habitats, and following a recommendation from the DEC, the Department of State designates and maps specific areas.

A habitat is designated "significant" if it serves one or more of the following functions: (a) the habitat is essential to the survival of a large portion of a particular fish or wildlife population; (b) the habitat supports populations of species which are endangered, threatened or of special concern; (c) the habitat supports populations having significant commercial, recreational, or educational value; and (d) the habitat exemplifies a habitat type which is not commonly found in the state or in a coastal region. In addition, the significance of certain habitats increases to the extent they could not be replaced if destroyed.

What is a Regionally Important Natural Area?

Regionally important natural areas are defined geographic areas within the Long Island Sound coastal boundary and generally are composed of a variety of smaller, natural ecological communities that together form a landscape of environmental, social, and economic value to the people of New York. A regionally important natural area would meet the following three conditions:

1) The area contains significant natural resources.
2) The resources are at risk.
3) Additional management measures are needed to preserve or improve the significant resources, or sustain their use.

To be designated as a CEA, an area must have an exceptional or unique character with respect to one or more of the following: a benefit or threat to human health; a natural setting (e.g., fish and wildlife habitat, forest

[13] http://www.dec.state.ny.us/website/dcs/seqr/cea/

and vegetation, open space and areas of important aesthetic or scenic quality); agricultural, social, cultural, historic, archaeological, recreational, or educational values; or an inherent ecological, geological or hydrological sensitivity to change that may be adversely affected by any change. Following designation, the potential impact of any Type I or Unlisted Action on the environmental characteristics of the CEA is a relevant area of environmental concern and must be evaluated in the determination of significance prepared pursuant to Section 617.7 of SEQR.

Additional information:

❖ Use impairments in Oyster Bay Harbor, Mill Neck Creek, Cold Spring Harbor and its tributaries are identified in the 2000 Atlantic Ocean/Long Island Sound Basin Waterbody Inventory and Priority Waterbodies List (PWL).[14] The use impairments include shellfishing, public bathing, fish consumption, habitat/hydrology, aquatic life, and recreation. (The use impairment of shellfishing is reinforced by the following facts: 1) Oyster Bay Harbor, Mill Neck Creek and its tidal tributaries are among the 69 water bodies, in the New York State 2002 303(d) list, impaired for shellfish harvesting[15] (SEE BELOW) and 2) The NYS DEC has decertified all shellfish harvesting areas in Mill Neck Creek and some shellfish harvesting areas in Oyster Bay.)

❖ According to *Pathogen Total Maximum Daily Loads for Shellfish Waters in Oyster Bay Harbor and Mill Neck Creek*, a September 2003 report[16] by the New York State Department of Environmental Conservation, "urban storm water is… the major source of pathogens (approx. 88% of total) to the Harbor." The report also points out that "the waters support a large recreational environment for boating which represents the second largest source of pathogens (approx. 11% of total) to these bodies." (Note that boat discharges have now been banned in Oyster Bay and throughout the Sound.)

❖ Oyster Bay Harbor, Mill Neck Creek, and its tidal tributaries are among the 69 water bodies listed in the New York State's 2002 303(d) as impaired for shellfish harvesting. The New York State Department of Environmental Conservation, with the cooperation and technical assistance of the U.S. Environmental Protection Agency (USEPA), along with their contractors Battelle and HydroQual, has completed the total maximum daily loads (TMDL) for pathogens in the shellfish waters for Oyster Bay Harbor and Mill Neck Creek. In accordance with USEPA's Water Quality Planning and Management Regulations (40 CFR, Part 30), TMDLs need to be developed to achieve the applicable water quality standards. Oyster Bay Harbor needed to be broken down into several distinct areas where individual TMDLs have been developed. Once implemented, these TMDLs are expected to achieve the targeted reductions in pathogen loads from point and non-point sources with the ultimate goal of achieving the water quality standards for shellfish harvesting. In management zone OBH-2 a 10% pathogen load reduction is mandated and in management zone OBH-3 an 89% pathogen load reduction is mandated. In the other management zones, it is necessary to ensure no increase in pathogen discharges.[17]

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[14] 2000 Atlantic Ocean/Long Island Sound Basin Waterbody Inventory and Priority Waterbodies List (PWL), New York State Department of Environmental Conservation.

[15] *Pathogen Total Maximum Daily Loads For Shellfish Waters in Oyster Bay Harbor and Mill Neck Creek*, New York State Department of Environmental Conservation (September 2003) http://www.dec.state.ny.us/website/dow/oystbay.pdf

[16] *Pathogen Total Maximum Daily Loads For Shellfish Waters in Oyster Bay Harbor and Mill Neck Creek*, New York State Department of Environmental Conservation (September 2003) http://www.dec.state.ny.us/website/dow/oystbay.pdf

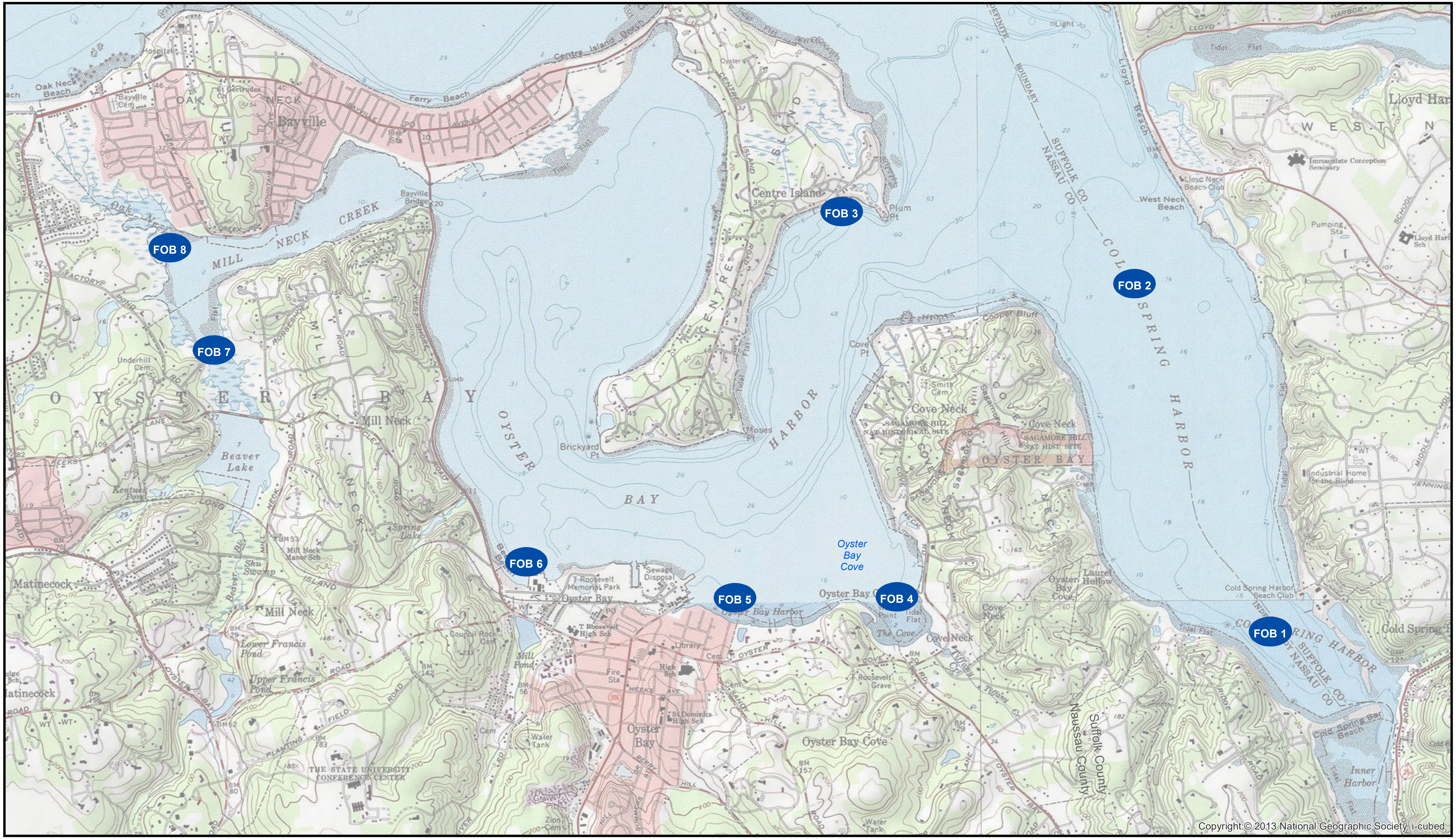
[17] *Pathogen Total Maximum Daily Loads For Shellfish Waters in Oyster Bay Harbor and Mill Neck Creek*, New York State Department of Environmental Conservation (September 2003) http://www.dec.state.ny.us/website/dow/oystbay.pdf

Further, the TMDL indicates that pollution from marinas and boat mooring areas should be reduced using appropriate mitigation techniques such as:

- Public awareness campaigns on illicit dumping of wastewater,
- Enhancement of public toilet facilities near the shore and,
- Expansion of current pump-out programs including the mobile and on-shore pump out facilities.

Appendix B

Sampling Locations Map and Description



Friends of the Bay — Protecting Oyster Bay & Cold Spring Harbor

Fuss & O'Neill

Friends of the Bay
Water Quality Monitoring Locations

N W E S

0 0.5 1
Miles

Data Sources:
Friends of the Bay; USGS Topo Maps © 2011 National Geographic Society;
Document Path: K:\P2005\1349\Q10\MXD\2022Updated_MonitoringLocations_202

Sampling Locations in Cold Spring Harbor, Oyster Bay Harbor, and Mill Neck Creek

	Site ID (2000-2021)	Site ID (2022)	Site Name	Site Description	Latitude	Longitude
Cold Spring Harbor	FB-1	not sampled	South Cold Spring Harbor Cove	50 yards off last dock in Cold Spring Harbor, just south of Whalers Yacht Club Slips	40°51’45” N	73°27’51” W
	FB-2	not sampled	CSH Cove North Mooring Field	Cove just north-east of Powell’s Marina, east of large sand bar and small mooring field	40°52’09” N	73°27’48” W
	FB-3	FB-1	CSH South	200 yards west of Cold Spring Harbor mooring field; mid channel between Mobil Oil Terminal and orange brick house	40°52’22” N	73°28’25” W
	FB-4	FB-2	CSH North	Center of CSH, south-east of Plum Point; just north of Charles Wang’s dock	40°53’47” N	73°29’08” W
Oyster Bay Harbor	FB-5	not sampled	Plum Point	Off Plum Point, 110 yards south of Red Nun “4”	40°54’04” N	73°30’23” W
	FB-6	FB-3	Seawanhaka Yacht Club PSTP outfall	Out fall is located at pink buoy. Station 200 years off boat yard dock	40°54’05” N	73°30’42” W
	FB-7	FB-4	Oyster Bay Cove	Center of cove 100 yards south-west of Mr. Yampole’s pier	40°52’31” N	73°30’25” W
	FB-8	FB-5	Whites Creek and OB-STP outfall	100 yards east of Commander Oil dock	40°52’31” N	73°31’17” W
	FB-9	not sampled	Roosevelt Beach	Approx. 200 yards offshore and in line with flagpole at Roosevelt Park	40°52’45” N	73°31’53” W
	FB-10	FB-6	Beekman Beach and Mill Pond outfall	Mid Channel between mooring field and finger piers, 100 yards off shore	40°52’40” N	73°32’24” W
	FB-11	not sampled	West Harbor	Midway between east and west shores, off large white house on North western shore	40°53’52” N	73°32’11” W
	FB-12	not sampled	Turtle Cove	110 yards west of canal	40°54’44” N	73°31’41 W

Sampling Locations in Cold Spring Harbor, Oyster Bay Harbor, and Mill Neck Creek

	Site ID (2000-2021)	Site ID (2022)	Site Name	Site Description	Latitude	Longitude
Mill Neck Creek	FB-13	not sampled	Mill Neck Creek-East	Mill Neck Creek, south of yellow house and wall	40°54’00” N	73°33’43” W
	FB-14	not sampled	Mill Neck Creek - West	Confluence of Oak Neck Creek and Mill Neck Creek	40°53’56” N	73°34’03” W
	FB-15	FB-7	Mill Neck Creek-South	As far south towards Beaver Dam in Oak Neck Creek as tidal stage allows	40°53’32” N	73°34’04” W
	FB-16	FB-8	Mill Neck Creek-North	As far North in Mill Neck Creek as tidal stage allows to steel pillared dock	40°53’57” N	73°34’18” W
	FB-17	not sampled	The Birches STP	North-west most channel past steel pillared dock in Mill Neck Creek	40°54’10” N	73°34’50” W
	FB-18	not sampled	Mill Neck Cove	North most point which tide will allow	40°54’20” N	73°33’20” W
	FB-19	not sampled	Flowers Oyster Hatchery	10 feet south of warning buoy marking shellfish racks	40°54’15” N	73°33’04” W

Appendix C

Water Quality Monitoring Data Sheets

Friends of the Bay

Volunteer Water Quality Monitoring Data Sheet

DATE: ____________________

CAPTAIN: ____________________ FIELD SAMPLING LEADER: ____________________

SAMPLERS: ____________________________ ____________________________

STATION: ______ Time (2400): __________ Air Temp (C°) ________

GPS Reading: 40°__________ 73°__________

☐ Bacteria Sample ☐ Duplicate

☐ Nitrogen Sample ☐ Duplicate

☐ DO Sample Collected ☐ DO Sample Preserved

___ Rainfall in previous 24 hours: 0= none 1= light 2= moderate 3= heavy

WATER & WEATHER CONDITIONS

	Tidal Stage	1=high slack 2 = ebbing/falling 3= low slack 4 = flooding/rising
	Water Color	1 = brown 2 = red brown 3 = green 4 = yellow brown 5 = green brown
	Surface conditions	1= algal bloom 2 = oil slick 3 = foam 4 =dead fish 5 = debris 6=Other: ______________________
	Cloud Cover	**0 = no clouds, 1 = <25%, 2 =25-50%, 3 =50-75%, 4 = 75-100%**
	Wind Direction	**1= North 2= Northeast 3= East 4= Southeast 5= South 6= Southwest 7= West 8= Northwest**
	Wind Speed	**0= no wind 1= <5mph 2= 5-10mph 3= 10-15mph 4= 15-20mph 5= 20-25mph 6= >25mph**

	Weather	**1 = fair 2 = partly cloudy 3 = cloudy 4 = rain 5 = snow 6 = fog**
	Wave Height	0 = no waves 1= slight movement 2= light chop small waves on shore 3= moderate chop 4 = white caps 5 = swells

FIELD MEASUREMENTS Site #______

Depth (m)	Temperature °C	Dissolved Oxygen (mg/l)	Salinity (ppt)	pH
0.5				
1.0				
____ (0.5 m above bottom)				
Bottom = ____				

SECCHI DEPTH: ________

	Initials:	Initials:
Hit bottom before disappearing?	Yes No	Yes No
Angle		
Average of Two Readings	(m)	

COMMENTS

______________________ ______________________ ________________

Rev. Aug 2014

Appendix D

Tide Tables for Oyster Bay – 2022

The NOAA Tide Predictions application provides predictions in both graphical and tabular formats, with many user selected options, for over 3000 stations broken down by key areas in each state. Users can also access stations via the Google map interface. Additional information can be found in the help page.

Station Types: The NOAA Tide Predictions application provides predictions from 2 distinct categories of stations at over 3000 locations:
Harmonic - The predicted height values for Harmonic stations are conducted by combining the harmonic constituents into a single tide curve.
Subordinate - The high and low height values for Subordinate stations are obtained by means and differences, and ratios applied to the full harmonic constant predictions at a specific Harmonic station (a Reference station).

Disclaimer: The official Tide prediction tables are published annually on October 1, for the following calendar year. Tide predictions generated prior to the publishing date of the official tables are subject to change. The predictions from the web based NOAA Tidal Predictions are based upon the latest information available as of the date of your request. Tide predictions generated may differ from the official published predictions if information for the station requested has been updated since the publishing date of the official published tables.

NOAA Tide Predictions

BAYVILLE BRIDGE, OYSTER BAY, NY,2022

(40 54.2N / 73 33.0W)

Times and Heights of High and Low Waters

January

Day	Time (h m)	Height (ft)	Height (cm)
1 Sa	03:29 AM	-0.2	-6
	09:39 AM	8.9	271
	04:18 PM	-1.2	-37
	10:19 PM	7.6	232
2 Su	04:25 AM	-0.5	-15
	10:32 AM	9.0	274
	05:10 PM	-1.4	-43
●	11:12 PM	7.8	238
3 M	05:19 AM	-0.6	-18
	11:26 AM	9.0	274
	06:01 PM	-1.5	-46
4 Tu	12:05 AM	8.0	244
	06:13 AM	-0.7	-21
	12:18 PM	8.8	268
	06:50 PM	-1.4	-43
5 W	12:57 AM	8.1	247
	07:07 AM	-0.6	-18
	01:11 PM	8.5	259
	07:40 PM	-1.2	-37
6 Th	01:48 AM	8.0	244
	08:01 AM	-0.4	-12
	02:03 PM	8.1	247
	08:30 PM	-0.9	-27
7 F	02:40 AM	7.9	241
	08:58 AM	-0.2	-6
	02:57 PM	7.7	235
	09:22 PM	-0.5	-15
8 Sa	03:34 AM	7.8	238
	09:59 AM	0.0	0
	03:55 PM	7.2	219
	10:17 PM	-0.1	-3
9 Su	04:30 AM	7.6	232
	11:01 AM	0.2	6
	04:56 PM	6.8	207
◐	11:15 PM	0.3	9
10 M	05:27 AM	7.4	226
	12:04 PM	0.3	9
	06:00 PM	6.4	195
11 Tu	12:13 AM	0.6	18
	06:26 AM	7.2	219
	01:04 PM	0.3	9
	07:04 PM	6.2	189
12 W	01:12 AM	0.8	24
	07:24 AM	7.2	219
	02:02 PM	0.3	9
	08:04 PM	6.2	189
13 Th	02:08 AM	0.9	27
	08:17 AM	7.1	216
	02:55 PM	0.2	6
	08:57 PM	6.2	189
14 F	02:59 AM	0.9	27
	09:05 AM	7.2	219
	03:42 PM	0.2	6
	09:43 PM	6.3	192
15 Sa	03:44 AM	0.9	27
	09:46 AM	7.2	219
	04:24 PM	0.1	3
	10:24 PM	6.4	195
16 Su	04:23 AM	0.9	27
	10:22 AM	7.3	223
	05:01 PM	0.0	0
	10:59 PM	6.5	198
17 M	04:59 AM	0.8	24
	10:54 AM	7.4	226
	05:33 PM	-0.1	-3
○	11:30 PM	6.6	201
18 Tu	05:32 AM	0.7	21
	11:26 AM	7.5	229
	06:03 PM	-0.1	-3
	11:59 PM	6.8	207
19 W	06:06 AM	0.5	15
	12:01 PM	7.5	229
	06:34 PM	-0.2	-6
20 Th	12:32 AM	7.1	216
	06:42 AM	0.4	12
	12:40 PM	7.6	232
	07:07 PM	-0.3	-9
21 F	01:09 AM	7.3	223
	07:22 AM	0.2	6
	01:21 PM	7.6	232
	07:43 PM	-0.3	-9
22 Sa	01:50 AM	7.5	229
	08:05 AM	0.1	3
	02:06 PM	7.5	229
	08:24 PM	-0.2	-6
23 Su	02:34 AM	7.7	235
	08:53 AM	0.1	3
	02:54 PM	7.3	223
	09:09 PM	-0.1	-3
24 M	03:22 AM	7.8	238
	09:48 AM	0.0	0
	03:47 PM	7.0	213
	10:01 PM	0.1	3
25 Tu	04:15 AM	7.9	241
	10:48 AM	0.0	0
	04:45 PM	6.8	207
◑	10:59 PM	0.3	9
26 W	05:13 AM	7.9	241
	11:53 AM	0.0	0
	05:48 PM	6.6	201
27 Th	12:02 AM	0.3	9
	06:15 AM	7.9	241
	01:01 PM	-0.2	-6
	06:58 PM	6.6	201
28 F	01:08 AM	0.3	9
	07:22 AM	8.0	244
	02:09 PM	-0.4	-12
	08:10 PM	6.8	207
29 Sa	02:17 AM	0.1	3
	08:30 AM	8.2	250
	03:13 PM	-0.7	-21
	09:15 PM	7.1	216
30 Su	03:21 AM	-0.1	-3
	09:32 AM	8.5	259
	04:09 PM	-1.0	-30
	10:13 PM	7.5	229
31 M	04:20 AM	-0.4	-12
	10:28 AM	8.6	262
	05:01 PM	-1.2	-37
	11:05 PM	7.8	238

February

Day	Time (h m)	Height (ft)	Height (cm)
1 Tu	05:14 AM	-0.7	-21
	11:20 AM	8.7	265
	05:49 PM	-1.3	-40
●	11:55 PM	8.1	247
2 W	06:06 AM	-0.8	-24
	12:09 PM	8.6	262
	06:35 PM	-1.3	-40
3 Th	12:41 AM	8.2	250
	06:55 AM	-0.8	-24
	12:57 PM	8.3	253
	07:19 PM	-1.1	-34
4 F	01:26 AM	8.2	250
	07:42 AM	-0.7	-21
	01:42 PM	8.0	244
	08:02 PM	-0.8	-24
5 Sa	02:10 AM	8.1	247
	08:30 AM	-0.4	-12
	02:28 PM	7.6	232
	08:46 PM	-0.4	-12
6 Su	02:54 AM	7.8	238
	09:20 AM	-0.1	-3
	03:16 PM	7.1	216
	09:32 PM	0.1	3
7 M	03:40 AM	7.5	229
	10:14 AM	0.2	6
	04:07 PM	6.6	201
	10:24 PM	0.5	15
8 Tu	04:31 AM	7.2	219
	11:13 AM	0.5	15
	05:05 PM	6.2	189
◐	11:20 PM	0.9	27
9 W	05:28 AM	7.0	213
	12:16 PM	0.7	21
	06:11 PM	6.0	183
10 Th	12:21 AM	1.2	37
	06:30 AM	6.8	207
	01:20 PM	0.7	21
	07:20 PM	5.9	180
11 F	01:25 AM	1.3	40
	07:35 AM	6.8	207
	02:20 PM	0.6	18
	08:22 PM	5.9	180
12 Sa	02:25 AM	1.2	37
	08:32 AM	6.9	210
	03:13 PM	0.5	15
	09:14 PM	6.1	186
13 Su	03:17 AM	1.1	34
	09:20 AM	7.0	213
	03:57 PM	0.3	9
	09:57 PM	6.4	195
14 M	04:00 AM	0.9	27
	10:00 AM	7.2	219
	04:35 PM	0.1	3
	10:34 PM	6.6	201
15 Tu	04:38 AM	0.7	21
	10:35 AM	7.4	226
	05:07 PM	0.0	0
	11:04 PM	6.9	210
16 W	05:13 AM	0.4	12
	11:08 AM	7.5	229
	05:37 PM	-0.2	-6
○	11:34 PM	7.2	219
17 Th	05:47 AM	0.1	3
	11:42 AM	7.7	235
	06:07 PM	-0.3	-9
18 F	12:06 AM	7.6	232
	06:22 AM	-0.1	-3
	12:20 PM	7.8	238
	06:40 PM	-0.4	-12
19 Sa	12:42 AM	7.9	241
	07:01 AM	-0.3	-9
	01:00 PM	7.8	238
	07:16 PM	-0.5	-15
20 Su	01:22 AM	8.2	250
	07:43 AM	-0.5	-15
	01:44 PM	7.7	235
	07:56 PM	-0.4	-12
21 M	02:06 AM	8.3	253
	08:29 AM	-0.4	-12
	02:31 PM	7.5	229
	08:42 PM	-0.2	-6
22 Tu	02:54 AM	8.3	253
	09:22 AM	-0.3	-9
	03:23 PM	7.2	219
	09:34 PM	0.0	0
23 W	03:48 AM	8.2	250
	10:23 AM	-0.1	-3
	04:21 PM	6.9	210
◑	10:34 PM	0.3	9
24 Th	04:48 AM	8.0	244
	11:31 AM	0.0	0
	05:27 PM	6.7	204
	11:43 PM	0.5	15
25 F	05:56 AM	7.8	238
	12:44 PM	0.0	0
	06:44 PM	6.6	201
26 Sa	12:58 AM	0.5	15
	07:11 AM	7.8	238
	01:58 PM	-0.2	-6
	08:03 PM	6.9	210
27 Su	02:13 AM	0.3	9
	08:26 AM	8.0	244
	03:03 PM	-0.4	-12
	09:09 PM	7.3	223
28 M	03:19 AM	-0.1	-3
	09:29 AM	8.2	250
	03:59 PM	-0.7	-21
	10:05 PM	7.7	235

March

Day	Time (h m)	Height (ft)	Height (cm)
1 Tu	04:17 AM	-0.4	-12
	10:23 AM	8.3	253
	04:48 PM	-0.9	-27
	10:54 PM	8.0	244
2 W	05:08 AM	-0.7	-21
	11:12 AM	8.4	256
	05:33 PM	-1.0	-30
●	11:38 PM	8.3	253
3 Th	05:54 AM	-0.8	-24
	11:56 AM	8.3	253
	06:15 PM	-0.9	-27
4 F	12:19 AM	8.3	253
	06:37 AM	-0.8	-24
	12:38 PM	8.1	247
	06:53 PM	-0.7	-21
5 Sa	12:58 AM	8.3	253
	07:18 AM	-0.6	-18
	01:18 PM	7.8	238
	07:30 PM	-0.4	-12
6 Su	01:34 AM	8.1	247
	07:58 AM	-0.4	-12
	01:56 PM	7.5	229
	08:08 PM	0.0	0
7 M	02:12 AM	7.9	241
	08:40 AM	-0.1	-3
	02:36 PM	7.1	216
	08:48 PM	0.4	12
8 Tu	02:52 AM	7.6	232
	09:26 AM	0.3	9
	03:20 PM	6.7	204
	09:34 PM	0.8	24
9 W	03:38 AM	7.2	219
	10:20 AM	0.7	21
	04:11 PM	6.3	192
	10:27 PM	1.2	37
10 Th	04:30 AM	6.9	210
	11:22 AM	1.0	30
	05:11 PM	6.0	183
◐	11:30 PM	1.5	46
11 F	05:32 AM	6.7	204
	12:30 PM	1.1	34
	06:25 PM	5.9	180
12 Sa	12:39 AM	1.6	49
	06:43 AM	6.6	201
	01:37 PM	1.0	30
	07:39 PM	6.0	183
13 Su	01:47 AM	1.5	46
	08:52 AM	6.7	204
	03:34 PM	0.8	24
	09:37 PM	6.2	189
14 M	03:44 AM	1.2	37
	09:47 AM	6.9	210
	04:20 PM	0.6	18
	10:22 PM	6.6	201
15 Tu	04:31 AM	0.9	27
	10:31 AM	7.2	219
	04:59 PM	0.3	9
	10:58 PM	7.0	213
16 W	05:11 AM	0.5	15
	11:08 AM	7.4	226
	05:32 PM	0.1	3
	11:29 PM	7.4	226
17 Th	05:47 AM	0.1	3
	11:43 AM	7.7	235
	06:03 PM	-0.1	-3
18 F	12:01 AM	7.9	241
	06:22 AM	-0.2	-6
	12:19 PM	7.9	241
○	06:36 PM	-0.3	-9
19 Sa	12:36 AM	8.3	253
	06:59 AM	-0.6	-18
	12:57 PM	8.0	244
	07:11 PM	-0.4	-12
20 Su	01:14 AM	8.6	262
	07:39 AM	-0.8	-24
	01:39 PM	8.1	247
	07:50 PM	-0.5	-15
21 M	01:56 AM	8.8	268
	08:22 AM	-0.8	-24
	02:23 PM	8.0	244
	08:33 PM	-0.4	-12
22 Tu	02:42 AM	8.8	268
	09:09 AM	-0.7	-21
	03:11 PM	7.8	238
	09:20 PM	-0.2	-6
23 W	03:32 AM	8.7	265
	10:03 AM	-0.5	-15
	04:05 PM	7.5	229
	10:15 PM	0.2	6
24 Th	04:28 AM	8.3	253
	11:05 AM	-0.1	-3
	05:05 PM	7.1	216
	11:20 PM	0.5	15
25 F	05:31 AM	8.0	244
	12:16 PM	0.1	3
	06:16 PM	6.9	210
◑			
26 Sa	12:36 AM	0.7	21
	06:45 AM	7.7	235
	01:32 PM	0.2	6
	07:39 PM	6.9	210
27 Su	01:56 AM	0.6	18
	08:07 AM	7.7	235
	02:46 PM	0.0	0
	08:56 PM	7.2	219
28 M	03:11 AM	0.3	9
	09:21 AM	7.8	238
	03:49 PM	-0.2	-6
	09:58 PM	7.7	235
29 Tu	04:14 AM	-0.1	-3
	10:21 AM	8.0	244
	04:43 PM	-0.4	-12
	10:50 PM	8.0	244
30 W	05:08 AM	-0.4	-12
	11:12 AM	8.1	247
	05:30 PM	-0.5	-15
	11:35 PM	8.3	253
31 Th	05:55 AM	-0.6	-18
	11:58 AM	8.1	247
	06:12 PM	-0.5	-15

NOAA Tide Predictions

BAYVILLE BRIDGE, OYSTER BAY, NY,2022

(40 54.2N / 73 33.0W)

Times and Heights of High and Low Waters

April

Day	Time (h m)	Height (ft)	Height (cm)
1 F ●	12:16 AM	8.4	256
	06:37 AM	-0.7	-21
	12:39 PM	8.0	244
	06:50 PM	-0.3	-9
2 Sa	12:53 AM	8.4	256
	07:16 AM	-0.6	-18
	01:16 PM	7.9	241
	07:25 PM	-0.1	-3
3 Su	01:26 AM	8.3	253
	07:52 AM	-0.4	-12
	01:51 PM	7.6	232
	07:58 PM	0.2	6
4 M	01:58 AM	8.1	247
	08:27 AM	-0.2	-6
	02:24 PM	7.4	226
	08:32 PM	0.5	15
5 Tu	02:32 AM	7.9	241
	09:04 AM	0.1	3
	03:00 PM	7.1	216
	09:09 PM	0.8	24
6 W	03:11 AM	7.6	232
	09:45 AM	0.5	15
	03:41 PM	6.8	207
	09:52 PM	1.1	34
7 Th	03:55 AM	7.3	223
	10:33 AM	0.8	24
	04:29 PM	6.5	198
	10:43 PM	1.4	43
8 F	04:46 AM	7.0	213
	11:31 AM	1.1	34
	05:25 PM	6.2	189
	11:45 PM	1.7	52
9 Sa ◐	05:44 AM	6.8	207
	12:36 PM	1.2	37
	06:31 PM	6.1	186
10 Su	12:54 AM	1.7	52
	06:50 AM	6.6	201
	01:42 PM	1.2	37
	07:42 PM	6.3	192
11 M	02:03 AM	1.6	49
	08:00 AM	6.7	204
	02:42 PM	1.1	34
	08:45 PM	6.6	201
12 Tu	03:04 AM	1.2	37
	09:02 AM	6.9	210
	03:31 PM	0.8	24
	09:34 PM	7.0	213
13 W	03:54 AM	0.8	24
	09:52 AM	7.2	219
	04:12 PM	0.6	18
	10:13 PM	7.5	229
14 Th	04:36 AM	0.3	9
	10:34 AM	7.5	229
	04:50 PM	0.3	9
	10:49 PM	8.0	244
15 F	05:16 AM	-0.1	-3
	11:13 AM	7.8	238
	05:26 PM	0.1	3
	11:26 PM	8.5	259
16 Sa ○	05:55 AM	-0.5	-15
	11:53 AM	8.0	244
	06:03 PM	-0.2	-6
17 Su	12:05 AM	8.9	271
	06:35 AM	-0.9	-27
	12:34 PM	8.2	250
	06:43 PM	-0.3	-9
18 M	12:48 AM	9.1	277
	07:18 AM	-1.0	-30
	01:18 PM	8.2	250
	07:27 PM	-0.4	-12
19 Tu	01:33 AM	9.2	280
	08:04 AM	-1.0	-30
	02:05 PM	8.2	250
	08:13 PM	-0.3	-9
20 W	02:22 AM	9.1	277
	08:53 AM	-0.8	-24
	02:56 PM	8.0	244
	09:05 PM	0.0	0
21 Th	03:15 AM	8.8	268
	09:49 AM	-0.5	-15
	03:52 PM	7.7	235
	10:05 PM	0.3	9
22 F	04:13 AM	8.4	256
	10:52 AM	-0.2	-6
	04:57 PM	7.5	229
	11:15 PM	0.6	18
23 Sa ◑	05:21 AM	8.0	244
	12:04 PM	0.1	3
	06:12 PM	7.3	223
24 Su	12:33 AM	0.7	21
	06:39 AM	7.7	235
	01:18 PM	0.2	6
	07:30 PM	7.4	226
25 M	01:52 AM	0.5	15
	07:58 AM	7.6	232
	02:26 PM	0.1	3
	08:39 PM	7.7	235
26 Tu	03:01 AM	0.2	6
	09:07 AM	7.7	235
	03:27 PM	0.0	0
	09:38 PM	8.0	244
27 W	04:00 AM	-0.1	-3
	10:05 AM	7.8	238
	04:20 PM	0.0	0
	10:28 PM	8.3	253
28 Th	04:51 AM	-0.3	-9
	10:55 AM	7.8	238
	05:06 PM	0.0	0
	11:11 PM	8.4	256
29 F	05:37 AM	-0.4	-12
	11:39 AM	7.8	238
	05:47 PM	0.1	3
	11:50 PM	8.4	256
30 Sa ●	06:17 AM	-0.4	-12
	12:19 PM	7.7	235
	06:24 PM	0.3	9

May

Day	Time (h m)	Height (ft)	Height (cm)
1 Su	12:24 AM	8.3	253
	06:53 AM	-0.3	-9
	12:54 PM	7.5	229
	06:57 PM	0.5	15
2 M	12:54 AM	8.2	250
	07:27 AM	-0.1	-3
	01:25 PM	7.3	223
	07:28 PM	0.7	21
3 Tu	01:25 AM	8.0	244
	07:59 AM	0.1	3
	01:56 PM	7.2	219
	08:01 PM	0.9	27
4 W	01:59 AM	7.9	241
	08:34 AM	0.3	9
	02:31 PM	7.0	213
	08:37 PM	1.1	34
5 Th	02:38 AM	7.7	235
	09:12 AM	0.5	15
	03:11 PM	6.8	207
	09:19 PM	1.3	40
6 F	03:21 AM	7.4	226
	09:57 AM	0.8	24
	03:57 PM	6.7	204
	10:08 PM	1.5	46
7 Sa	04:10 AM	7.2	219
	10:49 AM	1.0	30
	04:50 PM	6.6	201
	11:07 PM	1.7	52
8 Su	05:05 AM	6.9	210
	11:47 AM	1.2	37
	05:48 PM	6.6	201
9 M ◐	12:12 AM	1.7	52
	06:05 AM	6.8	207
	12:46 PM	1.2	37
	06:48 PM	6.7	204
10 Tu	01:17 AM	1.5	46
	07:08 AM	6.8	207
	01:42 PM	1.1	34
	07:46 PM	7.0	213
11 W	02:17 AM	1.1	34
	08:11 AM	6.9	210
	02:34 PM	0.9	27
	08:39 PM	7.5	229
12 Th	03:11 AM	0.7	21
	09:07 AM	7.1	216
	03:22 PM	0.7	21
	09:26 PM	7.9	241
13 F	03:59 AM	0.2	6
	09:57 AM	7.4	226
	04:06 PM	0.5	15
	10:10 PM	8.4	256
14 Sa	04:44 AM	-0.3	-9
	10:42 AM	7.7	235
	04:49 PM	0.2	6
	10:54 PM	8.9	271
15 Su	05:28 AM	-0.7	-21
	11:27 AM	8.0	244
	05:33 PM	0.0	0
	11:38 PM	9.2	280
16 M ○	06:13 AM	-1.0	-30
	12:13 PM	8.2	250
	06:19 PM	-0.2	-6
17 Tu	12:25 AM	9.4	287
	07:00 AM	-1.1	-34
	01:01 PM	8.2	250
	07:08 PM	-0.3	-9
18 W	01:14 AM	9.4	287
	07:49 AM	-1.1	-34
	01:51 PM	8.2	250
	07:59 PM	-0.2	-6
19 Th	02:07 AM	9.2	280
	08:41 AM	-0.9	-27
	02:45 PM	8.1	247
	08:55 PM	0.0	0
20 F	03:02 AM	8.9	271
	09:37 AM	-0.6	-18
	03:44 PM	8.0	244
	09:58 PM	0.2	6
21 Sa	04:03 AM	8.4	256
	10:40 AM	-0.3	-9
	04:49 PM	7.8	238
	11:09 PM	0.5	15
22 Su ◑	05:11 AM	8.0	244
	11:47 AM	0.0	0
	06:00 PM	7.8	238
23 M	12:24 AM	0.5	15
	06:26 AM	7.7	235
	12:55 PM	0.2	6
	07:09 PM	7.9	241
24 Tu	01:36 AM	0.4	12
	07:39 AM	7.5	229
	01:59 PM	0.2	6
	08:13 PM	8.0	244
25 W	02:41 AM	0.2	6
	08:45 AM	7.4	226
	02:58 PM	0.3	9
	09:10 PM	8.2	250
26 Th	03:39 AM	0.0	0
	09:42 AM	7.5	229
	03:52 PM	0.4	12
	10:01 PM	8.3	253
27 F	04:29 AM	-0.1	-3
	10:33 AM	7.4	226
	04:39 PM	0.5	15
	10:45 PM	8.2	250
28 Sa	05:15 AM	-0.2	-6
	11:17 AM	7.4	226
	05:21 PM	0.6	18
	11:23 PM	8.2	250
29 Su	05:55 AM	-0.1	-3
	11:57 AM	7.3	223
	05:58 PM	0.8	24
	11:57 PM	8.1	247
30 M ●	06:32 AM	0.0	0
	12:32 PM	7.2	219
	06:31 PM	1.0	30
31 Tu	12:27 AM	7.9	241
	07:05 AM	0.2	6
	01:03 PM	7.0	213
	07:03 PM	1.1	34

June

Day	Time (h m)	Height (ft)	Height (cm)
1 W	12:58 AM	7.9	241
	07:37 AM	0.3	9
	01:33 PM	7.0	213
	07:36 PM	1.2	37
2 Th	01:32 AM	7.8	238
	08:10 AM	0.4	12
	02:07 PM	7.0	213
	08:12 PM	1.3	40
3 F	02:11 AM	7.7	235
	08:46 AM	0.5	15
	02:46 PM	6.9	210
	08:53 PM	1.4	43
4 Sa	02:54 AM	7.5	229
	09:27 AM	0.7	21
	03:30 PM	6.9	210
	09:40 PM	1.4	43
5 Su	03:40 AM	7.3	223
	10:12 AM	0.8	24
	04:18 PM	7.0	213
	10:34 PM	1.5	46
6 M	04:32 AM	7.1	216
	11:02 AM	0.9	27
	05:09 PM	7.1	216
	11:33 PM	1.4	43
7 Tu ◐	05:27 AM	7.0	213
	11:55 AM	1.0	30
	06:02 PM	7.3	223
8 W	12:33 AM	1.2	37
	06:25 AM	6.9	210
	12:49 PM	1.0	30
	06:56 PM	7.5	229
9 Th	01:32 AM	0.9	27
	07:24 AM	6.9	210
	01:42 PM	0.9	27
	07:50 PM	7.9	241
10 F	02:29 AM	0.5	15
	08:24 AM	7.1	216
	02:35 PM	0.8	24
	08:44 PM	8.3	253
11 Sa	03:23 AM	0.1	3
	09:20 AM	7.3	223
	03:27 PM	0.5	15
	09:36 PM	8.7	265
12 Su	04:15 AM	-0.4	-12
	10:13 AM	7.6	232
	04:18 PM	0.3	9
	10:26 PM	9.1	277
13 M	05:05 AM	-0.7	-21
	11:04 AM	7.8	238
	05:09 PM	0.0	0
	11:17 PM	9.3	283
14 Tu ○	05:55 AM	-1.0	-30
	11:55 AM	8.1	247
	06:01 PM	-0.1	-3
15 W	12:08 AM	9.4	287
	06:45 AM	-1.1	-34
	12:47 PM	8.2	250
	06:55 PM	-0.2	-6
16 Th	01:01 AM	9.4	287
	07:37 AM	-1.1	-34
	01:40 PM	8.3	253
	07:50 PM	-0.2	-6
17 F	01:55 AM	9.2	280
	08:29 AM	-1.0	-30
	02:35 PM	8.3	253
	08:47 PM	-0.1	-3
18 Sa	02:52 AM	8.8	268
	09:23 AM	-0.7	-21
	03:33 PM	8.3	253
	09:48 PM	0.1	3
19 Su	03:51 AM	8.4	256
	10:21 AM	-0.4	-12
	04:33 PM	8.2	250
	10:55 PM	0.2	6
20 M	04:55 AM	8.0	244
	11:22 AM	-0.1	-3
	05:36 PM	8.2	250
21 Tu ◑	12:04 AM	0.3	9
	06:02 AM	7.6	232
	12:25 PM	0.2	6
	06:39 PM	8.1	247
22 W	01:10 AM	0.3	9
	07:10 AM	7.3	223
	01:26 PM	0.4	12
	07:40 PM	8.1	247
23 Th	02:13 AM	0.3	9
	08:15 AM	7.1	216
	02:25 PM	0.6	18
	08:38 PM	8.0	244
24 F	03:11 AM	0.2	6
	09:14 AM	7.1	216
	03:20 PM	0.8	24
	09:30 PM	8.0	244
25 Sa	04:04 AM	0.2	6
	10:07 AM	7.0	213
	04:10 PM	0.9	27
	10:17 PM	7.9	241
26 Su	04:51 AM	0.2	6
	10:53 AM	7.0	213
	04:55 PM	1.0	30
	10:58 PM	7.9	241
27 M	05:34 AM	0.2	6
	11:35 AM	6.9	210
	05:35 PM	1.1	34
	11:34 PM	7.8	238
28 Tu	06:12 AM	0.3	9
	12:12 PM	6.9	210
	06:10 PM	1.2	37
29 W ●	12:06 AM	7.8	238
	06:46 AM	0.3	9
	12:44 PM	6.9	210
	06:43 PM	1.2	37
30 Th	12:37 AM	7.7	235
	07:18 AM	0.4	12
	01:14 PM	6.9	210
	07:17 PM	1.2	37

StationId: 8516299
Source: NOAA/NOS/CO-OPS
Station Type: Primary
Time Zone: LST_LDT
Datum: MLLW

BAYVILLE BRIDGE, OYSTER BAY, NY,2022

(40 54.2N / 73 33.0W)

Times and Heights of High and Low Waters

July

Day	Time (h m)	Height (ft)	Height (cm)
1 F	01:11 AM	7.7	235
	07:49 AM	0.4	12
	01:46 PM	7.1	216
	07:52 PM	1.2	37
2 Sa	01:48 AM	7.7	235
	08:22 AM	0.4	12
	02:22 PM	7.2	219
	08:31 PM	1.1	34
3 Su	02:29 AM	7.6	232
	08:58 AM	0.5	15
	03:02 PM	7.3	223
	09:14 PM	1.1	34
4 M	03:13 AM	7.5	229
	09:38 AM	0.5	15
	03:45 PM	7.5	229
	10:02 PM	1.1	34
5 Tu	04:01 AM	7.4	226
	10:22 AM	0.7	21
	04:32 PM	7.6	232
	10:55 PM	1.0	30
6 W	04:52 AM	7.2	219
	11:11 AM	0.8	24
	05:22 PM	7.8	238
	11:53 PM	0.8	24
7 Th ◐	05:48 AM	7.1	216
	12:04 PM	0.8	24
	06:16 PM	7.9	241
8 F	12:52 AM	0.7	21
	06:46 AM	7.0	213
	12:59 PM	0.8	24
	07:12 PM	8.2	250
9 Sa	01:52 AM	0.4	12
	07:47 AM	7.0	213
	01:57 PM	0.8	24
	08:10 PM	8.4	256
10 Su	02:53 AM	0.1	3
	08:50 AM	7.2	219
	02:57 PM	0.6	18
	09:09 PM	8.7	265
11 M	03:52 AM	-0.2	-6
	09:51 AM	7.4	226
	03:56 PM	0.4	12
	10:07 PM	9.0	274
12 Tu	04:48 AM	-0.6	-18
	10:48 AM	7.7	235
	04:54 PM	0.1	3
	11:03 PM	9.2	280
13 W ○	05:42 AM	-0.8	-24
	11:43 AM	8.1	247
	05:50 PM	-0.2	-6
	11:57 PM	9.3	283
14 Th	06:33 AM	-1.0	-30
	12:36 PM	8.3	253
	06:46 PM	-0.3	-9
15 F	12:51 AM	9.3	283
	07:24 AM	-1.1	-34
	01:29 PM	8.5	259
	07:41 PM	-0.4	-12
16 Sa	01:45 AM	9.1	277
	08:14 AM	-1.0	-30
	02:21 PM	8.6	262
	08:35 PM	-0.3	-9
17 Su	02:38 AM	8.8	268
	09:03 AM	-0.7	-21
	03:13 PM	8.6	262
	09:31 PM	-0.2	-6
18 M	03:32 AM	8.4	256
	09:55 AM	-0.4	-12
	04:07 PM	8.5	259
	10:30 PM	0.0	0
19 Tu	04:29 AM	7.9	241
	10:50 AM	0.0	0
	05:02 PM	8.3	253
	11:33 PM	0.3	9
20 W ◑	05:30 AM	7.4	226
	11:47 AM	0.4	12
	06:00 PM	8.1	247
21 Th	12:35 AM	0.4	12
	06:33 AM	7.1	216
	12:47 PM	0.8	24
	07:00 PM	7.8	238
22 F	01:38 AM	0.6	18
	07:38 AM	6.8	207
	01:47 PM	1.0	30
	08:00 PM	7.7	235
23 Sa	02:38 AM	0.6	18
	08:41 AM	6.7	204
	02:46 PM	1.2	37
	08:57 PM	7.6	232
24 Su	03:35 AM	0.6	18
	09:38 AM	6.7	204
	03:42 PM	1.3	40
	09:49 PM	7.6	232
25 M	04:26 AM	0.6	18
	10:28 AM	6.7	204
	04:30 PM	1.3	40
	10:35 PM	7.6	232
26 Tu	05:11 AM	0.5	15
	11:12 AM	6.8	207
	05:13 PM	1.3	40
	11:14 PM	7.7	235
27 W	05:50 AM	0.5	15
	11:50 AM	6.9	210
	05:51 PM	1.2	37
	11:48 PM	7.7	235
28 Th ●	06:25 AM	0.4	12
	12:23 PM	7.0	213
	06:25 PM	1.1	34
29 F	12:19 AM	7.7	235
	06:55 AM	0.4	12
	12:52 PM	7.2	219
	06:58 PM	1.0	30
30 Sa	12:51 AM	7.8	238
	07:24 AM	0.3	9
	01:21 PM	7.4	226
	07:32 PM	0.9	27
31 Su	01:26 AM	7.8	238
	07:54 AM	0.3	9
	01:54 PM	7.6	232
	08:08 PM	0.8	24

August

Day	Time (h m)	Height (ft)	Height (cm)
1 M	02:05 AM	7.8	238
	08:27 AM	0.3	9
	02:31 PM	7.8	238
	08:48 PM	0.6	18
2 Tu	02:47 AM	7.8	238
	09:04 AM	0.4	12
	03:13 PM	8.0	244
	09:32 PM	0.6	18
3 W	03:32 AM	7.6	232
	09:46 AM	0.5	15
	03:58 PM	8.1	247
	10:22 PM	0.5	15
4 Th	04:22 AM	7.4	226
	10:34 AM	0.6	18
	04:48 PM	8.2	250
	11:18 PM	0.5	15
5 F ◐	05:16 AM	7.2	219
	11:28 AM	0.8	24
	05:42 PM	8.2	250
6 Sa	12:19 AM	0.5	15
	06:15 AM	7.0	213
	12:28 PM	0.9	27
	06:41 PM	8.2	250
7 Su	01:24 AM	0.4	12
	07:20 AM	7.0	213
	01:32 PM	0.9	27
	07:45 PM	8.3	253
8 M	02:32 AM	0.2	6
	08:30 AM	7.1	216
	02:39 PM	0.7	21
	08:53 PM	8.5	259
9 Tu	03:37 AM	-0.1	-3
	09:38 AM	7.4	226
	03:46 PM	0.4	12
	09:57 PM	8.8	268
10 W	04:36 AM	-0.4	-12
	10:39 AM	7.8	238
	04:47 PM	0.1	3
	10:56 PM	9.0	274
11 Th	05:30 AM	-0.7	-21
	11:33 AM	8.2	250
	05:44 PM	-0.2	-6
	11:50 PM	9.1	277
12 F ○	06:20 AM	-0.9	-27
	12:24 PM	8.6	262
	06:37 PM	-0.5	-15
13 Sa	12:42 AM	9.1	277
	07:07 AM	-0.9	-27
	01:13 PM	8.8	268
	07:28 PM	-0.6	-18
14 Su	01:31 AM	8.9	271
	07:53 AM	-0.8	-24
	02:00 PM	8.9	271
	08:18 PM	-0.5	-15
15 M	02:20 AM	8.7	265
	08:38 AM	-0.6	-18
	02:46 PM	8.8	268
	09:07 PM	-0.3	-9
16 Tu	03:07 AM	8.3	253
	09:24 AM	-0.2	-6
	03:32 PM	8.6	262
	09:58 PM	0.0	0
17 W	03:57 AM	7.8	238
	10:12 AM	0.3	9
	04:21 PM	8.2	250
	10:54 PM	0.4	12
18 Th	04:50 AM	7.3	223
	11:05 AM	0.8	24
	05:13 PM	7.9	241
	11:53 PM	0.7	21
19 F ◑	05:49 AM	6.9	210
	12:03 PM	1.2	37
	06:11 PM	7.6	232
20 Sa	12:57 AM	0.9	27
	06:55 AM	6.6	201
	01:06 PM	1.4	43
	07:15 PM	7.3	223
21 Su	02:01 AM	1.0	30
	08:03 AM	6.4	195
	02:11 PM	1.6	49
	08:21 PM	7.3	223
22 M	03:03 AM	1.0	30
	09:06 AM	6.5	198
	03:12 PM	1.5	46
	09:20 PM	7.3	223
23 Tu	03:57 AM	0.9	27
	09:59 AM	6.6	201
	04:05 PM	1.4	43
	10:09 PM	7.4	226
24 W	04:43 AM	0.7	21
	10:44 AM	6.9	210
	04:50 PM	1.2	37
	10:51 PM	7.6	232
25 Th	05:22 AM	0.6	18
	11:22 AM	7.1	216
	05:29 PM	1.1	34
	11:26 PM	7.7	235
26 F	05:56 AM	0.5	15
	11:54 AM	7.3	223
	06:03 PM	0.9	27
	11:58 PM	7.8	238
27 Sa ●	06:25 AM	0.4	12
	12:21 PM	7.6	232
	06:35 PM	0.7	21
28 Su	12:29 AM	7.9	241
	06:53 AM	0.3	9
	12:50 PM	7.9	241
	07:08 PM	0.4	12
29 M	01:03 AM	8.0	244
	07:23 AM	0.2	6
	01:23 PM	8.2	250
	07:43 PM	0.3	9
30 Tu	01:40 AM	8.0	244
	07:56 AM	0.2	6
	02:00 PM	8.4	256
	08:21 PM	0.1	3
31 W	02:21 AM	8.0	244
	08:33 AM	0.2	6
	02:42 PM	8.5	259
	09:04 PM	0.1	3

September

Day	Time (h m)	Height (ft)	Height (cm)
1 Th	03:06 AM	7.8	238
	09:15 AM	0.4	12
	03:27 PM	8.6	262
	09:53 PM	0.2	6
2 F	03:55 AM	7.6	232
	10:04 AM	0.6	18
	04:18 PM	8.5	259
	10:50 PM	0.3	9
3 Sa ◐	04:50 AM	7.3	223
	11:01 AM	0.8	24
	05:15 PM	8.3	253
	11:54 PM	0.5	15
4 Su	05:52 AM	7.1	216
	12:07 PM	1.0	30
	06:19 PM	8.2	250
5 M	01:05 AM	0.5	15
	07:03 AM	7.0	213
	01:19 PM	1.0	30
	07:31 PM	8.1	247
6 Tu	02:18 AM	0.4	12
	08:20 AM	7.2	219
	02:34 PM	0.8	24
	08:46 PM	8.3	253
7 W	03:26 AM	0.1	3
	09:32 AM	7.6	232
	03:43 PM	0.4	12
	09:53 PM	8.5	259
8 Th	04:25 AM	-0.3	-9
	10:30 AM	8.1	247
	04:44 PM	0.0	0
	10:51 PM	8.8	268
9 F	05:16 AM	-0.5	-15
	11:22 AM	8.5	259
	05:37 PM	-0.4	-12
	11:42 PM	8.9	271
10 Sa ○	06:03 AM	-0.7	-21
	12:08 PM	8.8	268
	06:26 PM	-0.6	-18
11 Su	12:29 AM	8.8	268
	06:47 AM	-0.6	-18
	12:52 PM	9.0	274
	07:12 PM	-0.7	-21
12 M	01:14 AM	8.7	265
	07:29 AM	-0.5	-15
	01:33 PM	8.9	271
	07:56 PM	-0.5	-15
13 Tu	01:57 AM	8.4	256
	08:09 AM	-0.2	-6
	02:14 PM	8.8	268
	08:39 PM	-0.3	-9
14 W	02:39 AM	8.0	244
	08:50 AM	0.2	6
	02:54 PM	8.5	259
	09:23 PM	0.1	3
15 Th	03:21 AM	7.6	232
	09:32 AM	0.7	21
	03:36 PM	8.1	247
	10:11 PM	0.5	15
16 F	04:07 AM	7.2	219
	10:20 AM	1.1	34
	04:24 PM	7.7	235
	11:06 PM	0.9	27
17 Sa ◑	05:01 AM	6.7	204
	11:16 AM	1.5	46
	05:19 PM	7.3	223
18 Su	12:10 AM	1.2	37
	06:05 AM	6.4	195
	12:22 PM	1.8	55
	06:24 PM	7.0	213
19 M	01:18 AM	1.3	40
	07:18 AM	6.3	192
	01:32 PM	1.8	55
	07:36 PM	7.0	213
20 Tu	02:23 AM	1.3	40
	08:28 AM	6.4	195
	02:39 PM	1.7	52
	08:43 PM	7.0	213
21 W	03:20 AM	1.1	34
	09:24 AM	6.7	204
	03:35 PM	1.4	43
	09:37 PM	7.2	219
22 Th	04:07 AM	0.9	27
	10:09 AM	7.0	213
	04:21 PM	1.1	34
	10:21 PM	7.5	229
23 F	04:45 AM	0.7	21
	10:46 AM	7.4	226
	05:00 PM	0.8	24
	10:58 PM	7.6	232
24 Sa	05:18 AM	0.5	15
	11:17 AM	7.7	235
	05:34 PM	0.5	15
	11:30 PM	7.8	238
25 Su ●	05:48 AM	0.4	12
	11:45 AM	8.1	247
	06:07 PM	0.2	6
26 M	12:02 AM	8.0	244
	06:18 AM	0.3	9
	12:16 PM	8.4	256
	06:41 PM	-0.1	-3
27 Tu	12:37 AM	8.1	247
	06:50 AM	0.2	6
	12:52 PM	8.7	265
	07:17 PM	-0.3	-9
28 W	01:16 AM	8.1	247
	07:26 AM	0.1	3
	01:31 PM	8.9	271
	07:57 PM	-0.3	-9
29 Th	01:58 AM	8.1	247
	08:06 AM	0.2	6
	02:15 PM	8.9	271
	08:41 PM	-0.3	-9
30 F	02:44 AM	7.9	241
	08:51 AM	0.3	9
	03:02 PM	8.8	268
	09:31 PM	-0.1	-3

StationId: 8516299
Source: NOAA/NOS/CO-OPS
Station Type: Primary
Time Zone: LST_LDT
Datum: MLLW

NOAA Tide Predictions

BAYVILLE BRIDGE, OYSTER BAY, NY,2022

(40 54.2N / 73 33.0W)
Times and Heights of High and Low Waters

October

Day	Time (h m)	Height (ft)	Height (cm)
1 Sa	03:35 AM	7.7	235
	09:43 AM	0.5	15
	03:56 PM	8.6	262
	10:30 PM	0.2	6
2 Su	04:32 AM	7.4	226
	10:44 AM	0.8	24
	04:56 PM	8.2	250
	11:37 PM	0.4	12
3 M ◐	05:38 AM	7.2	219
	11:57 AM	1.0	30
	06:05 PM	8.0	244
4 Tu	12:52 AM	0.5	15
	06:55 AM	7.2	219
	01:16 PM	0.9	27
	07:24 PM	7.9	241
5 W	02:06 AM	0.4	12
	08:15 AM	7.5	229
	02:33 PM	0.6	18
	08:42 PM	8.0	244
6 Th	03:12 AM	0.1	3
	09:22 AM	7.9	241
	03:40 PM	0.2	6
	09:47 PM	8.2	250
7 F	04:09 AM	-0.2	-6
	10:17 AM	8.4	256
	04:37 PM	-0.2	-6
	10:42 PM	8.4	256
8 Sa	04:58 AM	-0.3	-9
	11:05 AM	8.7	265
	05:26 PM	-0.5	-15
	11:30 PM	8.5	259
9 Su ○	05:43 AM	-0.4	-12
	11:48 AM	8.9	271
	06:11 PM	-0.7	-21
10 M	12:14 AM	8.4	256
	06:24 AM	-0.3	-9
	12:28 PM	8.9	271
	06:53 PM	-0.6	-18
11 Tu	12:55 AM	8.3	253
	07:03 AM	0.0	0
	01:05 PM	8.8	268
	07:32 PM	-0.5	-15
12 W	01:33 AM	8.0	244
	07:40 AM	0.3	9
	01:40 PM	8.5	259
	08:10 PM	-0.2	-6
13 Th	02:10 AM	7.7	235
	08:16 AM	0.6	18
	02:17 PM	8.2	250
	08:49 PM	0.2	6
14 F	02:47 AM	7.3	223
	08:55 AM	1.0	30
	02:56 PM	7.9	241
	09:32 PM	0.6	18
15 Sa	03:29 AM	7.0	213
	09:39 AM	1.3	40
	03:40 PM	7.5	229
	10:21 PM	0.9	27
16 Su	04:18 AM	6.7	204
	10:32 AM	1.6	49
	04:32 PM	7.2	219
	11:21 PM	1.2	37
17 M ◑	05:16 AM	6.4	195
	11:36 AM	1.9	58
	05:32 PM	6.9	210
18 Tu	12:27 AM	1.4	43
	06:26 AM	6.4	195
	12:48 PM	1.9	58
	06:42 PM	6.7	204
19 W	01:32 AM	1.3	40
	07:37 AM	6.5	198
	01:57 PM	1.7	52
	07:53 PM	6.8	207
20 Th	02:30 AM	1.2	37
	08:36 AM	6.8	207
	02:56 PM	1.4	43
	08:54 PM	7.0	213
21 F	03:18 AM	1.0	30
	09:23 AM	7.2	219
	03:44 PM	1.0	30
	09:42 PM	7.2	219
22 Sa	03:59 AM	0.8	24
	10:01 AM	7.6	232
	04:25 PM	0.5	15
	10:22 PM	7.4	226
23 Su	04:35 AM	0.6	18
	10:35 AM	8.0	244
	05:02 PM	0.1	3
	10:58 PM	7.7	235
24 M	05:08 AM	0.4	12
	11:08 AM	8.4	256
	05:37 PM	-0.2	-6
	11:34 PM	7.9	241
25 Tu ●	05:43 AM	0.2	6
	11:44 AM	8.8	268
	06:14 PM	-0.5	-15
26 W	12:12 AM	8.0	244
	06:20 AM	0.1	3
	12:23 PM	9.0	274
	06:54 PM	-0.7	-21
27 Th	12:53 AM	8.1	247
	07:00 AM	0.0	0
	01:06 PM	9.2	280
	07:37 PM	-0.8	-24
28 F	01:38 AM	8.1	247
	07:45 AM	0.0	0
	01:53 PM	9.1	277
	08:24 PM	-0.7	-21
29 Sa	02:26 AM	8.0	244
	08:34 AM	0.2	6
	02:44 PM	8.9	271
	09:16 PM	-0.4	-12
30 Su	03:20 AM	7.8	238
	09:30 AM	0.4	12
	03:39 PM	8.5	259
	10:16 PM	-0.1	-3
31 M	04:20 AM	7.5	229
	10:36 AM	0.6	18
	04:43 PM	8.1	247
	11:24 PM	0.1	3

November

Day	Time (h m)	Height (ft)	Height (cm)
1 Tu ◐	05:31 AM	7.4	226
	11:53 AM	0.8	24
	05:56 PM	7.8	238
2 W	12:37 AM	0.2	6
	06:48 AM	7.5	229
	01:13 PM	0.6	18
	07:17 PM	7.6	232
3 Th	01:48 AM	0.2	6
	08:01 AM	7.8	238
	02:26 PM	0.3	9
	08:31 PM	7.7	235
4 F	02:52 AM	0.1	3
	09:04 AM	8.2	250
	03:29 PM	-0.1	-3
	09:34 PM	7.8	238
5 Sa	03:48 AM	-0.1	-3
	09:58 AM	8.5	259
	04:23 PM	-0.4	-12
	10:27 PM	7.9	241
6 Su	03:37 AM	-0.1	-3
	09:45 AM	8.6	262
	04:11 PM	-0.6	-18
	10:14 PM	7.9	241
7 M	04:22 AM	0.0	0
	10:26 AM	8.7	265
	04:54 PM	-0.6	-18
	10:57 PM	7.8	238
8 Tu ○	05:02 AM	0.1	3
	11:04 AM	8.6	262
	05:34 PM	-0.5	-15
	11:36 PM	7.7	235
9 W	05:39 AM	0.3	9
	11:38 AM	8.4	256
	06:11 PM	-0.3	-9
10 Th	12:11 AM	7.5	229
	06:13 AM	0.6	18
	12:11 PM	8.1	247
	06:46 PM	-0.1	-3
11 F	12:44 AM	7.2	219
	06:48 AM	0.8	24
	12:45 PM	7.9	241
	07:21 PM	0.2	6
12 Sa	01:19 AM	7.0	213
	07:25 AM	1.1	34
	01:23 PM	7.7	235
	08:00 PM	0.5	15
13 Su	01:58 AM	6.8	207
	08:06 AM	1.3	40
	02:06 PM	7.4	226
	08:44 PM	0.7	21
14 M	02:44 AM	6.6	201
	08:55 AM	1.5	46
	02:54 PM	7.1	216
	09:35 PM	1.0	30
15 Tu	03:36 AM	6.5	198
	09:54 AM	1.6	49
	03:49 PM	6.8	207
	10:33 PM	1.1	34
16 W ◑	04:34 AM	6.5	198
	11:01 AM	1.6	49
	04:50 PM	6.6	201
	11:32 PM	1.2	37
17 Th	05:35 AM	6.6	201
	12:06 PM	1.5	46
	05:54 PM	6.6	201
18 F	12:28 AM	1.1	34
	06:33 AM	6.9	210
	01:06 PM	1.1	34
	06:57 PM	6.6	201
19 Sa	01:19 AM	1.0	30
	07:25 AM	7.3	223
	01:59 PM	0.7	21
	07:53 PM	6.8	207
20 Su	02:06 AM	0.8	24
	08:10 AM	7.7	235
	02:45 PM	0.3	9
	08:41 PM	7.1	216
21 M	02:48 AM	0.6	18
	08:52 AM	8.1	247
	03:27 PM	-0.2	-6
	09:24 PM	7.3	223
22 Tu	03:30 AM	0.3	9
	09:33 AM	8.5	259
	04:09 PM	-0.6	-18
	10:06 PM	7.6	232
23 W ●	04:11 AM	0.1	3
	10:15 AM	8.9	271
	04:51 PM	-0.9	-27
	10:49 PM	7.8	238
24 Th	04:54 AM	-0.1	-3
	11:00 AM	9.1	277
	05:35 PM	-1.0	-30
	11:34 PM	7.9	241
25 F	05:40 AM	-0.2	-6
	11:47 AM	9.2	280
	06:21 PM	-1.1	-34
26 Sa	12:23 AM	8.0	244
	06:30 AM	-0.2	-6
	12:37 PM	9.1	277
	07:11 PM	-1.0	-30
27 Su	01:14 AM	8.0	244
	07:23 AM	-0.1	-3
	01:30 PM	8.8	268
	08:04 PM	-0.8	-24
28 M	02:10 AM	7.9	241
	08:22 AM	0.0	0
	02:28 PM	8.4	256
	09:03 PM	-0.5	-15
29 Tu	03:11 AM	7.8	238
	09:30 AM	0.2	6
	03:32 PM	8.0	244
	10:08 PM	-0.3	-9
30 W ◐	04:19 AM	7.7	235
	10:44 AM	0.3	9
	04:44 PM	7.6	232
	11:16 PM	-0.1	-3

December

Day	Time (h m)	Height (ft)	Height (cm)
1 Th	05:30 AM	7.8	238
	11:59 AM	0.2	6
	06:00 PM	7.3	223
2 F	12:22 AM	0.0	0
	06:38 AM	7.9	241
	01:08 PM	0.0	0
	07:11 PM	7.3	223
3 Sa	01:25 AM	0.1	3
	07:39 AM	8.1	247
	02:10 PM	-0.2	-6
	08:13 PM	7.3	223
4 Su	02:23 AM	0.1	3
	08:34 AM	8.2	250
	03:04 PM	-0.4	-12
	09:08 PM	7.3	223
5 M	03:14 AM	0.2	6
	09:22 AM	8.2	250
	03:53 PM	-0.5	-15
	09:56 PM	7.3	223
6 Tu	04:00 AM	0.3	9
	10:05 AM	8.2	250
	04:37 PM	-0.5	-15
	10:40 PM	7.2	219
7 W	04:42 AM	0.4	12
	10:43 AM	8.0	244
	05:17 PM	-0.4	-12
	11:19 PM	7.1	216
8 Th ○	05:19 AM	0.6	18
	11:17 AM	7.9	241
	05:53 PM	-0.2	-6
	11:53 PM	6.9	210
9 F	05:53 AM	0.7	21
	11:48 AM	7.7	235
	06:27 PM	-0.1	-3
10 Sa	12:25 AM	6.8	207
	06:26 AM	0.9	27
	12:21 PM	7.6	232
	07:00 PM	0.1	3
11 Su	12:57 AM	6.8	207
	07:02 AM	1.0	30
	12:58 PM	7.5	229
	07:34 PM	0.2	6
12 M	01:33 AM	6.7	204
	07:41 AM	1.1	34
	01:38 PM	7.3	223
	08:13 PM	0.4	12
13 Tu	02:14 AM	6.7	204
	08:26 AM	1.1	34
	02:23 PM	7.1	216
	08:55 PM	0.5	15
14 W	03:00 AM	6.8	207
	09:17 AM	1.2	37
	03:12 PM	6.8	207
	09:43 PM	0.7	21
15 Th	03:49 AM	6.8	207
	10:14 AM	1.2	37
	04:06 PM	6.6	201
	10:34 PM	0.8	24
16 F ◑	04:41 AM	6.9	210
	11:13 AM	1.1	34
	05:03 PM	6.5	198
	11:27 PM	0.9	27
17 Sa	05:35 AM	7.1	216
	12:12 PM	0.8	24
	06:02 PM	6.4	195
18 Su	12:20 AM	0.8	24
	06:28 AM	7.4	226
	01:09 PM	0.5	15
	07:01 PM	6.5	198
19 M	01:13 AM	0.7	21
	07:21 AM	7.7	235
	02:03 PM	0.1	3
	07:58 PM	6.7	204
20 Tu	02:05 AM	0.5	15
	08:13 AM	8.1	247
	02:55 PM	-0.3	-9
	08:51 PM	7.0	213
21 W	02:55 AM	0.3	9
	09:03 AM	8.5	259
	03:43 PM	-0.7	-21
	09:41 PM	7.3	223
22 Th	03:45 AM	0.0	0
	09:53 AM	8.8	268
	04:32 PM	-1.0	-30
	10:30 PM	7.6	232
23 F ●	04:36 AM	-0.3	-9
	10:42 AM	9.0	274
	05:20 PM	-1.3	-40
	11:20 PM	7.8	238
24 Sa	05:27 AM	-0.5	-15
	11:33 AM	9.1	277
	06:09 PM	-1.4	-43
25 Su	12:11 AM	8.0	244
	06:21 AM	-0.6	-18
	12:26 PM	9.0	274
	06:59 PM	-1.4	-43
26 M	01:04 AM	8.1	247
	07:16 AM	-0.6	-18
	01:20 PM	8.7	265
	07:51 PM	-1.2	-37
27 Tu	01:59 AM	8.2	250
	08:14 AM	-0.5	-15
	02:17 PM	8.3	253
	08:46 PM	-0.9	-27
28 W	02:56 AM	8.1	247
	09:17 AM	-0.3	-9
	03:17 PM	7.9	241
	09:44 PM	-0.6	-18
29 Th	03:58 AM	8.0	244
	10:25 AM	-0.2	-6
	04:23 PM	7.4	226
	10:47 PM	-0.3	-9
30 F ◐	05:02 AM	7.9	241
	11:34 AM	-0.1	-3
	05:33 PM	7.1	216
	11:51 PM	0.0	0
31 Sa	06:06 AM	7.8	238
	12:41 PM	-0.1	-3
	06:42 PM	6.8	207

Appendix E

2022 Open Water Body Monitoring Results

Site FB-1 - COLD SPRING HARBOR SOUTH

DATE	TIME	WATER TEMPERATURE			SALINITY			PH			DISSOLVED OXYGEN			% SATURATION			DEPTH		BACTERIA		CONDITIONS										PERSONNEL			NOTES
		Top 0.5m	1.0 m	0.5 m from BTM	Top	1.0m	btm	Top	1.0m	0.5m from Btm	Top	1.0m	Btm	Top	1.0m	Btm	Secchi (m)	Sea floor (m)	Fecal Coli-form	Enter o-cocci	Air Temp (°C)	Rain in 24hrs	Tidal Stage	Water Color	Sur-face	Cloud Cover	Wind Dir	Wind m/s	Weather	Wave Ht (m)	Data by	Capt	Lead	
5/3/22	10:10	11.4	11.3	11.0	NS	NS	NS	8.3	8.4	8.3	10.5	11.0	11.2	111.6	116.5	119.6	1.3	4.8	<1	<1	12.2	1	4	5	6	4	NE	11.0	3	0.2	ES	DM		
5/16/22	10:24	14.3	14.0	12.6	NS	NS	NS	NS	NS	NS	9.1	9.9	10.4	105.5	112.3	113.4	2.1	6.2	17	<1	23.0	0	4	5	6	4	NW	6.0	3	0.0	NH	DM		
5/31/22	9:25	18.2	18.2	17.1	25.6	25.6	26.0	7.9	7.9	7.8	7.4	8.1	7.9	93.0	99.5	94.4	1.5	4.7	3	<1	28.0	0	4	5	6	1	E	10.0	1	0.0	NH	DM		
6/13/22	10:55	19.5	19.5	16.6	25.3	25.4	26.0	7.9	7.9	7.5	7.4	8.2	7.1	92.1	103.7	86.7	1.2	6.6	10	<1	24.0	1	4	1	6	1	WNW	4.0	1	0.0	RK	DM		
6/28/22	10:40	19.6	19.6	19.5	25.8	25.5	26.1	7.8	7.9	7.8	7.2	7.9	12.0	93.7	101.0	102.0	1.0	4.6	35	<1	22.0	3	4	5	6	1	N	3.0	2	0.0	RA	DM		
7/11/22	11:05	22.0	20.8	19.7	26.5	26.6	27.0	8.0	7.7	7.4	5.7	5.1	4.2	78.2	68.2	54.0	0.8	6.4	13	<1	25.5	0	2	3	6	0	SW	7.0	1	0.0	LP	DM		
7/25/22	9:56	24.3	24.1	22.7	26.7	26.7	27.3	7.7	7.7	7.6	5.0	5.3	4.4	70.3	74.5	60.0	1.2	6.4	4	<1	29.0	0	1	5	6	3	SW	11.0	2	<0.2	LD	DM		Lots of fish jumping here.
8/8/22	10:50	24.7	24.6	23.8	27.1	27.1	27.5	7.5	7.5	7.3	4.3	3.7	3.4	60.7	54.0	45.9	1.5	5.5	16	6	30.5	3	2	3	6	1	SW	8.0	1	0.0	LD	DM		
8/22/22	10:15	23.7	23.7	23.2	27.5	27.6	28.0	7.5	7.5	7.3	4.2	3.8	3.6	58.5	52.7	46.5	1.3	6.3	5	2	22.8	0	1	5	6	4	SE	6.0	3	0.0	LD	DM		
9/8/22	10:42	23.4	23.4	23.8	27.9	27.9	28.6	7.6	7.6	7.5	4.6	4.6	3.7	63.5	63.6	51.4	1.9	6.8	4	2	21.0	1	2	4	6	1	NE	12.0	2	0.5	ES	DM		
9/23/22	10:01	21.4	21.4	21.3	27.9	27.9	27.9	7.9	7.9	7.9	7.1	7.1	6.8	94.4	94.4	90.2	1.0	4.2	16	<1	12.0	3	2	5	6	1	NW	20.0	2	1.2	ES	DM		
10/6/22	10:46	16.0	16.0	16.1	26.0	26.1	27.7	8.0	8.0	8.0	8.3	8.3	8.3	99.2	98.4	99.6	2.5	6.2	5	<1	17.0	2	2	3	6	0	NW	6.0	1	0.0	AR	DM		
10/18/22	10:15	16.9	16.9	17.3	27.7	27.6	28.0	8.0	8.0	8.0	8.2	8.4	8.5	100.7	102.6	105.5	3.0	5.1	<1	7	11.0	1	2	5	6	3	W	10.0	3	0.5	ES	DM		

LT - Low Tide	**NS - No Sensor**
TS - Too Shallow	

Rainfall in previous 24 hours	0=none, 1=light, 2=moderate, 3=heavy
Tidal Stage	1=high slack, 2=ebbing/falling, 3=low, slack, 4=flooding rising
Water color	1=brown, 2=red brown, 3=green, 4=yellow brown, 5=green brown
Surface Conditions	1=algal bloom, 2=oil slick, 3=foam, 4=dead fish, 5=debris, 6=other
Cloud Cover	0=no clouds, 1=<25%, 2=25-50%, 3=50-75% 4=75-100%
Wind Direction	Use Cardinal and Semi-cardinal Headings (ex. NW, S, SE)
Wind Speed	Use MPH as read from Wind Meter
Weather	1=fair/Sunny, 2=partly cloudy, 3=cloudy, 4=rain, 5=snow, 6 =fog

Site FB-2 - COLD SPRING HARBOR NORTH

DATE	TIME	WATER TEMPERATURE			SALINITY			PH			DISSOLVED OXYGEN			% SATURATION			DEPTH		BACTERIA		CONDITIONS										PERSONNEL			NOTES
		Top 0.5m	1.0 m	0.5 m from BTM	Top	1.0m	btm	Top	1.0m	0.5m from Btm	Top	1.0m	Btm	Top	1.0m	Btm	Secchi (m)	Sea floor (m)	Fecal Coli-form	Enter o-cocci	Air Temp (°C)	Rain in 24hrs	Tidal Stage	Water Color	Sur-face	Cloud Cover	Wind Dir	Wind m/s	Weather	Wave Ht (m)	Data by	Capt	Lead	
5/3/22	9:49	11.2	11.2	10.7	NS	NS	NS	8.4	8.4	8.3	10.5	10.8	10.5	111.4	114.2	111.9	1.7	5.3	<1	<1	11.7	1	4	5	6	4	N	12.0	3	0.2	ES	DM		
5/16/22	10:08	14.2	14.1	13.5	NS	NS	NS	NS	NS	NS	9.4	9.7	9.8	106.2	110.8	110.3	2.0	6.6	1	<1	23.0	0	4	5	6	4	NW	5.0	3	0.0	NH	DM		
5/31/22	9:12	19.6	19.4	17.5	25.8	25.8	26.0	8.1	8.1	8.0	8.0	9.3	9.7	104.7	117.7	116.3	1.3	5.3	<1	<1	27.0	0	4	5	6	1	E	11.0	1	0.0	NC	DM		
6/13/22	10:05	18.8	18.1	16.1	25.7	25.8	26.1	7.8	7.8	7.7	7.4	7.6	7.2	94.1	95.0	85.8	1.3	6.2	1	1	24.0	1	4	1	6	1	NW	4.0	1	0.0	AR	DM		
6/28/22	9:04	20.0	19.9	19.0	26.0	26.0	26.2	7.9	7.9	7.7	6.8	7.5	7.1	88.1	96.8	88.5	1.3	6.4	5	1	19.0	3	4	5	6	1	N	3.0	2	0.0	EA	DM		
7/11/22	10:35	21.8	21.6	18.8	26.7	26.7	27.1	7.9	7.9	7.5	6.8	5.9	4.8	91.4	79.3	60.2	1.5	7.1	<1	<1	25.0	0	2	3	6	0	SW	7.0	1	0.0	LP	DM		
7/25/22	9:38	25.1	25.1	25.0	26.8	26.8	26.9	8.0	8.0	8.0	7.7	7.8	7.5	109.8	111.3	106.7	1.2	4.3	<1	<1	31.0	0	4	5	6	1	SW	11.0	1	0.0	LD	DM		
8/8/22	10:30	25.3	25.2	22.8	27.4	27.4	27.9	7.7	7.7	7.4	6.0	5.5	4.7	87.1	78.7	63.2	2.0	6.2	<1	<1	30.0	3	2	5	6	1	SW	8.0	1	0.0	LD	DM		
8/22/22	9:45	24.2	24.2	22.9	27.8	27.8	28.4	7.8	7.8	7.5	6.5	5.9	5.3	92.8	83.8	70.9	2.0	6.9	<1	<1	22.8	0	1	5	6	4	SE	6.0	3	0.0	LD	DM		
9/8/22	10:20	23.4	23.4	23.3	28.8	28.8	28.9	7.6	7.6	7.6	4.9	4.8	4.7	68.4	66.7	65.3	1.6	7.6	2	1	21.0	1	4	4	6	1	NE	11.0	2	0.5	ES	DM		
9/23/22	9:40	22.1	22.1	22.1	28.3	28.3	28.3	7.9	7.9	7.9	6.7	6.7	6.7	90.5	90.6	90.4	1.2	6.7	8	2	12.0	3	1	5	6	1	NW	20.0	2	1.1	ES	DM		
10/6/22	10:17	17.1	17.1	17.0	28.3	28.3	28.3	8.0	8.0	8.0	7.6	7.6	7.5	93.1	93.6	92.6	3.7	6.8	1	<1	19.0	2	2	3	6	0	NW	5.0	1	0.0	AR	DM		
10/18/22	9:57	16.9	16.9	17.3	28.0	28.1	28.4	8.1	8.1	7.9	8.7	9.0	9.0	107.0	110.0	111.0	2.3	5.9	3	<1	10.0	1	2	5	6	3	W	10.0	3	0.5	ES	DM		

LT - Low Tide	**NS - No Sensor**
TS - Too Shallow	

Rainfall in previous 24 hours	0=none, 1=light, 2=moderate, 3=heavy
Tidal Stage	1=high slack, 2=ebbing/falling, 3=low, slack, 4=flooding rising
Water color	1=brown, 2=red brown, 3=green, 4=yellow brown, 5=green brown
Surface Conditions	1=algal bloom, 2=oil slick, 3=foam, 4=dead fish, 5=debris, 6=other
Cloud Cover	0=no clouds, 1=<25%, 2=25-50%, 3=50-75% 4=75-100%
Wind Direction	Use Cardinal and Semi-cardinal Headings (ex. NW, S, SE)
Wind Speed	Use MPH as read from Wind Meter
Weather	1=fair/Sunny, 2=partly cloudy, 3=cloudy, 4=rain, 5=snow, 6 =fog

Site FB-3 SEAWANHAKA YACHT CLUB PSTP OUTFALL

DATE	TIME	WATER TEMPERATURE			SALINITY			PH			DISSOLVED OXYGEN			% SATURATION			DEPTH		BACTERIA		CONDITIONS										PERSONNEL			NOTES
		Top 0.5m	1.0 m	0.5 m from BTM	Top	1.0m	btm	Top	1.0m	0.5m from Btm	Top	1.0m	Btm	Top	1.0m	Btm	Secchi (m)	Sea floor (m)	Fecal Coli-form	Enter o-cocci	Air Tem p (°C)	Rain in 24hr s	Tidal Stag e	Wate r Color	Sur-face	Clou d Cov er	Wind Dir	Wind m/s	Weat her	Wave Ht	Data by	Capt	Lead	
5/3/22	9:30	11.5	11.5	10.8	NS	NS	NS	8.3	8.3	8.3	9.7	9.8	9.8	103.9	105.0	103.4	1.4	6.4	<1	<1	11.7	1	4	5	6	4	N	12.0	3	0.2	ES	DM		
5/16/22	9:55	14.4	14.4	13.9	NS	NS	NS	NS	NS	NS	9.0	9.2	9.5	102.3	106.5	107.7	1.8	6.2	4	1	22.0	0	4	5	6	4	NW	6.0	3	0.0	NH	DM		
5/31/22	8:58	18.7	18.6	17.8	26.0	25.9	26.0	7.9	7.9	7.9	8.1	8.2	8.2	100.3	101.8	100.3	1.8	4.6	<1	<1	26.0	0	4	5	6	1	E	9.0	1	0.0	NH	DM		
6/13/22	9:47	18.5	18.4	17.7	25.6	25.6	25.7	7.8	7.8	7.7	7.6	7.7	7.5	94.6	95.7	92.0	1.2	5.4	2	<1	24.0	1	4	1	6	0	W	5.0	1	0.0	RK	DM		
6/28/22	9:45	19.5	19.2	19.0	26.1	26.1	26.1	7.8	7.8	7.7	6.8	6.9	6.7	86.4	86.6	84.0	1.3	5.8	24	1	19.0	3	4	5	6	1	N	5.0	2	0.0	EA	DM		
7/11/22	10:30	22.1	21.9	21.2	26.7	26.7	26.7	7.9	7.9	7.7	7.2	6.9	6.2	96.9	91.9	81.5	1.6	6.4	<1	<1	23.9	0	1	3	6	0	SW	6.0	1	0.0	LP	DM		
7/25/22	9:15	24.9	24.8	24.3	26.9	26.9	27.0	7.8	7.8	7.8	6.0	6.1	5.9	85.0	86.3	82.8	1.2	7.4	1	<1	31.0	0	4	3	6	3	SW	12.0	3	<0.2	LD	DM		
8/8/22	10:00	25.0	24.9	24.6	27.5	27.4	27.5	7.6	7.6	7.4	5.9	5.7	5.2	84.3	80.4	70.0	2.0	6.7	2	7	28.3	3	2	5	6	1	SW	8.0	1	0.0	LD	DM		
8/22/22	9:26	23.9	23.9	23.9	27.9	27.9	27.9	7.6	7.6	7.6	5.7	5.7	5.8	80.3	79.4	80.0	1.6	6.9	<1	<1	22.8	0	1	5	3	4	SE	6.0	3	0.0	LD	DM		
9/8/22	9:56	23.4	23.4	23.3	28.6	28.6	28.7	7.6	7.6	7.6	5.0	4.9	4.8	69.9	68.2	66.4	2.0	5.3	8	2	21.0	1	4	4	6	2	NE	12.0	2	0.5	ES	DM		
9/23/22	9:32	21.9	21.9	21.9	28.2	28.4	28.4	7.8	7.8	7.8	7.3	6.9	6.8	98.3	93.6	91.2	1.2	2.9	1	1	12.0	3	4	5	6	1	NW	18.0	2	0.5	ES	DM		
10/6/22	9:57	16.6	16.7	16.8	28.0	28.0	28.2	8.0	8.0	8.0	7.5	7.5	7.5	91.4	91.9	91.2	3.0	5.1	5	<1	16.0	2	2	3	4	0	NW	5.0	1	0.0	AR	DM		
10/18/22	9:44	17.1	17.1	17.0	28.3	28.3	28.3	8.0	8.0	8.0	8.5	8.4	8.4	104.4	103.8	103.6	3.0+	5.3	3	<1	10.0	1	2	5	6	2	W	9.0	2	0.3	ES	DM		

LT - Low Tide	**NS - No Sensor**
TS - Too Shallow	

Rainfall in previous 24 hours	0=none, 1=light, 2=moderate, 3=heavy
Tidal Stage	1=high slack, 2=ebbing/falling, 3=low, slack, 4=flooding rising
Water color	1=brown, 2=red brown, 3=green, 4=yellow brown, 5=green brown
Surface Conditions	1=algal bloom, 2=oil slick, 3=foam, 4=dead fish, 5=debris, 6=other
Cloud Cover	0=no clouds, 1=<25%, 2=25-50%, 3=50-75% 4=75-100%
Wind Direction	Use Cardinal and Semi-cardinal Headings (ex. NW, S, SE)
Wind Speed	Use MPH as read from Wind Meter
Weather	1=fair/Sunny, 2=partly cloudy, 3=cloudy, 4=rain, 5=snow, 6 =fog

Site FB-4 - OYSTER BAY COVE

DATE	TIME	WATER TEMPERATURE			SALINITY			PH			DISSOLVED OXYGEN			% SATURATION			DEPTH		BACTERIA		CONDITIONS										PERSONNEL			NOTES
		Top 0.5m	1.0 m	0.5 m from BTM	Top	1.0m	btm	Top	1.0m	0.5m from Btm	Top	1.0m	Btm	Top	1.0m	Btm	Secchi (m)	Sea floor (m)	Fecal Coli-form	Entero-cocci	Air Temp (°C)	Rain in 24hrs	Tidal Stage	Water Color	Sur-face	Cloud Cover	Wind Dir	Wind m/s	Weather	Wave Ht (m)	Data by	Capt	Lead	
5/3/22	9:07	11.6	11.6	11.5	NS	NS	NS	8.2	8.2	8.2	9.8	9.9	10.0	104.5	105.9	106.6	1.7	2.4	1	<1	11.0	1	4	5	6	4	NE	12.0	3	0.2	ES	DM		
5/16/22	9:40	15.2	14.7	14.2	NS	NS	NS	NS	NS	NS	9.0	9.3	9.4	102.7	107.1	107.6	1.8	2.8	3	<1	22.0	0	4	5	6	3	NW	6.0	2	0.0	NH	DM		
5/31/22	8:41	19.9	19.9	19.9	25.6	25.7	25.7	7.9	7.9	7.9	7.4	7.6	7.6	93.6	96.1	96.1	?	1.1	12	<1	26.0	0	3	5	6	1	E	9.0	1	0.0	NH	DM		
6/13/22	9:20	19.5	19.5	19.1	25.5	25.5	25.5	7.7	7.7	7.7	7.2	7.2	7.3	90.6	91.7	91.7	0.9	3.1	15	<1	24.0	1	4	1	6	1	NW	3.0	1	0.0	ES	DM		
6/28/22	9:07	20.1	20.0	20.1	25.7	25.7	25.8	7.7	7.7	7.7	7.8	6.8	6.8	87.0	87.5	87.5	1.1	2.6	26	<1	19.0	3	4	5	6	3	N	5.0	2	0.0	EA	DM		
7/11/22	9:49	22.8	22.5	22.1	26.6	26.6	26.6	7.8	7.8	7.7	6.7	6.7	6.8	91.4	90.5	90.8	1.2	3.4	<1	<1	24.4	0	1	5	6	0	SW	6.0	1	0.0	LP	DM		
7/25/22	8:55	25.2	25.2	24.3	26.6	26.7	26.9	7.9	7.9	7.7	5.6	6.0	5.9	81.5	86.0	80.9	1.2	3.4	3	2	31.0	0	4	5	6	2	SW	11.0	1	0.0	LD	DM		
8/8/22	9:25	25.4	25.5	24.9	27.4	27.3	27.4	7.7	7.7	7.4	5.0	5.0	5.1	72.8	72.3	69.1	1.8	3.6	7	1	28.3	3	2	5	6	2	SW	8.0	2	0.0	LD	DM		
8/22/22	9:00	24.0	24.1	24.1	27.7	27.7	27.8	7.5	7.5	7.5	5.0	5.0	5.3	69.4	70.4	73.7	1.3	3.5	5	<1	22.2	0	1	5	6	4	SE	5.0	3	0.0	LD	DM		
9/8/22	9:24	23.4	23.4	23.3	28.2	28.2	28.2	7.6	7.6	7.6	5.1	5.1	5.0	69.9	69.9	69.1	1.3	4.4	19	4	21.0	1	4	4	6	1	NE	12.0	2	0.5	ES	DM		
9/23/22	9:18	20.8	20.5	20.3	27.9	28.0	27.9	7.9	7.9	7.9	7.2	7.1	7.0	94.6	92.9	91.7	1.0	3.6	19	7	12.0	3	4	5	6	1	NW	19.0	2	0.9	ES	DM		
10/6/22	9:38	15.6	15.6	15.6	26.7	26.9	27.3	8.0	8.0	8.0	8.0	7.9	7.9	94.3	93.7	94.1	3.1	4.1	15	2	15.0	2	2	3	6	0	NW	6.0	1	0.0	AR	DM		
10/18/22	9:25	16.4	16.4	16.5	27.6	27.6	27.6	8.0	8.0	8.0	8.8	8.8	8.8	106.7	106.3	106.3	2.8+	3.6	1	<1	10.0	1	2	5	6	2	W	9.0	2	0.3	ES	DM		

LT - Low Tide	**NS - No Sensor**
TS - Too Shallow	

Rainfall in previous 24 hours	0=none, 1=light, 2=moderate, 3=heavy
Tidal Stage	1=high slack, 2=ebbing/falling, 3=low, slack, 4=flooding rising
Water color	1=brown, 2=red brown, 3=green, 4=yellow brown, 5=green brown
Surface Conditions	1=algal bloom, 2=oil slick, 3=foam, 4=dead fish, 5=debris, 6=other
Cloud Cover	0=no clouds, 1=<25%, 2=25-50%, 3=50-75% 4=75-100%
Wind Direction	Use Cardinal and Semi-cardinal Headings (ex. NW, S, SE)
Wind Speed	Use MPH as read from Wind Meter

Site FB-5 - OYSTER BAY STP OUTFALL AT WHITES CREEK

DATE	TIME	WATER TEMPERATURE Top 0.5m	WATER TEMPERATURE 1.0 m	WATER TEMPERATURE 0.5 m from BTM	SALINITY Top	SALINITY 1.0m	SALINITY btm	PH Top	PH 1.0m	PH 0.5m from Btm	DISSOLVED OXYGEN Top	DISSOLVED OXYGEN 1.0m	DISSOLVED OXYGEN Btm	% SATURATION Top	% SATURATION 1.0m	% SATURATION Btm	DEPTH Secchi (m)	DEPTH Sea floor (m)	BACTERIA Fecal Coli-form	BACTERIA Enter o-cocci	CONDITIONS Air Temp (°C)	CONDITIONS Rain in 24hrs	CONDITIONS Tidal Stage	CONDITIONS Water Color	CONDITIONS Sur-face	CONDITIONS Cloud Cover	CONDITIONS Wind Dir	CONDITIONS Wind m/s	CONDITIONS Weather	CONDITIONS Wave Ht (m)	PERSONNEL Data by	PERSONNEL Capt	PERSONNEL Lead	NOTES
5/3/22	8:20	11.5	11.5	TS	NS	NS	NS	8.2	8.2	TS	9.6	9.7	TS	103.0	103.8	TS	1.3	1.8	<1	<1	10.6	1	4	5	6	4	N	6.0	3	0.2	ES	DM		
5/16/22	9:20	15.0	14.9	14.4	NS	NS	NS	NS	NS	NS	9.0	9.2	9.4	104.9	106.7	108.1	1.9	2.8	9	<1	22.0	0	4	5	6	2	NW	6.0	1	0.0	NH	DM		
5/31/22	8:25	18.8	18.6	18.5	25.8	25.8	25.9	7.9	7.9	7.9	8.0	8.1	8.1	98.3	100.5	100.2	1.1	1.8	14	<1	26.0	0	3	5	6	1	E	9.0	1	0.0	NH	DM		
6/13/22	8:55	19.7	19.2	18.9	25.6	25.5	25.5	7.7	7.7	7.6	7.1	7.3	6.9	91.4	91.6	86.1	1.1	3.4	3	2	22.0	1	4	1	6	0	NW	4.0	1	0.0	RK	DM		
6/28/22	8:57	23.0	20.3	20.2	25.8	25.8	25.8	7.8	7.8	7.7	7.1	7.0	6.9	90.7	89.9	88.4	1.1	3.1	6	1	18.0	3	4	5	6	3	N	5.0	2	0.0	EA	DM		
7/11/22	9:35	22.1	22.1	21.8	26.4	26.5	28.6	7.7	7.7	7.6	5.9	5.5	5.5	78.9	74.4	72.0	1.0	4.2	3	2	23.9	0	1	3	6	0	SW	6.0	1	0.0	LP	DM		
7/25/22	8:34	24.7	24.7	22.6	26.7	26.7	27.3	7.8	7.8	7.6	5.1	5.7	4.9	74.4	80.5	66.5	1.5	3.8	9	4	28.0	0	4	5	6	2	SW	12.0	2	0.0	LD	DM		
8/8/22	8:45	25.0	25.0	24.7	27.3	27.3	27.4	7.5	7.5	7.4	5.0	4.9	5.5	71.0	69.2	75.3	2.0	3.4	5	12	27.8	3	1	5	6	4	SW	8.0	2	0.0	LD	DM		
8/22/22	8:40	24.1	24.1	24.0	27.7	27.7	27.7	7.6	7.6	7.5	5.1	5.1	5.6	71.8	71.4	76.5	1.8	3.7	<1	6	22.2	0	4	5	6	4	SE	3.0	3	0.0	LD	DM		
9/8/22	9:08	23.3	23.3	23.3	28.2	28.2	28.2	7.6	7.6	7.6	5.5	5.4	5.0	76.4	74.0	69.1	2.9	3.9	16	1	20.0	1	4	4	6	1	NE	12.0	2	0.5	ES	DM		
9/23/22	9:02	20.7	20.7	20.7	28.1	28.0	28.0	7.8	7.8	7.8	7.0	7.0	6.9	92.8	91.9	90.5	1.2	3.8	46	7	12.0	3	4	5	6	1	NW	15.0	2	0.6	ES	DM		
10/6/22	9:28	15.6	15.6	15.6	27.1	27.1	27.4	8.0	8.0	7.9	7.8	7.8	7.8	92.5	92.6	92.2	3.0	4.1	12	6	15.0	2	4	3	6	0	NW	6.0	1	0.0	AR	DM		
10/18/22	9:12	16.8	16.9	17.2	27.8	28.0	28.1	8.0	8.0	8.0	8.4	8.4	8.4	103.0	102.5	103.1	3.0+	3.3	11	6	10	1	2	5	6	2	W	9.0	2	0.2	ES	DM		

LT - Low Tide	NS - No Sensor
TS - Too Shallow	

Rainfall in previous 24 hours	0=none, 1=light, 2=moderate, 3=heavy
Tidal Stage	1=high slack, 2=ebbing/falling, 3=low, slack, 4=flooding rising
Water color	1=brown, 2=red brown, 3=green, 4=yellow brown, 5=green brown
Surface Conditions	1=algal bloom, 2=oil slick, 3=foam, 4=dead fish, 5=debris, 6=other
Cloud Cover	0=no clouds, 1=<25%, 2=25-50%, 3=50-75% 4=75-100%
Wind Direction	Use Cardinal and Semi-cardinal Headings (ex. NW, S, SE)
Wind Speed	Use MPH as read from Wind Meter
Weather	1=fair/Sunny, 2=partly cloudy, 3=cloudy, 4=rain, 5=snow, 6 =fog

Site FB-6 BEEKMAN BEACH

DATE	TIME	WATER TEMPERATURE			SALINITY			PH			DISSOLVED OXYGEN			% SATURATION			DEPTH		BACTERIA		CONDITIONS										PERSONNEL			NOTES
		Top 0.5m	1.0 m	0.5 m from BTM	Top	1.0m	btm	Top	1.0m	0.5m from Btm	Top	1.0m	Btm	Top	1.0m	Btm	Secchi (m)	Sea floor (m)	Fecal Coli-form	Enter o-cocci	Air Temp (°C)	Rain in 24hrs	Tidal Stage	Water Color	Sur-face	Cloud Cover	Wind Dir	Wind m/s	Weather	Wave Ht (m)	Data by	Capt	Lead	
5/3/22	7:40	11.6	11.7	11.7	NS	NS	NS	8.3	8.3	8.2	9.7	9.6	9.7	103.2	103.6	104.4	1.3	3.7	15	<1	11.0	1	4	5	6	4	NNE	11.0	3	0.3	ES	DM		
5/16/22	9:00	15.7	15.6	15.3	NS	NS	NS	NS	NS	NS	9.2	9.5	9.6	108.8	111.6	111.6	1.1	4.7	9	<1	19.0	0	4	5	6	2	NW	4.0	1	0.0	NH	DM		
5/31/22	7:54	20.0	19.8	19.1	25.7	25.8	25.7	7.9	7.9	7.8	7.8	8.0	7.8	98.9	100.8	97.6	1.5	3.6	4	<1	25.0	0	3	5	6	1	E	8.0	1	0.0	NH	DM		
6/13/22	8:15	20.5	20.5	19.9	25.0	25.2	25.4	7.7	7.7	7.7	7.5	7.7	7.5	96.5	99.5	96.1	0.9	4.9	13	2	22.0	1	4	1	6	0	NW	5.0	1	0.0	A?	DM		
6/28/22	8:00	21.2	21.2	21.1	25.4	25.4	25.5	7.9	7.9	7.8	7.3	7.3	7.2	95.0	95.4	92.9	1.8	3.7	10	1	18.0	3	4	1	6	3	N	5.0	3	0.0	ES	DM		
7/11/22	8:35	22.7	22.7	22.1	26.4	26.4	26.4	7.7	7.7	7.6	5.9	6.9	5.5	79.4	93.4	73.7	1.1	5.6	3	<1	21.1	0	4	5	6	0	SW	6.0	1	0.0	LP	DM		
7/25/22	7:50	25.8	25.7	24.7	26.7	26.7	26.7	7.9	7.9	7.6	6.0	6.4	5.6	88.6	92.4	77.3	1.1	4.9	4	3	27.2	0	4	5	6	2	SW	11.0	2	0.0	LD	DM		
8/8/22	7:38	25.7	25.6	24.9	27.1	27.2	27.4	7.7	7.6	7.5	5.1	4.8	4.3	73.9	68.3	60.4	1.5	4.7	10	6	26.7	3	4	5	-	0	SW	8.0	1	0.0	LD	DM		
8/22/22	7:40	24.7	24.7	24.7	27.5	27.6	27.6	7.8	7.9	8.2	6.2	6.2	6.2	87.9	88.0	87.0	1.7	1.9	5	2	21.7	0	4	5	6	4	SE	3.0	3	0.0	LD	DM		
9/8/22	8:27	22.0	23.5	23.3	26.9	28.0	28.0	7.7	7.6	7.6	5.7	5.6	5.2	75.5	76.9	71.4	0.5	6.0	170	33	19.4	1	4	4	6	3	NE	8.0	2	0.5	ES	DM		
9/23/22	7:35	21.6	21.6	21.6	27.9	27.9	27.9	7.7	7.7	7.7	6.8	6.5	7.1	90.9	87.3	94.5	1.3	3.4	24	21	12.0	3	4	5	6	1	NW	16.0	1	0.5	ES	DM		
10/6/22	8:32	14.8	14.8	15.1	26.8	26.8	27.1	7.9	7.9	7.9	7.9	7.9	7.8	92.2	92.3	91.5	2.9	5.7	9	2	16.0	2	4	3	6	0	NW	5.0	1	0.0	AR	DM		
10/18/22	8:29	16.9	17.1	17.1	27.5	27.8	28.0	8.0	8.0	7.9	8.4	8.3	8.4	102.3	102.2	103.6	3.6	5.5	17	14	9.0	1	2	5	6	4	W	8.0	3	0.5	ES	DM		

LT - Low Tide	**NS - No Sensor**
TS - Too Shallow	

Rainfall in previous 24 hours	0=none, 1=light, 2=moderate, 3=heavy
Tidal Stage	1=high slack, 2=ebbing/falling, 3=low, slack, 4=flooding rising
Water color	1=brown, 2=red brown, 3=green, 4=yellow brown, 5=green brown
Surface Conditions	1=algal bloom, 2=oil slick, 3=foam, 4=dead fish, 5=debris, 6=other
Cloud Cover	0=no clouds, 1=<25%, 2=25-50%, 3=50-75% 4=75-100%
Wind Direction	Use Cardinal and Semi-cardinal Headings (ex. NW, S, SE)
Wind Speed	Use MPH as read from Wind Meter
Weather	1=fair/Sunny, 2=partly cloudy, 3=cloudy, 4=rain, 5=snow, 6 =fog

Site FB-7 - MILL NECK CREEK SOUTH

DATE	TIME	WATER TEMPERATURE			SALINITY			PH			DISSOLVED OXYGEN			% SATURATION			DEPTH		BACTERIA		CONDITIONS										PERSONNEL			NOTES
		Top 0.5m	1.0 m	0.5 m from BTM	Top	1.0m	btm	Top	1.0m	0.5m from Btm	Top	1.0m	Btm	Top	1.0m	Btm	Secchi (m)	Sea floor (m)	Fecal Coli-form	Enter o-cocci	Air Temp (°C)	Rain in 24hrs	Tidal Stage	Water Color	Sur-face	Cloud Cover	Wind Dir	Wind m/s	Weather	Wave Ht (m)	Data by	Capt	Lead	
5/3/22	11:25	13.4	TS	TS	NS	NS	NS	8.1	TS	TS	9.1	TS	TS	100.1	TS	TS	0.8	1.2	7	<1	13.0	1	4	5	6	4	NE	12.0	3	0.2	ES	DM		
5/16/22	TS	TS	TS	TS	NS	NS	NS	NS	NS	NS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS		0	4	5		2			1		NH	DM		
5/31/22	10:16	21.9	TS	TS	25.2	TS	TS	7.8	TS	TS	7.5	TS	TS	99.1	TS	TS		0.9	18	<1	30.0	0	4	5	6	1	SE	10.0	1	0.0	NH	DM		
6/13/22	12:28	21.5	21.1	TS	24.9	25.3	TS	7.6	7.6	TS	7.0	7.6	TS	93.2	98.6	TS	0.6	7.9	320	1	22.0	1	2	1	6	3	W	5.0	3	0.0	ES	DM		
6/28/22	12:18	22.6	22.5	TS	24.6	24.9	TS	7.6	7.6	TS	6.8	6.8	TS	90.4	90.7	TS	0.6	1.9	110	3	23.0	3	4	5	6	1	N	3.0	1	0.0	AV	DM		
7/11/22	7:40	24.1	TS	TS	25.8	TS	TS	7.6	TS	TS	5.5	TS	TS	75.7	TS	TS	0.8	1.5	63	46	21.1	0	4	5	6	0	SW	3 - 4	1	0.0	LP	DM		
7/25/22	11:05	27.3	27.2	TS	25.7	26.1	TS	7.9	7.9	TS	6.4	6.6	TS	95.7	97.5	TS	0.7	1.9	50	19	29.0	0	2	5	6	4	SW	13	3	0.0	LD	DM		We took accurate time. Nb the time on the handheld is 10" f
8/8/22	12:10	TS	TS	27.9	TS	TS	27.0	TS	TS	7.7	TS	TS	6.4	TS	TS	94.1	0.6	1.0	41	15	30.6	3	2	3	6	1	SW	9	1	0.0	LD	DM		
8/22/22	11:30	25.8			26.4	27.1	27.1	7.6	7.5	7.5	4.8	4.9	4.9	69.3	68.4	68.4	0.7	1.3	43	3	23.3	0	2	5	6	4	SE	6	3	0.0	LD	DM		
9/8/22	12:26	22.7	TS	TS	26.3	TS	TS	7.5	TS	TS	4.6	TS	TS	62.1	TS	TS	0.7	1.0	350	20	22.0	1	2	4	6	1	NE	10	2	0.3	ES	DM		
9/23/22	10:43	18.8	18.8	TS	25.7	25.8	TS	7.7	7.7	TS	6.5	6.4	TS	84.2	80.7	TS	0.7	1.8	84	16	13.0	3	2	5	6	1	NW	19	1	0.2	ES	DM		
10/6/22	11:46	14.7	TS	14.9	25.1	TS	26.3	7.7	TS	7.7	7.4	TS	7.4	84.7	TS	85.5	1.0	1.5	90	9	19.0	2	4	3	6	0	NW	5	1	0.0	AR	DM		
10/18/22	7:52	16.5	16.7	TS	25.7	26.4	TS	7.8	7.8	TS	7.6	7.4	TS	90.6	89.4	TS	1.0	1.3	53	52	9.0	1	2	5	6	4	W	8	3	0.3	ES	DM		

LT - Low Tide	**NS - No Sensor**
TS - Too Shallow	

Rainfall in previous 24 hours	0=none, 1=light, 2=moderate, 3=heavy
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Water color	1=brown, 2=red brown, 3=green, 4=yellow brown, 5=green brown
Surface Conditions	1=algal bloom, 2=oil slick, 3=foam, 4=dead fish, 5=debris, 6=other
Cloud Cover	0=no clouds, 1=<25%, 2=25-50%, 3=50-75% 4=75-100%
Wind Direction	Use Cardinal and Semi-cardinal Headings (ex. NW, S, SE)
Wind Speed	Use MPH as read from Wind Meter
Weather	1=fair/Sunny, 2=partly cloudy, 3=cloudy, 4=rain, 5=snow, 6 =fog

Site FB-8 - MILL NECK CREEK NORTH

DATE	TIME	WATER TEMPERATURE Top 0.5m	WATER TEMPERATURE 1.0 m	WATER TEMPERATURE 0.5 m from BTM	SALINITY Top	SALINITY 1.0m	SALINITY btm	PH Top	PH 1.0m	PH 0.5m from Btm	DISSOLVED OXYGEN Top	DISSOLVED OXYGEN 1.0m	DISSOLVED OXYGEN Btm	% SATURATION Top	% SATURATION 1.0m	% SATURATION Btm	DEPTH Secchi (m)	DEPTH Sea floor (m)	BACTERIA Fecal Coli-form	BACTERIA Enter o-cocci	CONDITIONS Air Temp (°C)	CONDITIONS Rain in 24hrs	CONDITIONS Tidal Stage	CONDITIONS Water Color	CONDITIONS Sur-face	CONDITIONS Cloud Cover	CONDITIONS Wind Dir	CONDITIONS Wind m/s	CONDITIONS Weather	CONDITIONS Wave Ht (m)	PERSONNEL Data by	PERSONNEL Capt	PERSONNEL Lead	NOTES
5/3/22	11:07	12.7	12.7	TS	NS	NS	NS	8.1	8.1	TS	9.1	9.2	TS	99.0	100.6	TS	0.8	2.4	5	<1	13.0	1	4	5	6	4	ENE	12.0	3	0.2	ES	DM		
5/16/22	TS	TS	TS	TS	NS	NS	NS	NS	NS	NS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS		0	4	5		2			1		NH	DM		
5/31/22	10:06	21.4	TS	TS	25.4	TS	TS	7.8	TS	TS	7.5	TS	TS	98.1	TS	TS		0.9	8	<1	29.0	0	4	5	6	1	SE	9.0	1	0.0	NH	DM		
6/13/22	12:15	21.8	20.8	20.4	25.5	25.6	25.6	7.8	7.8	7.8	7.3	7.2	7.7	97.1	101.1	99.0	0.7	2.6	49	<1	23.9	1	2	1	6	1	WNW	5.0	2	0.2	ES	DM		
6/28/22	12:25	22.9	22.2	TS	25.4	25.5	TS	7.8	7.8	TS	7.0	7.2	TS	94.3	95.6	TS	1.0	2.1	21	1	23.0	3	4	5	6	1	N	3.0	1	0.0	A?	DM		
7/11/22	7:55	23.2	23.2	TS	26.1	26.2	TS	7.7	7.7	TS	6.1	6.1	TS	82.5	82.6	TS	0.8	1.8	14	10	21.1	0	4	5	6	0	SW	2.0	1	0.0	LP	DM		
7/25/22	11:15	27.4	27.2	26.7	26.1	26.2	26.4	8.0	7.9	7.9	6.6	6.9	6.4	98.4	101.2	94.1	0.9	1.9	16	<1	29.4	0	2	5	6	4	SW	12.0	3	0.0	LD	DM		
8/8/22		TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	LD	DM		
8/22/22	11:35	25.6	25.5	25.5	27.0	27.1	27.1	7.6	7.6	7.6	5.7	5.9	5.9	80.7	83.8	83.8	0.7	1.4	11	4	23.3	0	2	5	4/6	4	SE	6.0	3	0.0	LD	DM		1 dead fish
9/8/22	12:31	23.3	TS	TS	26.5	TS	TS	7.5	TS	TS	5.2	TS	TS	71.8	TS	TS	TS	1.0	56	2	22.0	1	2	4	6	1	NE	10.0	2	1.0	ES	DM		
9/23/22	10:52	21.2	21.1	TS	27.8	27.8	TS	7.8	7.8	TS	6.7	6.8	TS	89.6	90.1	TS	0.8	2.2	5	1	13.0	3	4	5	6	0	NW	19.0	1	0.2	ES	DM		
10/6/22	11:15	15.0	TS	15.2	26.2	TS	26.6	7.8	TS	7.8	7.7	TS	7.8	89.0	TS	90.4	0.9	1.6	20	3	19.0	2	2	3	6	0	NW	5.0	1	0.0	AR	DM		
10/18/22	8:02	16.3	16.7	TS	26.5	26.9	TS	7.9	7.9	TS	8.3	7.8	TS	99.6	94.6	TS	1.2	1.7	25	7	9.0	1	2	5	6	4	W	7.0	3	0.3	ES	DM		

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