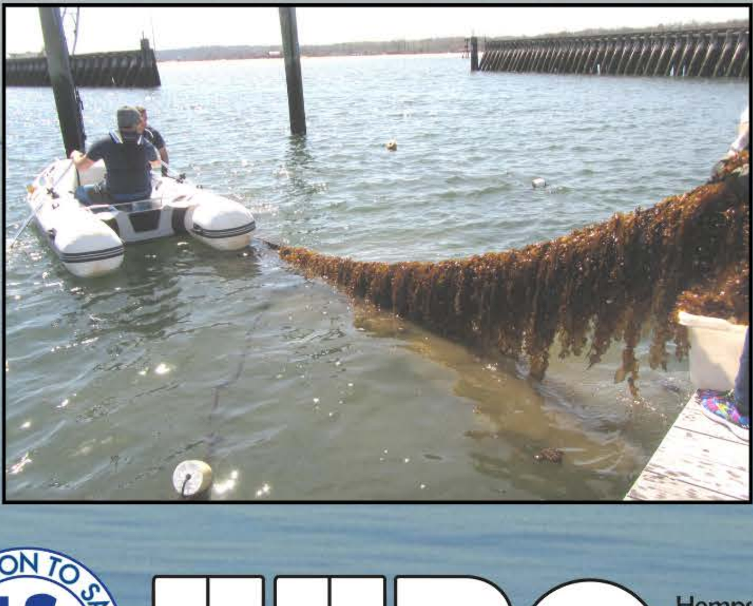
2022
Water-Quality Report
Hempstead Harbor

(Full Report, Including Appendices)



Coalition to Save Hempstead Harbor
Est. 1986

HHPC
Hempstead
Harbor
Protection
Committee

prepared by

COALITION TO SAVE
EST. 1986
HEMPSTEAD HARBOR

September 8, 2023

Cover Photos

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Acknowledgments

Environmental restoration and conservation require dedication, passion, patience, broad-based community support, and collaboration, as well as large infusions of technical expertise and funding. We therefore gratefully acknowledge the financial support and participation of all who have partnered with Coalition to Save Hempstead Harbor (CSHH) and the Hempstead Harbor Protection Committee (HHPC) to protect our local environment.

We especially thank the US Environmental Protection Agency (EPA), Long Island Sound Study Office; National Fish and Wildlife Foundation; Long Island Sound Futures Fund; NYS Department of Environmental Conservation; and Nassau County Soil and Water Conservation District for funds to support the Hempstead Harbor core regular-season and winter water-monitoring program.

We are grateful to all of the individuals who have helped us maintain our water-monitoring programs, including:

- CSHH volunteers;
- Members of local fishing clubs, local beach and marina managers, boaters and sailors, and other community members who report on harbor conditions;
- Town of Oyster Bay Department of Environmental Resources for staff assistance and use of its boat and Department of Parks for use of a Tappen Marina boat slip;
- Nassau County Department of Health (NCDH) staff members who facilitate and perform the lab analysis and data review of bacteria samples collected at up to 21 CSHH stations weekly in Hempstead Harbor; and
- Nassau County Department of Public Works staff.

This report was prepared by the

Coalition to Save Hempstead Harbor

with technical advisory review

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Introduction

About 30 years ago, the view of Hempstead Harbor was much different from what it is today. The harbor was suffering from air, water, and land-based problems that resulted from past industrial activities along its shores. These problems were the impetus for the formation of a citizens' activist group in 1986, the Coalition to Save Hempstead Harbor. CSHH established Hempstead Harbor's **Citizens Water-Monitoring Program** in 1992 and initially funded the program through membership support, grants from local foundations and businesses, and volunteer services. The program became widely recognized by other groups around Hempstead Harbor and Long Island Sound and quickly was able to garner support from local municipalities and government agencies.

As the program continued, positive changes were occurring not only on the landscape around the harbor, but also on the political landscape, as citizens and government learned to work collaboratively to achieve environmental goals. In 2006, the Hempstead Harbor Protection Committee, a municipal organization formed in 1995, was able to step up to fund the harbor's water-monitoring program through a Long Island Sound Study grant administered by the National Fish and Wildlife Foundation. The grant enabled the completion of an EPA-approved **Quality Assurance Project Plan** (QAPP) in 2006, which further enhanced the credibility of the monitoring program and enabled the HHPC to obtain future federal funds for the program. The QAPP was updated and approved by EPA in 2011 and 2014, and a new QAPP was completed and certified in 2019. An updated QAPP was approved in 2020.

During 2007, a copy of the QAPP, water-quality data, and other information from the water-monitoring program were requested for two separate shellfish-related projects. The information was used to help fill out the New York State Department of Environmental Conservation’s (DEC’s) data on the level of pathogens in Hempstead Harbor and to determine whether the harbor could be opened to shellfish harvesting in the near term.

The results of the DEC's rigorous water-quality testing showed that dramatic water-quality improvements had been achieved in Hempstead Harbor. On June 1, 2011, the efforts of all parties that worked for years to improve conditions in the harbor culminated in the **reopening of 2,500 acres of shellfish beds for harvesting** in the northern portion of the harbor–a success story that has been highlighted all around Long Island Sound and beyond.

Initiation of the Monitoring Program

By 1990, there had been a history of chronic sewage spills from the failing wastewater treatment plants that were sited along Hempstead Harbor’s shoreline. These spills along with cutbacks in Nassau County Department of Health's water-quality monitoring program were the factors that motivated CSHH to create a citizens water-monitoring program for Hempstead Harbor. The program was intended as a springboard for public education and outreach, to foster increased awareness of environmental issues, and to encourage public participation in local conservation efforts.

In the early 1990s, at the same time that CSHH developed the water-quality monitoring program for Hempstead Harbor, concerns about the health of Long Island Sound gained increased attention. CSHH recognized that the priorities established under the Long Island Sound Study's **Comprehensive Conservation and Management Plan** (CCMP) (1994) were the same priorities that had to be addressed for Hempstead Harbor, perhaps to a different extent. These priorities were low dissolved oxygen (hypoxia), toxic-substance contamination, pathogen contamination, habitat degradation, and floatable debris. Therefore, at the start, Hempstead Harbor's water-quality monitoring program included dissolved oxygen as a critical monitoring parameter.

CSHH worked hard to develop a credible water-testing program that could be relied on to indicate the health of the harbor. However, the primary purpose in establishing the program was to encourage all who live, work, and enjoy recreational activities around Hempstead Harbor to renew their interest in the harbor, as well as in Long Island Sound, and to participate in restoration efforts. An important component of the program since its start has been to involve citizens in observing changing conditions around the harbor and notifying CSHH as well as appropriate municipal and environmental agencies of any unusual events affecting the harbor.

Program Expansion

Over the years, the scope of the water-monitoring program has expanded, as has the network of partners that have supported it. The number of testing parameters and stations has increased to better address watershed issues.

Scudder's Pond in 2022 (l) and coir banks for stream and upper-pond restoration in 2014 (r) (photos by Carol DiPaolo, 10/25/22 and 3/11/14, respectively)

As described in later sections of this report, Scudder's Pond had been identified as a major contributor of bacteria to Hempstead Harbor through stormwater runoff. In 2009, in anticipation of restoration work planned for the pond to mitigate the effects of stormwater runoff, two new monitoring stations were established (CSHH #15A and #15B). The stations are located at the weir that drains water from the pond directly to the harbor and at the outfall across the road that carries pond water as well as runoff from the larger area around the pond. At the same time, a new station was also established at the powerhouse drain outfall (CSHH #14A), which had been identified as the second largest contributor of bacteria to the harbor.

The years of monitoring these stations established a baseline of bacteria levels that occur from May to November. In 2013, the program was expanded to include winter monitoring (November to May) of the pond and powerhouse outfalls. Monitoring these outfalls during the winter has helped understand what happens to bacteria levels during the coldest months of the year. We were also able to examine changes in bacteria levels as construction work at the pond proceeded and following the completion of the restoration in June 2014. Although weekly winter monitoring for Scudder’s Pond ended in April 2016, samples are collected periodically to check on conditions as we continue the winter monitoring focusing on the powerhouse drain outfall.

In 2015, three new stations were established in the outer harbor for the regular monitoring season. These stations are located within or just beyond the boundaries of the certified shellfish beds of Hempstead Harbor and are important for obtaining more detailed information on water-quality conditions in this section of the harbor.

Municipal Watershed-Based Management

As CSHH continued its monitoring efforts, the nine municipalities that share jurisdiction over Hempstead Harbor recognized they also shared the harbor's water-quality problems but did not, individually, have the resources to tackle large harbor issues. It became increasingly evident that they needed a mechanism to overcome the complexities of municipal boundaries and facilitate a more coordinated government approach to water-quality problems. In 1995, the Hempstead Harbor Protection Committee was created and became Long Island’s first watershed-based intermunicipal organization, specifically formed to protect and improve the water quality of Hempstead Harbor. CSHH became the first environmental organization to join the committee–as a nonvoting member and technical adviser.

HHPC first focused on abatement of stormwater runoff as it developed a comprehensive Hempstead Harbor Water-Quality Improvement Plan (1998). CSHH’s already-existing monitoring program was able to satisfy the plan's water-quality monitoring component. Also, in recognition of the need to balance the diverse uses of Hempstead Harbor, the HHPC secured a grant to prepare the Harbor Management Plan for Hempstead Harbor (2004), which was adopted by all nine HHPC municipalities.

CSHH and HHPC Profiles and Activities

The Coalition to Save Hempstead Harbor and the Hempstead Harbor Protection Committee continue to work closely together on improving Hempstead Harbor's water quality. Each organization has offered separate and valuable contributions to improving conditions around the harbor. At the same time, the two organizations illustrate the great successes that can result from creating valuable partnerships that can pool resources and maximize results to benefit the environment and local communities.

CSHH's Carol DiPaolo and HHPC's Eric Swenson join other LIS Citizens Advisory Committee members in Washington, DC, for Long Island Sound Day, 7/14/22

CSHH

CSHH's mission, to identify and eliminate environmental threats to Hempstead Harbor and surrounding communities, is longstanding. When CSHH first formed in 1986, it was in response to reports of continued degradation of Hempstead Harbor on a number of fronts. CSHH joined with other community members and successfully prevented a new mass-burn incinerator from being built on the harbor's western shore and shut down a failing incinerator that was operating on its eastern shore. CSHH sponsored the development of a townwide recycling plan for the Town of North Hempstead, offering a solution to problems of solid-waste management, and became a critical watchdog for the harbor as remediation plans were formulated to clean up contaminated sites.

As CSHH developed its Citizens Water-Monitoring Program, it also participated in the meetings and hearings that led to the completion of the Long Island Sound Study's Comprehensive Conservation and Management Plan (1994) and participated in the meetings leading up to the 2015 revision and update of that plan. (CSHH has been a member of the Long Island Sound Study's Citizens Advisory Committee since 1992 and served for three years as chair of its Communications Subcommittee; CSHH is currently a member of the Long Island Sound Study's Water Quality Monitoring Workgroup.)

During the early years of the Hempstead Harbor monitoring program (1996), CSHH initiated the creation of a soundwide network of environmental organizations and agencies who were conducting water-monitoring programs. This first Long Island Sound Water-

Monitoring Work Group provided a forum for reviewing current testing parameters, methodologies, and equipment used by members and for examining testing results in a broader context. Among the work group's achievements was completion of the **Long Island Sound Mapping Project** (July 1998), which mapped sites monitored around Long Island Sound and identified the agencies and other organizations responsible for testing at those sites. The project was funded through a grant awarded to CSHH, on behalf of the work group, by EPA/Long Island Sound Study.

In 1998, CSHH published ***Hempstead Harbor: Its History, Ecology, and Environmental Challenges***. The book supports the goals of the water-monitoring program, encouraging community members to learn about Hempstead Harbor's importance as a habitat for marine life and other species. It also describes the critical relationship between the ecology of the harbor and sound and the quality of life (and economy) of surrounding communities.

In 2000, CSHH became a partner in **EPA's Environmental Monitoring for Public Awareness and Community Tracking** (EMPACT) program. CSHH worked with the Marine Sciences Department of the University of Connecticut to maintain a telemetry link at the EMPACT website at www.MYSound.uconn.edu, so that water-quality data from Hempstead Harbor could be viewed on the web. (In 2005, the program was discontinued due to logistical problems and lack of funding.)

In 2001, CSHH received the prestigious **Clearwater Award**, announced by The Waterfront Center, a Washington, DC-based educational organization with worldwide membership. CSHH was commended for the scope of its activities in working to improve conditions in and around Hempstead Harbor. Particularly noted were CSHH's book (mentioned above) and the expansion of its water-monitoring program.

In 2002, CSHH was asked by the US EPA Long Island Sound Study Office to plan and coordinate a **Stormwater Workshop** to help prepare Long Island communities to meet the requirements of the EPA Phase II Stormwater Regulations. CSHH received a grant to host the workshop, which was cosponsored by the EPA Long Island Sound Office, Long Island Sound Study, and the New York Sea Grant Program.

In 2009, CSHH initiated a community work group to focus on development of a townwide land-preservation plan. A first step toward a broader land-use preservation plan was to determine the feasibility of a watershed-protection overlay district for Hempstead Harbor. The scope of the Glenwood Road/Powerhouse Drain Stormwater Pollution Abatement Plan (HHPC, 2013) was expanded to include this element. Also in 2009, CSHH became a member of the newly formed **Long Island Sound/New York State Sentinel Site Work Group** (a bistate–New York and Connecticut–approach to understanding climate-change indicators for Long Island Sound and selecting appropriate sites to measure them).

In 2013, CSHH was invited to participate in a project that would establish a report-card system to communicate the health of Long Island Sound. Hempstead Harbor and Norwalk Harbor were to have the first embayment report cards, serving as pilot projects to help launch a **soundwide report-card system**; both harbors have longstanding and credible water-quality monitoring programs and availability of long-term water-quality data.

Since 2016, CSHH has participated in the **Unified Water Study: Long Island Sound Embayment Research** (UWS). The goal of the study is to standardize testing parameters and operating procedures among groups monitoring bays and harbors around Long Island Sound so that a report card can be developed comparing ecological conditions in those bays. CSHH conducts the biweekly UWS program in Hempstead Harbor separate from the harbor's weekly core monitoring program.

In early 2018, CSHH was awarded a grant by Patagonia to spearhead a **habitat restoration project in Glenwood Landing** to raise community awareness of stormwater runoff problems that contribute bacteria and nitrogen to Hempstead Harbor. Local homeowners participating in the program reserved portions of their property to be planted with native plants to improve soil conditions and reduce runoff. This project concluded in 2020. Also in 2018, the New York State Outdoor Education Association (NYSOEA) recognized CSHH for its long-standing dedication to the ecological health of Hempstead Harbor and Long Island Sound, and CSHH became one of the recipients of **NYSOEA's Environmental Impact Award**.

In 2019, CSHH was awarded a grant from the Nassau County Soil and Water Conservation District (NCSWCD) for the **Tappen Marina monitoring program** in anticipation of a pilot project to raise seed clams in the marina. NCSWCD awarded grants to CSHH in 2020 and 2021 to continue the marina monitoring program. In July 2020, Town of Oyster Bay staff placed seed clams in floating upweller systems in the marina for the first aquaculture project in Hempstead Harbor; the program continued through 2022 and included oysters. In January 2022, Town of Oyster Bay began growing sugar kelp in Tappen Marina; CSHH established Tappen Marina testing stations to monitor water quality around the sugar kelp lines.

CSHH sponsors several shoreline cleanups each season. In September 2022, CSHH coordinated local activities as part of the **International Coastal Cleanup**, as it has for all

Volunteers for the CSHH Scudder's Pond Cleanup and International Coastal Cleanup (photos by Carol DiPaolo, 4/24/22, and 9/25/22, respectively) but three years since 1992. For 2022, however, the cleanup was expanded to be a harborwide cleanup. In 2020, in lieu of the International Coastal Cleanup, which was cancelled due to COVID-19, CSHH sponsored a month-long **harborwide "Clean-a-Thon."** In April 2011, CSHH organized an **emergency cleanup of plastic disks** accidentally released from an aeration tank at the Mamaroneck sewage treatment plant. The cleanup resulted in the collection of over 27,000 disks from five beaches around Hempstead Harbor and helped convince Westchester County to send crews to continue cleanup efforts (disks are still found occasionally during beach cleanups).

Hempstead Harbor spat-on-shell oysters ready to be planted (photo by Carol DiPaolo, 10/10/22)

In 2022, CSHH initiated the first **oyster gardening program** for Hempstead Harbor. Volunteers at three locations helped to maintain the cages that included a total of 30,000 spat-on-shell oysters. At the end of the season, half of the oysters were released to a DEC-approved spawner sanctuary in Cold Spring Harbor, and the other half were released in the newly CSHH-established conservation management area in Hempstead Harbor.

In response to the increase in development pressure around Hempstead Harbor, CSHH commissioned Sarah Meyland, MS, JD (a local aquifer expert), to prepare a 2022 report on the local drinking water supply, "**Water Supply Sustainability for Hempstead Harbor Communities."** The report is intended as a resource for regional land-use planning that recognizes Long Island's sole source aquifer as a limited resource and prioritizes water conservation.

For the 2022 regular monitoring season, CSHH collaborated with Dr. Luciana Santoferrara from Hofstra University, who had begun research on how microbial communities are affected by varying levels of dissolved oxygen. Hofstra students joined CSHH for a portion of the monitoring season to collect samples required for their research with Dr. Santoferrara.

CSHH continues to work with other environmental groups and agencies around Hempstead Harbor and Long Island Sound. CSHH has served on **advisory committees** formed to develop local revitalization plans for harbor communities (e.g., Glen Cove Creek Reclamation Committee, Glenwood Landing Steering Committee, Roslyn Waterfront Committee, Glen Cove Waterfront Citizens' Planning Committee, and Glen Cove Master Plan Task Force); **review committees** for restoration-plan proposals (e.g., Scudder's Pond Restoration Program and Glenwood Road/Powerhouse Drain Stormwater Pollution Abatement Plan); and **technical work groups** (e.g., Long Island Nitrogen Action Plan, Long Island Sound Nitrogen Reduction Strategy, and Long Island Pathogen TMDL Work Group).

HHPC

The idea for addressing Hempstead Harbor's water-quality issues on a harborwide basis was conceived in the mid-1990s by NYS Comptroller Tom DiNapoli (then-NYS Assemblyman) and former Sea Cliff Mayor Ted Blackburn.

In 1995, funds were sought and received from the NYS Department of State, and the Hempstead Harbor Protection Committee (Long Island's first intermunicipal watershed organization) was born. The funds were used to hire a part-time director and to hire coastal experts to prepare an in-depth **Hempstead Harbor Water Quality Improvement Plan** (completed in 1998). Each of the nine municipalities signed an intermunicipal agreement to work cooperatively and to contribute financially to the HHPC.

HHPC's municipal members include Nassau County, the Towns of Oyster Bay and North Hempstead, the City of Glen Cove, and the Villages of Sea Cliff, Roslyn Harbor, Roslyn, Flower Hill, and Sands Point. The committee accomplishes its mission to protect and improve the harbor's water quality through planning studies, capital-improvement projects, educational outreach, water-quality monitoring, information and technology sharing, development of model ordinances, coordination of enforcement, and working with other governmental agencies as well as environmental, educational, community, and business groups. HHPC's executive director serves on the Long Island Sound Study's Citizens Advisory Committee, the Board of Directors of the Nassau County Soil and Water Conservation District, and on the Board of Directors of Friends of Cedarmere, Friends of the Bay, and the Oyster Bay/Cold Spring Harbor Protection Committee. These ties and cooperative efforts save each municipality expenses and provide a coordinated approach to solving harbor problems and a year-round focus on harbor issues.

HHPC event display (photo by Eric Swenson, 10/6/19)

The HHPC prepared the **Scudder's Pond Subwatershed Plan** (2006) and had secured nearly $2.5 million toward the implementation of its recommendations, which began in November 2013 and was completed in June 2014. This subwatershed (located in Sea Cliff) had been identified as one of the most significant contributors of bacteria-laden stormwater runoff to the harbor. A similar study, the **Glenwood Road/Powerhouse Drain Pollution Abatement Plan** for the subwatershed in Glenwood Landing, was completed in December 2013.

In 2007, HHPC applied for federal **No Discharge Zone (NDZ)** designation for Hempstead Harbor; the US EPA approved the application on November 6, 2008. The NDZ designation affords the harbor the necessary legal basis to restrict boaters from discharging their wastes into the harbor and strengthens avenues for enforcement. On September 6, 2011, New York State, following Connecticut's example, banned vessel sewage discharges from its portion of Long Island Sound, including all harbors and bays, making the entire sound a no-discharge zone.

The HHPC has also established a website (www.HempsteadHarbor.org) and a Facebook page to serve as harbor resources. Other efforts have included the production of professional coastal interpretive signage; the production of a series of three television programs; the purchase of a portable display unit that is used at area fairs, festivals, libraries, and town and village halls; the installation of pet-waste stations around the harbor; and intermunicipal cleanups of debris in the harbor.

The HHPC was instrumental in expanding the harbor's designation as a NYS Significant Coastal Fish and Wildlife Habitat Area to encompass the entire harbor. It has also played a role in having harbor trails and land acquisition added to the state's Open Space Plan; having the harbor designated by the Long Island Sound Study as an inaugural "Long Island Sound Stewardship Site"; and having the harbor designated as part of Audubon New York's "Important Bird Areas of New York State." The HHPC has been a great success and has spawned the creation of other intermunicipal efforts, including the Manhasset Bay Protection Committee, Oyster Bay/Cold Spring Harbor Protection Committee, Northport Water Quality Protection Committee, and Peconic Estuary Protection Committee.

Since 1995, the HHPC has received over 25 grants, which have covered much of the committee's costs. The balance of the HHPC's budget (including monetary matches for the grants) is made up of annual dues received from the nine member municipalities.

In 2012, the HHPC received an Environmental Quality Award from the US EPA Region 2 for its efforts in improving water quality in Hempstead Harbor to the point where 2,500 acres of the harbor were reopened to shellfish harvesting for the first time in 45 years. Since the water-quality standards to support shellfish harvesting are the highest of all water-quality standards, this achievement unquestionably demonstrated the water-quality improvements that the HHPC was created to seek. In so doing, Hempstead Harbor also became the first major water body in New York State to achieve this status in several decades. The HHPC continues to work with others to achieve this for the remaining portions of the harbor.

For more information or to request a copy of this report contact:

Carol DiPaolo, Water-Monitoring Coordinator
Michelle Lapinel McAllister, Programs Director
Coalition to Save Hempstead Harbor
PO Box 159, Sea Cliff, NY 11579
Phone: 516-801-6792
E-mail: info@thecshh.org
www.coalitiontosavehempsteadharbor.org

Eric Swenson, Executive Director
Hempstead Harbor Protection Committee
29 Spring Street
Oyster Bay, NY 11771
Phone: 516-677-5921; Fax: 516-677-5875
E-mail: e.swenson@hempsteadharbor.org
www.HempsteadHarbor.org

1 Harbor Overview

Hempstead Harbor lies along the north shore of Long Island, bordering the western portion of Long Island Sound, between Manhasset Bay to the west and Oyster Bay to the east. The V-shaped harbor is about 5 miles long from mouth to head, and its shoreline extends about 14 miles from Prospect Point on the west at its mouth to Matinecock Point on the east. For the most part, the harbor presents a beautiful water body that is quiet and uncrowded, though it has widely mixed uses.

Industrial or commercial enterprises were historically concentrated in four areas along the harbor's shoreline. They remain currently, to a much lesser degree, in three areas of the harbor. The former industrial sites degraded the harbor's shorelines, wetlands, and water quality with the effects of oil and sewage spills, toxic contamination, stormwater runoff, air pollution, and industrial discharges. The worst of these effects were noted in the mid-1980s.

South view of Hempstead Harbor and east shore with National Grid property to the left and Gladsky Marine crane to the right (photo by Carol DiPaolo, 8/3/22)

Efforts to restore the harbor resulted in the closure of a landfill, two incinerators, and a sewage treatment plant (STP), as well as the remediation of numerous hazardous waste sites. These dramatic changes have helped to improve the harbor's water quality.

One sewage treatment plant (in Glen Cove) remains and in 2003 was upgraded, using a biological process to remove nitrogen from its discharge. In late 2006, an ultraviolet (UV) light disinfection system was installed to replace the chlorination system. In June 2009, after a backup generator was installed at the STP to make the UV system fully operational, the chlorine vats were emptied and CSHH ceased chlorine testing at the STP outfall, CSHH #8. The replacement of the chlorination system with the UV disinfection system offers a significant benefit for water quality because it removes the risks posed by chlorine by-products, which can have an adverse impact on marine life. (In 2008, Nassau County purchased the plant from the City of Glen Cove; in August 2020, Suez North America began operation of the Glen Cove plant and the two other county-owned plants. In January 2022, Suez was purchased by Veolia, a French transnational utility company.)

Wetland restoration projects have been expanded on the western shore of the harbor, south of the former Bar Beach Park, which is now part of the larger North Hempstead Beach Park. (In September 2007, Nassau County transferred ownership of the Hempstead Harbor Beach Park to the Town of North Hempstead, which merged it with the adjacent town-owned Bar Beach Park; in May 2008, the combined beaches were renamed North Hempstead Beach Park.) In 2015, the section of the trail along the western shore just south of the former Bar Beach was completed. By 2020 the trail was nearly two miles long. Work to restore Gerry Pond in Roslyn was completed in May 2021.

Starting point of the Hempstead Harbor shoreline trail and extension south along the western shoreline (above l and r) (photos by Carol DiPaolo, 5/20/15 and 9/16/20, respectively); new plantings installed by the Town of North Hempstead in 2019 (r) (photo by Kevin Braun, 10/22/19)

Despite the harbor's impaired condition during the 1980s, in 1987 New York State designated Hempstead Harbor a **Significant Coastal Fish and Wildlife Habitat** area, which included the upper portion of Hempstead Harbor, from Mott Point on the west to the Glen Cove breakwater on the east. Over the last 30 years, the harbor's ecosystem has vastly improved, containing a diversity of marine life and water birds. Wetland grasses have recovered a large portion of the lower harbor south of the North Hempstead Beach Park, once again providing a nursery and healthy habitat for marine species and bird populations. Reflecting Hempstead Harbor's dramatic turnaround, its designation as a Significant Coastal Fish and Wildlife Habitat was modified in October 2005 to include the lower portion of the harbor, extending south to the Roslyn viaduct.

By 2009, water quality had improved so dramatically in Hempstead Harbor that the results of water-quality testing undertaken by the NYS Department of Environmental Conservation (DEC) indicated that a portion of the outer harbor could be certified for shellfish harvesting. (The harbor had been restricted for shellfish harvesting for over 40 years.) The testing and regulatory process was completed in 2011, and on June 1, 2011, 2,500 acres of shellfish beds that form a band across the outer harbor were officially reopened for harvesting. In

2021, DEC closed 134 acres of shellfish beds adjacent to Prospect Point in the harbor, while certifying 6,150-acres in Long Island Sound, just beyond the mouth of the harbor (see *Section 3.8.6*).

Today, Hempstead Harbor continues to support many diverse uses and activities. Fuel is transported to the Glenwood Landing terminal (Global Partners LP) that is adjacent to a power plant that has operated since the early 1900s. Farther north, tugboats tow barges to and from a sand and gravel transfer station on the western shore of the harbor and into Glen Cove Creek, which flows from the harbor's eastern shore. In contrast to these commercial uses, the recreational uses continue to flourish and expand as the harbor's water quality improves. Marinas and yacht, sailing, rowing, and fishing clubs, which are concentrated in the middle portion of the harbor, are thriving. Town, city, village, and small private beaches are also located along the harbor's shore. As the harbor environment has continued to improve, there has been increased pressure to develop properties along the shoreline, which in time could exacerbate the problems that are currently being mitigated.

The Residences at Glen Harbor development close to completion on eastern shore of the harbor in Glenwood Landing (photo by Carol DiPaolo, 8/24/22)

These diverse and often competing interests must be balanced in planning for the future of Hempstead Harbor. The **Harbor Management Plan** for Hempstead Harbor (Hempstead Harbor Protection Committee, 2004) offers a comprehensive strategy for the municipalities that share jurisdiction over Hempstead Harbor to "work cooperatively to address issues related to the wise use and protection of the harbor's surface waters, natural resources, underwater lands, and shorefront." Environmental challenges and priorities that remain for the harbor include stormwater runoff abatement; reductions in bacteria and nitrogen levels; prevention of inappropriate land use and development, particularly along the shore; and continued remediation of contamination from former industrial activities.

2 Methods

It is difficult to draw direct relationships among all the variables that affect water quality, and this is the challenge presented every year in attempting to analyze the past season's water-quality data. The graphs presented in this report compare seasonal and long-term averages for various water-quality parameters. The data collected over the years are a critical resource as we look for trends that point to the health of Hempstead Harbor.

Addressing the areas that negatively affect the harbor's water quality is complicated. Some things are within our control–such as nitrogen discharges and other pollution from both point and nonpoint sources; other things, are not–such as rainfall and temperature. However, all of these factors have critical relationships that have an impact on the ecological health and human use of our waters, including swimming, fishing, and other recreational pursuits.

The data collected through the water-monitoring program help us understand the interrelationships that occur in Hempstead Harbor. This information enables us to work with others in addressing harborwide and soundwide issues, so that we can plan and implement best management practices to assure a healthy environment for the future.

2.1 Quality Assurance Plans

The first Quality Assurance Project Plan (QAPP) for the Hempstead Harbor Water-Quality Monitoring Program was completed in 2006. The QAPP documents the testing methods and quality assurance and quality control (QA/QC) procedures CSHH has implemented in the program. QAPP revisions were approved by the US Environmental Protection Agency (EPA), Region 2, to reflect changes in the program in 2011 and 2014. A new QAPP was completed and approved in early 2019 and again updated and approved in 2020.

The EPA approval of the QAPP broadens the use of the program's data by outside organizations, enables the program to receive federal funding for future monitoring efforts, reiterates CSHH's ongoing commitment to provide high-quality monitoring data for Hempstead Harbor, and demonstrates the reliability of the data presented in this and previous water-quality reports.

CSHH completed data usability assessment reports (DUARs) for 2017-2019 data, which were approved by NYS DEC. Data assessment reports were also completed for 2020-2022; see *Appendix E* for the most recent report.

2.2 Core Program

The core monitoring program for Hempstead Harbor encompasses weekly testing from May through October at stations established in the upper and lower harbor and in Glen Cove Creek. Also included are several shoreline stations; a few of these are part of the winter monitoring program, which currently focuses on the Powerhouse Drain Subwatershed.
The principal CSHH stations that are sampled weekly during the regular monitoring season for all program parameters are located between the former Bar Beach (now part of the 36.2-acre North Hempstead Beach Park) and Long Island Sound, as well as in Glen Cove Creek. Lower-harbor stations and others located close to the shoreline can be accessed only during high tide. See *Figures 1-2* for core-program station locations; see *Table 1* for the latitude/longitude points for the monitoring stations. Note that five core-program stations correspond to stations established for the Unified Water Study: Long Island Sound Embayment Research (UWS), as described at *Section 2.4,* and these are indicated in *Table 1*.

Aerial view of upper harbor, eastern shore, from right to left: Glen Cove Creek, Garvies Point, Morgan Park, Crescent Beach, and Matinecock Point in Glen Cove (photo by David North, 7/13/19)

2.2.1 Station Locations

Below is a list of CSHH stations for the core monitoring program.

Upper-harbor monitoring stations also include those by outfalls in Glen Cove Creek and near Scudder's Pond:

- CSHH #1, at Beacon 11 (between Tappen Beach Marina on the east shore and North Hempstead Beach Park on the west shore)
- CSHH #2, at Bell Buoy 6 (a stationary marker near the harbor mouth, east of Mott Point)
- CSHH #3, at the red channel marker C-1, at the mouth of Glen Cove Creek, between the Hempstead Harbour Club and Sea Cliff Beach
- CSHH #8, at the Glen Cove sewage treatment plant outfall pipe
- CSHH #9, outfall about 10 ft west of CSHH #8
- CSHH #10, outfall about 20 ft west of CSHH #8, at the end of the seawall
- CSHH #11, about 50 ft east of CSHH #8
- CSHH #12, about 100 ft east of CSHH #8, in the middle of the creek, north of the bend in the south seawall
- CSHH #13, 60 ft from the Mill Pond cement weir at the head of Glen Cove Creek
- CSHH #15, about 50 yds from Scudder's Pond outfall, near northwest corner of the Tappen Beach pool area
- CSHH #15A, at the Scudder's Pond/Littleworth Lane outfall, north of the Tappen Beach pool area
- CSHH #15B, at the Scudder's Pond weir on the east side of Shore Road
- CSHH #16, a central point in the outer harbor (corresponds with DEC shellfish monitoring station #24)

- CSHH #17, outside Crescent Beach restricted shellfish area across from white beach house
- CSHH #17A, within the Crescent Beach restricted area across from the stream that runs alongside the beach

Lower-harbor stations (except for CSHH #14A, which is tested from shore) are often inaccessible during low tides and are monitored less frequently:

- CSHH #4, north of the sand spit at North Hempstead Beach Park (south section)
- CSHH #5, at Mott's Cove
- CSHH #6, at a point east of the site of the former Town of North Hempstead incinerator, now the waste-transfer station
- CSHH #7, at the southernmost section of the harbor, near the east shore just before the walkway for Bryant Landing buildings (208 senior residential units) and just north of the Roslyn viaduct. (The former marker for this station was a portion of an old oil dock, which was removed during the construction of Bryant Landing buildings.)
- CSHH #14, about 50 yds west of the powerhouse outfall
- CSHH #14A, directly from the powerhouse outfall (may be mixed with harbor water at higher tide)

Aerial view of lower harbor, looking south, with Harry Tappen Beach on eastern shore and North Hempstead Beach Park north of the sandspit on western shore (photo by David North, 7/13/19)

Figure 1
Core-Program Station Locations

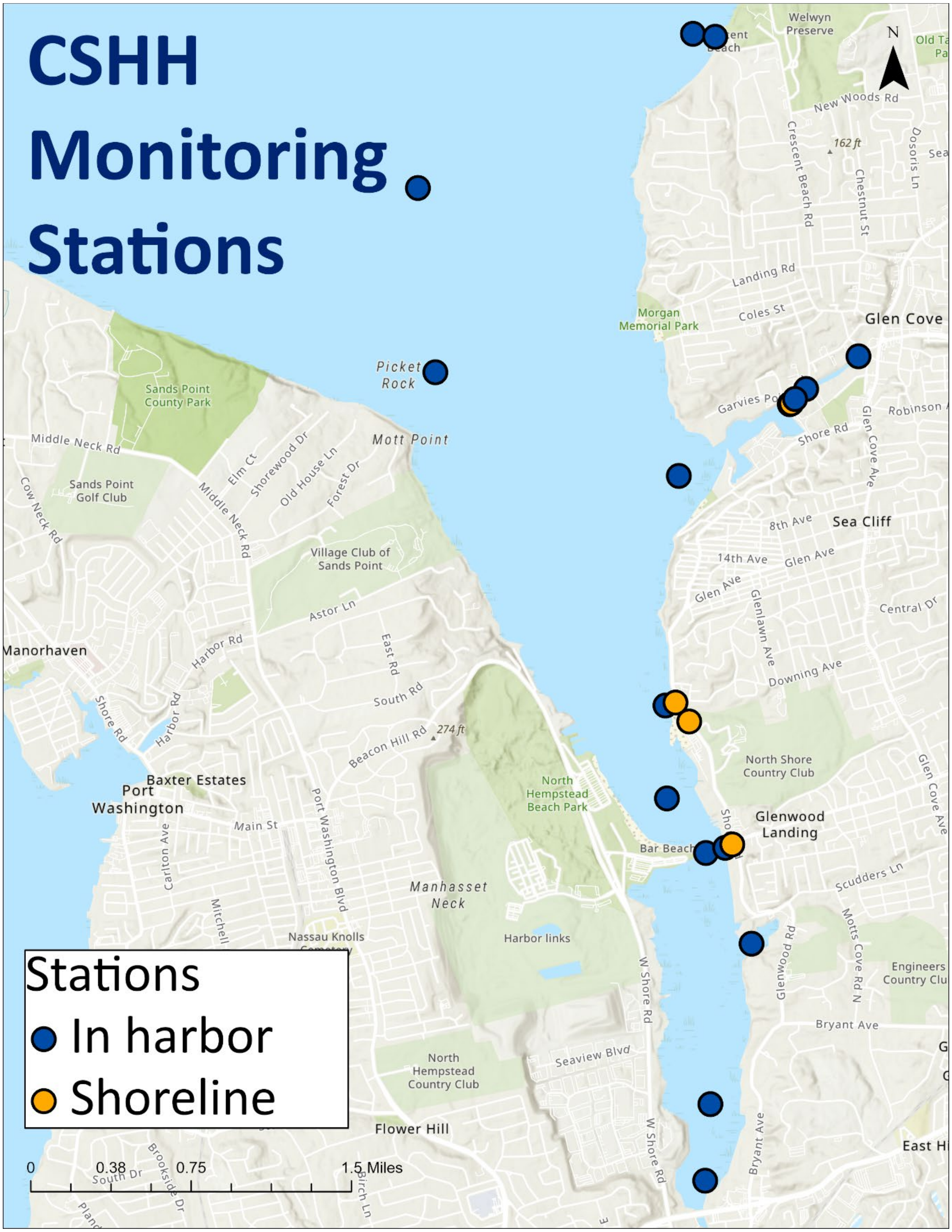


Figure 2
Station Locations for Harbor Sections and Glen Cove Creek

Table 1
Latitude/Longitude Points for Monitoring Stations (NAD 83 Datum)

Station ID	Latitude N	Longitude W
Upper-Harbor Stations		
CSHH #1, Beacon 11 (Corresponds to UWS station HEM-M-01)	40.83189	073.65353
CSHH #2, Bell 6 (Corresponds to UWS station HEM-O-04)	40.86099	073.67362
CSHH #3, red channel marker (Corresponds to UWS station HEM-M-03)	40.85373	073.65202
CSHH #8, adjacent to STP outfall pipe	40.85851	073.64191
CSHH #9, 10 ft west of #8	40.85850	073.64195
CSHH #10, 20 ft west of #8	40.85846	073.64203
CSHH #11, 50 ft east of #8	40.85881	073.64154
CSHH #12, 100 ft east of #8	40.85947	073.64054
CSHH #13, 60 ft from Mill Pond weir	40.86165	073.63583
CSHH #15, about 50 yds from Scudder's Pond outfall, north of Tappen Beach pool area	40.83820	073.65355
CSHH #15A, at outfall north of Tappen Beach pool	40.83837	073.65263
CSHH #15B, at Scudder's Pond weir	40.83709	073.65144
CSHH #16, north of Bell 6 (Corresponds to UWS station HEM-O-05)	40.87349	073.67493
CSHH #17, just outside the Crescent Beach restricted shellfish area (Corresponds to UWS station HEM-O-06)	40.88365	073.65016
CSHH #17A, inside Crescent Beach restricted shellfish area, just off shoreline	40.88343	073.64819
Lower-Harbor Stations		
CSHH #4, east of North Hempstead Beach Park (formerly Bar Beach) near sand spit	40.82815	073.65015
CSHH #5, Mott's Cove	40.82197	073.64619
CSHH #6, east of Port Washington transfer station	40.81114	073.65008
CSHH #7, west of Bryant Landing (formerly site of oil dock)	40.80596	073.65065
CSHH #14, about 50 yds from powerhouse drain outfall	40.82848	073.64840
CSHH #14A, at powerhouse drain outfall	40.82872	073.64776

2.2.2 Station Expansion

At the end of the 2004 monitoring season, CSHH #9, #10, #11, and #12 were added in the vicinity of the Glen Cove sewage treatment plant outfall (CSHH #8) (in Glen Cove Creek) specifically to provide additional samples for bacteria analysis by the Nassau County Department of Health (NCDH). These stations were added to track the frequency and source of unusual dry- and wet-weather flows that were noticed at discharge points west of the STP outfall and that, on testing, indicated high levels of bacteria; the four stations became a permanent part of the program in 2005.

CSHH #13 was also established to monitor bacteria levels at the head of the creek and became a permanent part of the program in 2007. In 2008, CSHH #13 was set at 60 feet west of the Mill Pond weir to avoid shifting the sampling location as access to the weir varied due to tidal cycles. Samples collected at CSHH #13 can help indicate whether the restoration of Mill Pond is curtailing bacteria inputs to Glen Cove Creek and indicates the effect of fresh water from the large outfall that drains Cedar Swamp Creek. (Construction on the north side of Glen Cove Creek and the increased number of barges near the head of the creek in 2018-2022 sometimes impaired access to CSHH #13.)

In 2009, the water-monitoring program was temporarily expanded to incorporate areas previously tested by the NYS Department of Environmental Conservation. Thirteen of the stations that were set up in 1988 as sampling points for DEC's shellfish growing area (SGA) #50 were reestablished, and five new stations were added. CSHH collected samples once or twice a week (depending on tidal cycles), and the samples were delivered to the DEC lab for analysis. The purpose of this sampling was to determine whether these areas of the harbor could be reopened for shellfish harvesting in addition to the areas in the outer harbor that were already being slated for reopening (in 2011). Unfortunately, the test results showed that all but two of the stations failed DEC shellfish standards on a regular basis. The stations that were monitored by CSHH in 2009 will not be monitored again for DEC until there are further water-quality improvements in areas of the mid- and lower harbor.

CSHH continues to collect samples at stations #14, #14A, #15, #15A, and #15B (established in 2009) for bacteria analysis by the NCDH (using water-quality standards for bathing beaches) as an alternative way to monitor discharges from the powerhouse outfall (#14 and #14A) and Scudder's Pond (#15 and #15A and B). Both subwatersheds were identified as the largest contributors of bacteria to Hempstead Harbor, and remediation plans were developed for both areas and implemented for Scudder's Pond (pond restoration was completed in June 2014). The samples collected established a benchmark of bacteria levels prior to restoration of the pond and allowed for comparison of levels during and following completion of restoration work. Similarly, samples collected from #14A, the large outfall at the bottom of Glenwood Road, have helped establish conditions prior to any construction or other measures that will be implemented to diminish stormwater runoff in this area.

In 2015, CSHH stations #16, #17, and #17A were added to the monitoring program to further evaluate the water quality in the outer harbor within the recertified shellfish harvesting area and in the restricted area just offshore of Crescent Beach.

CSHH #17A is offshore of the stream that flows alongside Crescent Beach and into Hempstead Harbor (photo by Carol DiPaolo, 5/18/22)

2.2.3 Frequency of Testing and Testing Parameters

Testing for the core Hempstead Harbor monitoring program includes the regular-season and winter-season testing. Testing for the regular season is conducted weekly from May through October, generally on the same day of the week and at the same time, starting at approximately 7 AM and typically continuing for five hours.

Beginning in 2013, weekly collection of water samples during the winter (November through April) was added to the monitoring program for CSHH #15A (outfall that drains from Scudder's Pond and Littleworth Lane, north of Tappen Beach pool), #15B (Scudder's Pond weir), and #14A (powerhouse outfall). The water samples are delivered to Nassau County Department of Health for bacteria analysis (fecal coliform and enterococci). This component of the monitoring program corresponded with the start of the restoration work (November 2013) at Scudder's Pond. (Phragmites removal, dredging of the pond bottom, installation of a new storm-water basin at Littleworth Lane to curtail future sedimentation of the pond, and planting of native plants were included in the restoration work, and the anticipated result was to diminish bacteria loading to Hempstead Harbor.) The winter monitoring continues; as of 2020, winter testing is conducted biweekly for bacteria and nitrogen. Beginning in 2018, winter sample collection has focused primarily on conditions at the Powerhouse Drain Subwatershed; samples from Scudder's Pond outfalls are collected periodically or after a heavy rain or snowfall.

For the regular monitoring season, CSHH collects water samples and conducts water-quality tests with the assistance of volunteers as well as municipal staff for boat transportation to sampling sites. Water samples are collected (weather and tidal cycles permitting) from up to 21 testing stations for bacterial analysis by the NCDH. In addition, tests for dissolved oxygen (DO), salinity, water temperature, pH, and turbidity are conducted weekly at CSHH #1-3, #8, #13, and #16-17 and less frequently at CSHH #4-7, #14 and #15, where access is limited by tidal cycles. Samples were collected for nitrite and nitrate analysis at the Town of Oyster Bay lab until 2016 when the facility closed. However, samples continued to be collected for onboard ammonia testing. In 2018, sample collection for nitrogen resumed, and samples were delivered to Pace Analytical Laboratory for analysis of nitrite, nitrate, and ammonia (onboard ammonia testing was eliminated). Starting in 2019, nitrogen samples were collected during the regular monitoring season on a biweekly basis from a select 10 stations and delivered to Pace Analytical Laboratory for analysis of nitrite, nitrate, ammonia, and total Kjeldahl nitrogen. A listing of core-program testing parameters, sampling locations, and analyses performed is presented in *Table 2*.

Physical observations are recorded regarding weather conditions, wind direction and velocity, water surface, air temperature, floatables, and wildlife and human activities. Whenever possible, floatable debris is retrieved and brought back to shore for disposal.

Dissolved oxygen (DO), salinity, water temperature, pH, and turbidity are recorded with an electronic meter. In 2017 to present, a Eureka Manta+ 35 multiparameter meter, which was provided to groups participating in the Unified Water Study for Long Island Sound Embayments (see *Section 2.4*), was used by CSHH also for the core Hempstead Harbor monitoring program. (The YSI ProPlus meter, used previously starting in 2014, is maintained as a backup instrument. The LaMotte 2020e portable turbidity meter, which had been used previously, is also maintained as a backup.) For the core program, the electronic meter is used starting at 0.5 meter and at 1-meter increments thereafter. At the first station that is monitored for the day (typically, CSHH #1), a replicate vertical profile is conducted as a quality-assurance check. To verify the meter readings, samples are tested from bottom for DO (using the Winkler titration method) and surface water for pH (using a LaMotte wide-range indicator test kit that uses a color comparator).

CSHH water-monitoring crew members (photos by Carol DiPaolo, 6/16/21, 6/2/21, 10/28/21, respectively)

The Eureka Manta+ 35 also measures chlorophyll a (Chl a), which is not a parameter required for the core Hempstead Harbor monitoring program but is a “Tier 1” parameter for the UWS. Because the same multiparameter meter is maintained and calibrated for both programs and monitoring events for the programs occur on consecutive days, Chl-a levels are recorded for the core program as merely a frame of reference (see *Section 3.6*).

Table 2
CSHH Monitoring-Program Parameters

Parameter	Location	Analyzer or Method	Location of Analysis
Dissolved oxygen	Vertical profile* at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Dissolved oxygen	One station for electronic meter validation	LaMotte 5860-01 (Winkler titration)	Field
Water temperature	Vertical profile at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Water temperature	One station for electronic meter validation	Calibrated electronic thermometer	Field
Air temperature	CSHH #1-14, 14A, 15, 15A, 15B, 16-17, and 17A	Calibrated electronic thermometer	Field
Salinity	Vertical profile at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
pH	Vertical profile at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
pH	One station for electronic meter validation	LaMotte 5858-01 test kit	Field
Turbidity	Vertical profile at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Water clarity	CSHH #1-8, 13, 14, 15, 16, and 17	LaMotte Secchi disk	Field
Chlorophyll a	Vertical profile at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Fecal coliform	Grab sample at half-meter depth or from outfall flow at CSHH #1-14, 14A, 15, 15A, 15B, 16-17, and 17A	Membrane filter, SM 9222 D-2006	Nassau County Department of Health
Enterococci	Grab sample at half-meter depth or from outfall flow at CSHH #1-14, 14A, 15, 15A, 15B, 16-17, and 17A	Membrane filter, EPA 1600	Nassau County Department of Health
Total Kjeldahl nitrogen	Grab sample at half-meter depth or from outfall flow at CSHH #1, 3, 6-8, 12-13, 14A, 15A, and 16	EPA 351.2, Rev. 2.0	Pace Analytical Services, LLC
Ammonia	Grab sample at half-meter depth or from outfall flow at CSHH #1, 3, 6-8, 12-13, 14A, 15A, and 16	EPA 350.1, Rev. 2.0	Pace Analytical Services, LLC
Nitrate	Grab sample at half-meter depth or from outfall flow at CSHH #1, 3, 6-8, 12-13, 14A, 15A, and 16	EPA 353.2, Rev. 2.0	Pace Analytical Services, LLC
Nitrite	Grab sample at half-meter depth or from outfall flow at CSHH #1, 3, 6-8, 12-13, 14A, 15A, and 16	EPA 353.2, Rev. 2.0	Pace Analytical Services, LLC
Precipitation	Village of Sea Cliff	Stratus Precision Rain Gauge (visually read)	Field

**Vertical profiles start at 0.5 m below surface followed by 1-meter increments.*

2.3 Tappen Marina Monitoring

The marina at Harry Tappen Beach Park is one of three marinas for which the Town of Oyster Bay (TOBAY) assembled and installed floating upweller systems (FLUPSYs) to raise clams and oysters. The two other marinas involved in the project are the Theodore Roosevelt Memorial Park marina and the TOBAY marina on the south shore. The Tappen Marina FLUPSYs represent the first-ever aquaculture project for Hempstead Harbor.

In 2019, the Coalition to Save Hempstead Harbor conducted a monitoring program for Tappen Marina under a grant awarded by the Nassau County Soil & Water Conservation District (NCSWCD). Two marina locations were monitored from May through October to gather baseline data for water-quality conditions and to determine whether discernible water-quality changes occur while seed clams are growing. Monitoring continued even though the FLUPSYs were not installed, due to an unexpected shortage of seed clams.

In 2020, despite the COVID-19 shutdown, CSHH monitored Tappen Marina as scheduled (under a second grant awarded by NCSWCD). Although challenges related to the COVID pandemic resulted in a reduction of FLUPSYs and seed clams that had been planned in Tappen Marina, the town was able to install four FLUPSYs in May; on July 31, 2020, two million seed clams were distributed among 36 barrels in three of the four FLUPSYs.

In 2021, CSHH continued monitoring Tappen Marina for purposes of the shellfish program from May through October. TOBAY's 2021 program expanded to include approximately 4.8 million seed clams, 20,000 larger clams, and 45,000 oysters. To accommodate seeding and growth needs, the town rotated shellfish in and out of Tappen Marina and moved two of the six FLUPSYs from R dock to S dock late in the season. The town continues to grow shellfish in Tappen Marina, but CSHH monitoring around the FLUPSYs concluded in 2021.

Monitoring near FLUPSYs (l), collecting water samples around kelp lines (c) and pulling kelp lines for harvesting (r) (photos by Carol DiPaolo, 6/16/21 and 4/13/22, respectively)

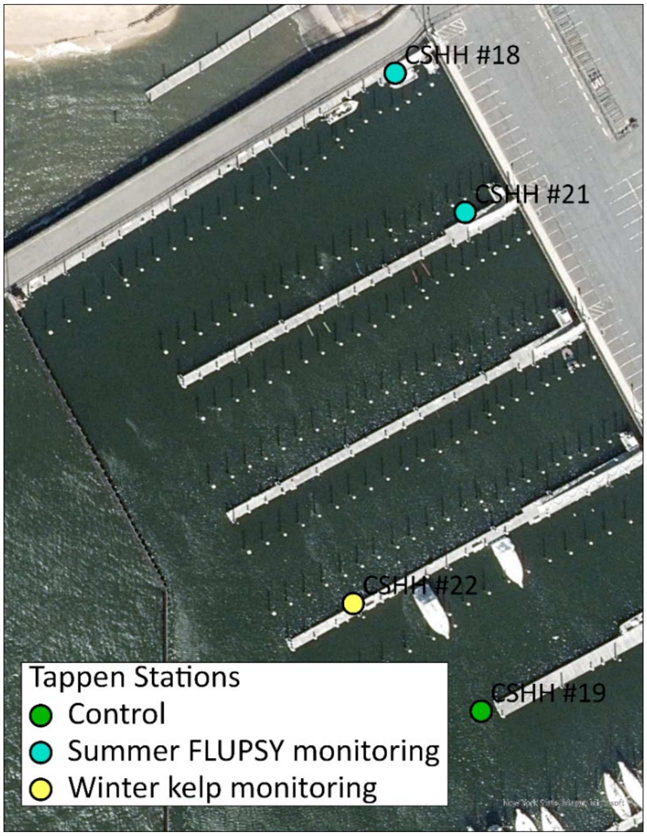
In December 2021, TOBAY installed sugar kelp lines in the three town marinas. CSHH added a monitoring component to the kelp growing sites in Tappen Marina that consisted of biweekly sample collection for nitrogen and bacteria from January to April 2022. Growing kelp in the winter provides similar water-quality benefits to those derived from growing clams and oysters in the summer; as kelp and shellfish grow, they take up nitrogen, which in excess is a known pollutant in marine waters. The kelp was harvested on April 13, dried, and then used as fertilizer on TOBAY golf courses.

2.3.1 Marina Station Locations

Sampling sites originally selected in 2019 in Tappen Marina were modified over the next monitoring seasons to accommodate changes to TOBAY's shellfish aquaculture program:

- In 2019, monitoring stations were established at CSHH #18 (S dock), #19 (end of service dock), and #20 (beginning of service dock), with CSHH #19 as a control station. The data collected in 2019 provided baseline information about water-quality conditions in the marina when no aquaculture projects were present.
- For 2020, testing was discontinued at CSHH #20 and conducted at new station CSHH #21 (located at R dock) and at CSHH #18 and CSHH #19.
- In 2021, testing continued at stations CSHH #19 and #21. Testing was suspended at CSHH #18 as water-quality conditions from the previous year were found to be less favorable for clam growth (low pH). Late in the 2021 season, two of the six FLUPSYs were moved to S dock (CSHH #18), so a one-time vertical profile and sample collection for bacteria and nitrogen were performed.

For 2022 winter kelp monitoring, a new station was selected, CSHH #22, located on L dock (between L-18 and L-19) where the kelp growing lines were installed. The previously used control station, CSHH #19, was also maintained. All other testing sites that were specific to the location of FLUPSYs were suspended.



Aerial photo of Tappen Marina monitoring stations

2.3.2 Marina Testing Parameters and Results

Weekly testing for 2019-2021 FLUPSY water-quality monitoring was conducted for water temperature, salinity, dissolved oxygen, pH, and turbidity using a Eureka Manta+ 35; a Secchi disk was used to test for water clarity. Also, water samples were collected weekly for bacteria analysis (fecal coliform and enterococci), which was conducted by the Nassau County Department of Health. Biweekly water samples were collected for nitrogen analysis (nitrite, nitrate, ammonia, and total Kjeldahl nitrogen), which was conducted by Pace Analytical Services, LLC.

For the two seasons that seed clams and other shellfish stock were set in FLUPSYs in Tappen Marina, the data that was collected did not indicate measurable differences in water quality within the shellfish growing area. It is not clear whether the quantity or size of the shellfish in the FLUPSYs or the duration of their presence in a particular season reached a threshold necessary to see those differences given the size of the marina and the amount of tidal flow that normally occurs there. However, the monitoring provided important information that indicated why shellfish in one location in the marina had better growth rates than those in another location. Also important are the town's observations that shellfish growth rates in Tappen Marina were comparable with those in the other two town marinas. This allows for future efforts of growing shellfish in the marina that may ultimately be used to seed Hempstead Harbor.

Cleaning barrels of clams in FLUPSYs
(photo by Carol DiPaolo, 8/18/21)

Testing around sugar kelp occurred biweekly from January 5 to April 13, 2022, for a total of eight sampling events. Samples were collected for bacteria and nitrogen analysis at NCDH and Pace Analytical Services, LLC, respectively; no vertical profiles were performed. Below are highlights from the kelp monitoring results.

Bacteria. Fecal coliform is the indicator bacteria used currently by New York State for determining shellfish-bed closures. It was also previously used to determine beach closures when levels exceeded the threshold of 1,000 CFU/100 ml. (Enterococci is the indicator bacteria currently used in determining beach closures by New York State, and, therefore, by NCDH as well; the exceedance threshold is 104 CFU/100 ml.) (See also *Section 3.8.*)

NCDH performs the bacteria analysis of the water samples CSHH collects at Tappen Marina and other stations around Hempstead Harbor and provides both enterococci and fecal coliform levels (even though county beach data is reported for enterococci only).

CSHH #19 and #22 had generally low numbers of bacteria throughout the season, with no exceedances in fecal coliform or enterococci. This was a departure from the previous years' summer testing at Tappen Marina monitoring sites, which did have some exceedances for enterococci only.

Nitrogen. Monitoring for nitrogen is important because excess nitrogen in water can spur the growth of algal cells and lead to algae blooms, which in turn deplete dissolved oxygen in the water as the algal cells decompose. (See also *Section 3.7.*) Kelp, a type of brown macroalgae, uses nitrogen to grow; the kelp is then harvested, resulting in a net reduction of assimilated nitrogen as well.

Measuring kelp growth in Tappen Marina (photos by Carol DiPaolo, 3/22/22)

Total nitrogen (TN) was used to compare nitrogen levels among monitoring stations. To further characterize the data for water-quality purposes, the Mid-Atlantic Tributary Assessment Coalition's tidal indicator protocol (Wicks et al., 2011) as described in "Water Quality Gradients and Trends in New York Harbor" (Taillie et al., 2019) was used for reference (see more in *Section 3.7.2*).

The average TN at CSHH #19 was 0.56 mg/L (considered "fair") and at CSHH #22 was 0.92 mg/L (considered "poor"). The TN was higher at CSHH #22 due to comparatively higher levels of organic nitrogen at this station. The average total organic nitrogen at CSHH #19 was 0.32 mg/L and at CSHH #22 was 0.73 mg/L.

In contrast, the average total inorganic nitrogen was higher at CSHH #19 (0.23 mg/L) than at CSHH #22 (0.16 mg/L). Though values for ammonia were below the detectable limit for the majority of samples at both stations, CSHH #19 had a slightly higher average ammonia (0.03 mg/L) compared with CSHH #22 (0.01 mg/L). For both stations, all nitrite samples had values below the detectable limit of 0.050 mg/L. Average nitrate for CSHH #19 was 0.26 mg/L and for CSHH #22 was 0.17 mg/L. There was no apparent trend in total nitrogen or any particular species of nitrogen over the course of samples taken from January to April 2022.

2.4 Unified Water Study

The Coalition to Save Hempstead Harbor has participated in the Unified Water Study: Long Island Sound Embayment Research since the program's inception in 2016. Funded by the federal EPA's Long Island Sound Study and administered by Save the Sound, the UWS is an ecological study of Long Island Sound bays in both Connecticut and New York. It is intended to engage citizen scientists in water monitoring by using uniform equipment and methodologies to collect biweekly samples from May through October. In 2022, 26 groups monitored 44 bays, from the Bronx River in NY in the west to the easternmost location at Wequetequock Cove in CT.

Although CSHH conducts monitoring for the UWS as a separate program from the core monitoring program for Hempstead Harbor, to the extent possible CSHH has aligned testing equipment and methodologies for both programs. For example, the same multiparameter meter is used and maintained as per UWS standard operating procedures to measure parameters that are common to both programs (e.g., water temperature, salinity, dissolved oxygen, and turbidity).

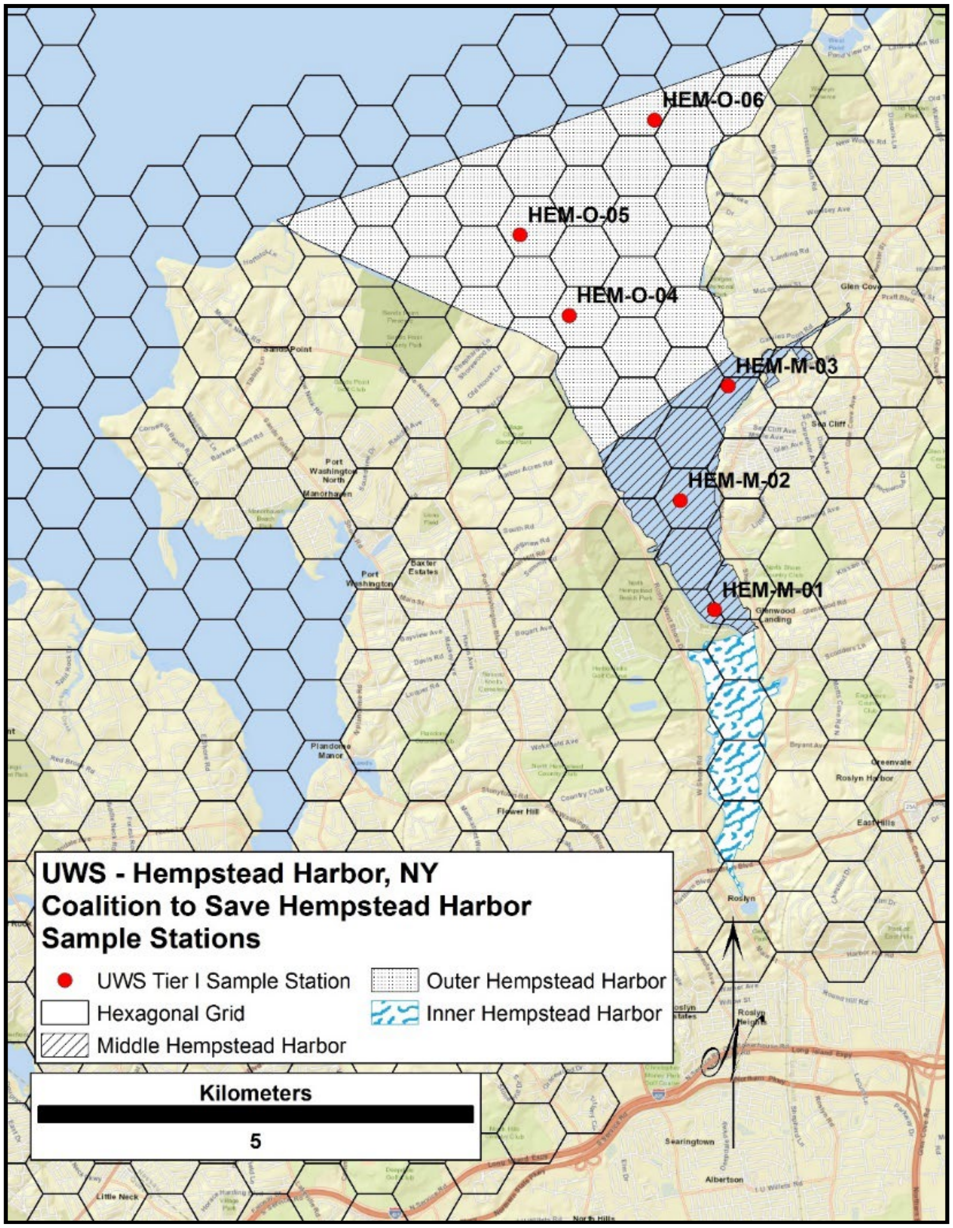
Beacon 11 is CSHH #1 for the core program and HEM-M-01 for the UWS (photo by Michelle Lapinel McAllister, 6/14/22)

2.4.1 UWS Station Locations

In 2017, five CSHH/Hempstead Harbor core monitoring program stations were selected to be included in the UWS study and are coded as "HEM" for that study. In 2018, a sixth station was added (which does not correspond with a core monitoring program station), and all UWS stations were renumbered as follows:

- HEM-M-01, same as CSHH #1
- HEM-M-02 (added in 2018)
- HEM-M-03, same as CSHH #3
- HEM-0-04, same as CSHH #2
- HEM-0-05, same as CSHH #16
- HEM-0-06, same as CSHH #17

Figure 3
Location of Hempstead Harbor UWS Stations



Credit: Hexagonal grid and UWS station map provided by Peter Linderoth, Save the Sound

2.4.2 UWS Testing Parameters

As mentioned above, UWS monitoring is conducted on a biweekly basis, from May through October. As per UWS protocols, sampling must be completed within three hours of sunrise and so generally begins at approximately 6 AM.

For the UWS, the Eureka Manta+ 35 is used by most participating groups to measure "Tier 1" parameters: water temperature, specific conductivity (salinity), dissolved oxygen, chlorophyll a, and turbidity. UWS protocols specify collecting data at half a meter below surface and at half a meter off the bottom for stations that have a total depth of fewer than 10 meters; for deeper stations, data is recorded at mid-depth as well. At the end of each survey, four chlorophyll filtrations are performed along with meter readings from the same water that is filtered, and two of the filters are sent to a laboratory for analysis (i.e., the Interstate Environmental Commission's lab through 2021 and a laboratory at Save the Sound, thereafter) (see also *Section 3.6*).

The program also includes a qualitative macrophyte (aquatic plant, or seaweed) assessment that must be conducted on three days (ideally a week apart) from July 15 to August 7, within three hours of low tide. The assessment may be from a soft shoreline or from a submerged area (from a dock or boat). CSHH selected unraked areas of three Hempstead Harbor beaches: Sea Cliff Beach, Harry Tappen Beach, and North Hempstead Beach Park. A photo assessment was completed for each area, and seaweed was categorized by color and general growth type (e.g., sheet, twig-like, or hair-like).

View looking north from Town of North Hempstead Beach Park (l) and close-up of green seaweed and rockweed near Tappen Beach pool (r) (photos by Michelle Lapinel McAllister, 7/19/22 and 7/26/22, respectively)

The 2020-2021 results from the UWS monitoring for all bays were included in the "2022 Long Island Sound Report Card." This was the second report card to include information and grades on bays and bay segments along with segments of the sound, i.e., from west to east, Western Narrows, Eastern Narrows, Western Basin, and Eastern Basin. Hempstead Harbor is included in the Eastern Narrows segment of the sound, which received an overall "C" grade. Despite enormous improvements in water quality for Hempstead Harbor over the last 35 years, the two segments of the harbor that were graded for the report card, "Middle Hempstead Harbor" and "Outer Hempstead Harbor," received grades of "D" and "C+," respectively. These are the same overall segment grades as in the previous "2020 Long Island Sound Report Card." Hempstead Harbor's lowest score (F) was for chlorophyll in the middle harbor.

3 Monitoring Results

This section summarizes the results of CSHH's core monitoring program. Where relevant, long-term data (from 2000 on) are assessed and compared with data from the current season. Appendices A, B, C, and D include data, graphs, and tables constructed with both current and long-term data to supplement understanding of the presented parameters. See *Figures 1* and *2* for station maps.

3.1 Dissolved Oxygen

Key Findings – Dissolved Oxygen

- Healthy DO levels (greater than 4.8 ppm) were observed in 72.2% of all surface and bottom measurements taken in 2022. For bottom DO levels (which are most crucial to bottom-dwelling marine life), hypoxic conditions (less than 3.0 ppm) were observed in 18.5% of all measurements taken in 2022.
- Unlike the previous two seasons, during which no surface hypoxia was observed, 10 surface readings across five stations (4.9% of all surface readings) were hypoxic in 2022.
- In 2022, there was one anoxic bottom reading (less than 1.0 ppm) on July 27 at CSHH #16. The last anoxic readings occurred in 2019.
- CSHH #13 had the longest duration of bottom hypoxia of all stations surveyed in 2022 and saw the largest increase in hypoxic frequency from 2021 to 2022.

Dissolved oxygen (DO), the form of oxygen that marine life needs to survive, is an important indicator of the health of our Long Island Sound estuary. Hypoxia (low oxygen) and anoxia (no oxygen) are water-quality problems that commonly occur during the summer in Hempstead Harbor and in other areas in and around Long Island Sound, particularly in the western sound.

Lower DO levels may be the result of a variety of factors, including anthropogenic influences such as nutrient enrichment (e.g., from nitrogen) via wastewater-treatment-plant discharges, overuse of fertilizers in home gardening and golf-course maintenance, and residual oxygen demand in bottom sediments from past industrial activities. Changes in air and water temperature and the physical nature and chemistry of the water can also influence DO levels (see *Sections 3.2* and *3.3*). It is also possible that differences in wind patterns could affect vertical mixing within the water column, resulting in a well-mixed water column during some years, and a more stratified water column in others.

Dissolved oxygen operates on a daily cycle, making the timing of data collection important for this parameter. During the day, algae and other organisms produce oxygen as a byproduct of photosynthesis. At night, photosynthesis does not occur, and oxygen is used in the decomposition of organic matter. Therefore, the lowest levels of dissolved oxygen are generally observed in the early morning hours, and levels gradually increase during the course of the day. CSHH core-program surveys are conducted in a routine order such that any given station is surveyed at approximately the same time each week to allow for more accurate short- and long-term assessments (e.g., CSHH #1 is surveyed at about 8 am).

Nitrogen accelerates the growth of algae (including phytoplankton). This can result in frequent or prolonged "blooms." When the cells in the blooms die off, the decomposition process depletes dissolved oxygen that fish, shellfish, and other aquatic organisms need to survive. The larvae of these organisms are often especially sensitive to low DO concentrations. In addition, low DO levels can cause some bacteria to produce hydrogen sulfide, which is a gas that can be toxic to fish.

Although algal species produce oxygen during their growth stage through photosynthesis, algal mortality and subsequent decay generally influence DO levels more strongly, especially later in the summer when there are generally higher air and water temperatures. Therefore, productive aquatic ecosystems with larger nutrient loads are more prone to low DO levels. Because the majority of organic-matter decay occurs at the estuary bottom, DO levels tend to be higher at the surface and lower at the bottom of the water column. Density-dependent stratification, such as elevated salinity levels at the harbor bottom, inhibits mixing and exaggerates this effect.

Algal bloom seen in the wake of the boat (photo by Michelle Lapinel McAllister, 6/1/22)

Prior to 2008, DO levels above 5.0 ppm were considered healthy. A revised dissolved oxygen standard was implemented by the NYS DEC on February 16, 2008. For estuarine waters such as Hempstead Harbor, the chronic, or long-term, DO standard is 4.8 ppm. This means DO levels of 4.8 ppm and above are considered to be protective of most marine species, but the severity of impacts, and threshold DO levels where impacts occur, are strongly species dependent. The acute DO standard is 3.0 ppm; if DO concentrations fall below 3.0 ppm, conditions are considered hypoxic. Under hypoxic conditions, many juvenile fish will not survive, many adult fish will avoid or leave the area, and species that cannot leave the area may die. For DO concentrations that are equal to or greater than 3.0 ppm and less than 4.8 ppm, 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.

Percent saturation of dissolved oxygen is also monitored in Hempstead Harbor. Percent saturation is a measure of the amount of oxygen currently dissolved in water compared with the amount that can be dissolved in the water, and it is influenced by variability in water temperature and salinity. In a marine system such as Hempstead Harbor, which has abundant nutrients and organisms, dissolved oxygen levels near the surface can be oversaturated during the day (greater than 100%) due to plant/algal photosynthesis, which produces oxygen, and undersaturated at night (50% or lower) due to the process of respiration, which uses up oxygen in the decomposition of dead organic matter.

Figure 4
DO Standards and Effects of Depleted DO on Marine Life

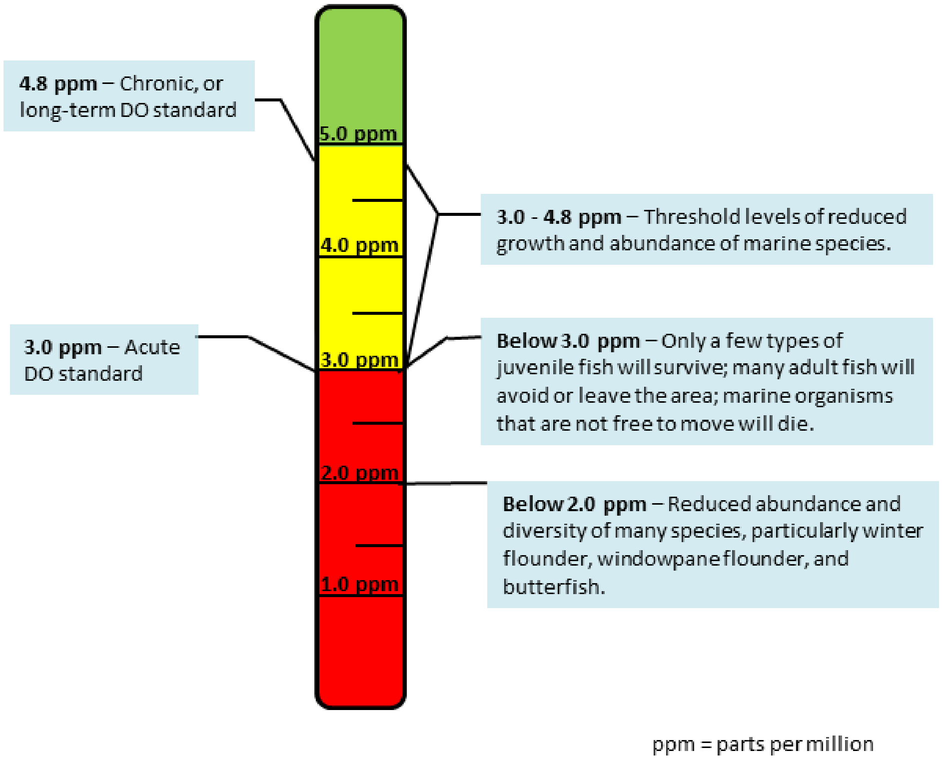


Figure 6 evaluates 2022 DO measurements collected at the bottom of Hempstead Harbor, which are considered critical because bottom-dwelling marine life have more difficulty than other marine species in trying to escape low DO conditions. Hypoxic conditions (low DO, interpreted to be less than 3.0 ppm in this report) and anoxic conditions (no DO, which, for purposes of this report, is less than 1.0 ppm) have been implicated in fish kills in Hempstead Harbor, particularly of Atlantic menhaden (commonly known as bunker) but also of juvenile flounder and other species.

Table 3
Fish Kill Occurrences since 2001

Years	Fish Kills	Locations	Conditions
2022	Frequent but limited bunker kills with increased die-offs in August	Harborwide, soundwide	Large bunker population, frequent bottom hypoxia (18.5% of all measurements taken)
2021	Limited/scattered bunker kills	Harborwide	Large bunker population; limited bottom hypoxia (9.1% of all measurements taken)
2020	Limited/scattered bunker kills	Soundwide, New Jersey	Large bunker population present; vibrio bacterium present
2019	Limited fish kill (primarily bunker)	Parts of Hempstead Harbor and other bays in western Long Island Sound	Hypoxic and anoxic conditions
2016-2018	None reported	N/A	N/A
2015 (October-November)	Two limited bunker kills	Harborwide	(Corresponded with large bunker population that remained in the harbor through January 2016)
2007-2014	None reported	N/A	N/A
2006 (August)	Small, localized fish kill	Morgan Beach	Low DO and hydrogen sulfide produced by bacteria
2005	Clam kill	Near CSHH #5 (Mott's Cove)	Lunar/tidal effects exposing clam beds
2001-2004	None reported	N/A	(Despite extended periods of hypoxia)

In 2022, there were dead bunker present throughout the harbor. Limited numbers were observed during several surveys in May through July. While no distinct die-off events occurred this season, throughout the month of August, an increasing number of dead bunker were noted in various areas of the harbor and on shore. Several dozen were counted on August 17, and hundreds more on August 24. These conditions were also observed in other bays around Long Island Sound. Note that factors other than low DO may affect the mortality of bunker.

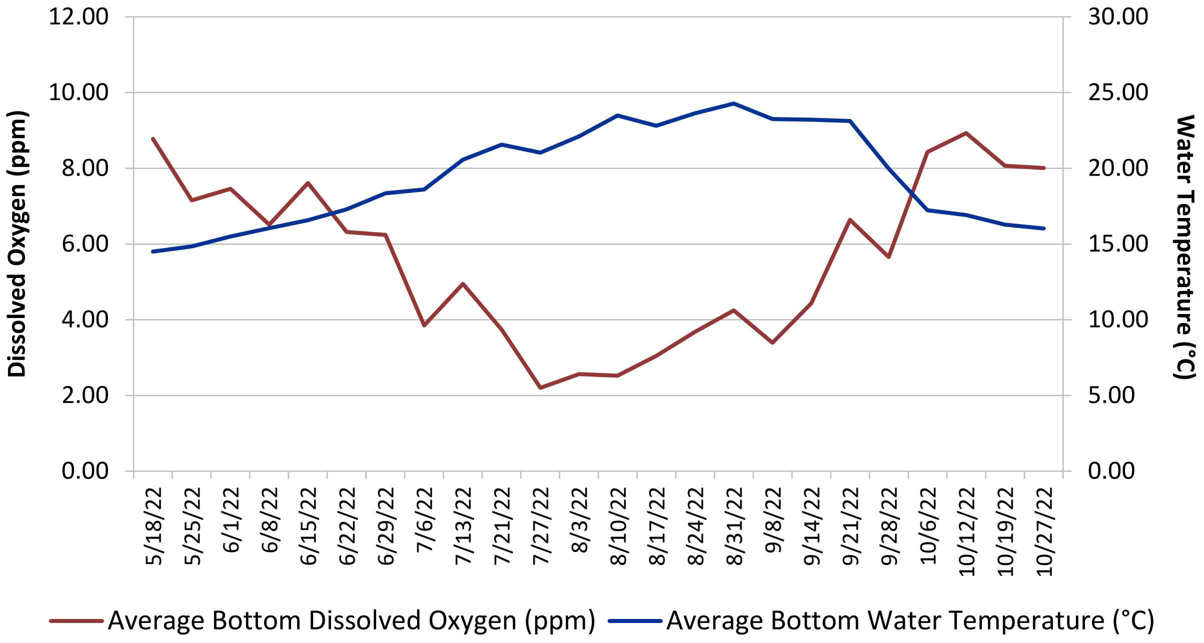
3.1.1 Seasonal Conditions

We observed the usual trend of decreasing DO that occurs in the middle of the summer season. However, the period over which hypoxic conditions were observed was longer in 2022 than in 2021. The first incidence of hypoxia in 2022 was observed on July 6 at CSHH #1, where hypoxic values were recorded at both the surface and bottom. This occurred several weeks earlier than the first incidence of hypoxia in the previous year (July 21, 2021). In mid-July, hypoxic readings were observed at other stations and became more frequent (see *Appendix A*). The last incidence of hypoxia in 2022 was observed on September 28 at CSHH #13, but only at the bottom. This was the only station that was hypoxic on that date. Most incidences of hypoxia occurred between July 21 and September 8.

How long hypoxic conditions last typically varies spatially. At upper harbor stations (CSHH #2, #16, and #17), all incidences of hypoxia were observed between July 21 and August 10. Meanwhile, at most lower harbor stations, hypoxic readings persisted until September 8. In Glen Cove Creek, specifically at CSHH #13, hypoxic readings were consistent, with only one exception, from July 21 through September 28—the longest duration of all stations surveyed. Interestingly, other stations nearest to CSHH #13 (CSHH #3 and #8) did not reflect the conditions observed at CSHH #13 in 2022.

Figure 5
2022 Harborwide Dissolved Oxygen and Water Temperature

Dissolved oxygen and water temperature, recorded at bottom depth and averaged for the entire harbor, are depicted below and illustrate the seasonal trend for both parameters.



For the entire 2022 regular monitoring season, 18.5% of all bottom readings exhibited hypoxic conditions (DO < 3.0 ppm), 22.4% of bottom readings fell in the 3.0 to 5.0 ppm range, and 59.0% of bottom readings were at healthy levels (≥ 5.0 ppm). (Although the "healthy" threshold for DO is currently 4.8 ppm, for purposes of this report, we use 5.0 ppm in order to make both short- and long-term comparisons. See *Appendix A* for long-term dissolved oxygen graphs.)

For all core-program sampling dates in 2022, ten surface readings across five stations were hypoxic (CSHH #1, #7, #13, #6, and #14). There were incidences of surface hypoxia in 2019, but not in 2020 or 2021.

In 2022, there was one anoxic (less than 1.0 ppm) reading on July 27 at CSHH #16, only at the bottom. No anoxic readings were observed in 2021 or 2020.

Annual fluctuations in dissolved oxygen conditions are typical for Hempstead Harbor and can be brought about by a number of factors, but year-to-year comparisons remain valuable in assessing seasonal conditions. The percentage of bottom DO measurements that exhibited hypoxic conditions in 2022 (18.5%) was more than double that of 2021 (9.1%).

Using a 1994-2018 dataset, a study on hypoxia found that bottom dissolved oxygen concentrations at a station in western Long Island Sound had "pronounced interannual variability," but found a positive trend of 0.48 mg/L per decade, suggesting improvement in oxygen conditions despite increasing bottom-water temperatures at this station (see *Section 3.2) (Whitney, M. and Vlahos, P. (2021). Reducing hypoxia in an urban estuary despite climate warming*).

Long-term (2000 to present) dissolved oxygen data for Hempstead Harbor also show high interannual variability. A Mann-Kendall test, a statistical test used to detect trends in long-term data, was performed on monitoring data from 2000-2022, specifically using bottom dissolved oxygen values for the month of August at CSHH #1. (CSHH #1 was chosen as a representative station because it is one of the earliest established stations, is generally the first station monitored during weekly surveys (making the timing of arrival relatively consistent), and is an open-water station.) The results of the test indicate that there is no statistically significant positive or negative trend in this dataset.

3.1.2 Spatial Considerations

Of the 13 core-program stations where dissolved oxygen was measured in 2022, 11 had at least one hypoxic reading (CSHH#1-7, #13-14, and #16-17). This represents an increase from 2021, where only eight stations had at least one hypoxic reading. Just two stations, CSHH #8 and #15, had no hypoxic readings for the entire 2022 season.

As noted in the previous section, hypoxia persisted in the lower harbor later than what was observed at most other stations. Lower harbor stations (CSHH #4-7) were surveyed just seven times throughout the season due to tidal-dependent access. None of these surveys took place in July and only two took place in August, which limits our understanding of seasonal dissolved oxygen conditions in this area of the harbor.

CSHH #3 had two hypoxic readings at the bottom. In Glen Cove Creek, CSHH #13 had 10 hypoxic readings at the bottom and 2 at the surface. This station saw the biggest change in hypoxic frequency as compared with 2021 of all stations surveyed (see long-term dissolved oxygen graphs in *Appendix A*). In 2021, there were no hypoxic readings at any Glen Cove Creek stations.

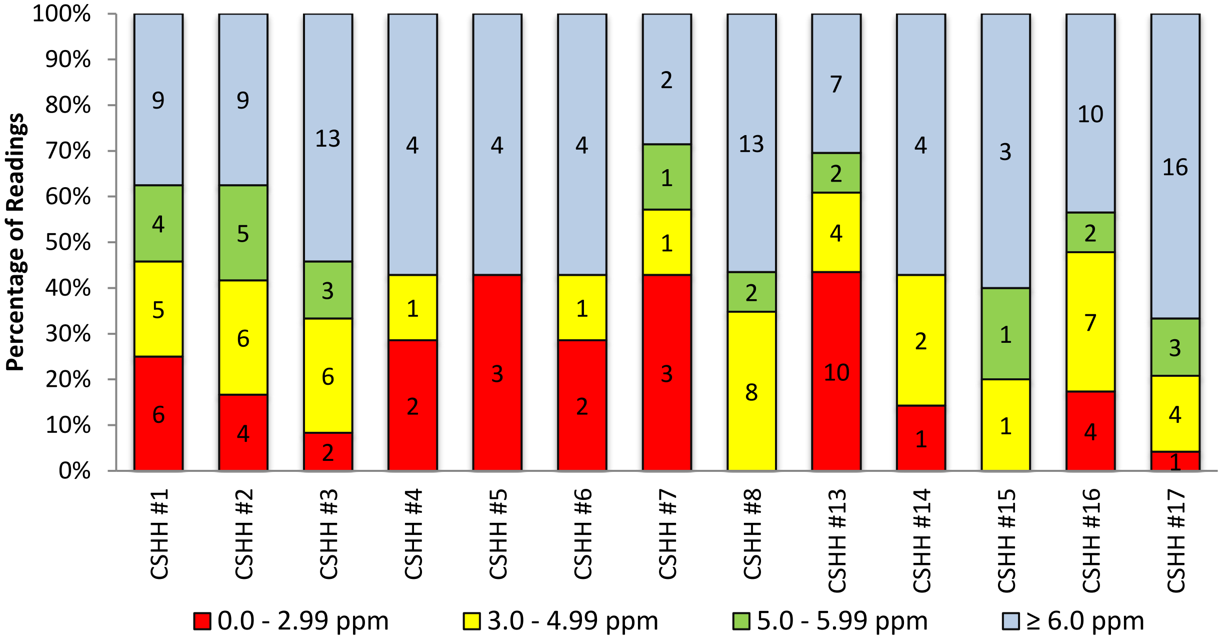
CSHH #13 also had the highest percentage of hypoxic readings (43.5%, representing 10 out of 23 surveys), followed closely by CSHH #5 and #7 (both 42.9%, representing three out of seven surveys). It is important to note that in 2022, 9 out of 24 surveys at CSHH #13, mainly in August and September, were taken west of the usual station due to construction of a new bulkhead on the north side, which blocked access to the head of the creek.

Glen Cove Creek experiences higher nutrient loading than other areas of the harbor because of the number of stormwater outfalls that empty into the creek as well as the discharge from the Glen Cove sewage treatment plant, which is located on the south side of the creek. In addition, a sewer-line break that was confirmed in November 2021 was responsible for discharging raw sewage to Mill Pond and Glen Cove Creek for months. (See *Section 3.8* for details.)

Figure 6

2022 Bottom Dissolved Oxygen by Station

Each vertical bar represents one of CSHH's monitoring stations. They indicate the percentage of all readings taken at a location that falls into each of the four ranges. Numbers inside the bars indicate the number of observations within each bar segment. Red bars are representative of hypoxic conditions (DO below 3.0 ppm). DO in the 3.0 to 5.0 ppm range is considered marginal and is shown in yellow. DO above at 5.0 ppm and above is considered a healthy condition and is shown in green and blue.



3.2 Temperature

Water temperature is monitored to record seasonal and annual changes within the harbor and to determine whether temperature could be affecting marine life, especially organisms in the harbor that are in the southernmost limit of their habitat.

Water temperature is also used to determine the percent saturation of DO within the harbor. As described previously, percent saturation is a measure of the amount of oxygen currently dissolved in water compared with the amount that can be dissolved in the water. Percent saturation is strongly influenced by temperature: the lower the temperature, the higher the DO level must be to reach 100% saturation, and vice versa. For example, at 32ºF (0ºC), DO reaches 100% saturation concentration in water when it is present at a level of 14.6 ppm, whereas at 68ºF (20ºC), 100% DO saturation concentration is reached at 9.2 ppm, and at 77ºF (25ºC), it is reached at 8.6 ppm.

Key Findings – Temperature

- Overall, thermal stratification of the water column was slightly greater in 2022 than in 2021.
- Maximum air temperatures reached 97°F in mid-July during a week-long heat wave, and air temperatures recorded on July 21 were the highest of the season at each station surveyed.
- Despite heatwave in July, average air temperature for the entire season, as measured during core-program weekly surveys, was cooler in 2022 than in 2021.

Additionally, temperature monitoring tells us whether the water column is stratified or well mixed. Stratification is a naturally occurring condition whereby water at the surface is warmer while water at the bottom stays cold. Because the colder water is denser, it stays at the bottom and cannot mix easily with the warmer water. This colder water becomes isolated from the surface (where most of the oxygen transfer occurs), which prevents replacement of DO lost through consumption by organisms. Hempstead Harbor does not generally exhibit pronounced stratification, because the harbor is relatively shallow and strongly influenced by tides and currents; vertical mixing continues through much of the season. In 2022, we observed the anticipated trend that the water column is most stratified from around May through August. Additionally, the difference between average surface and bottom water temperature in 2022 was 0.66ºC, and in 2021, the difference was 0.49ºC.

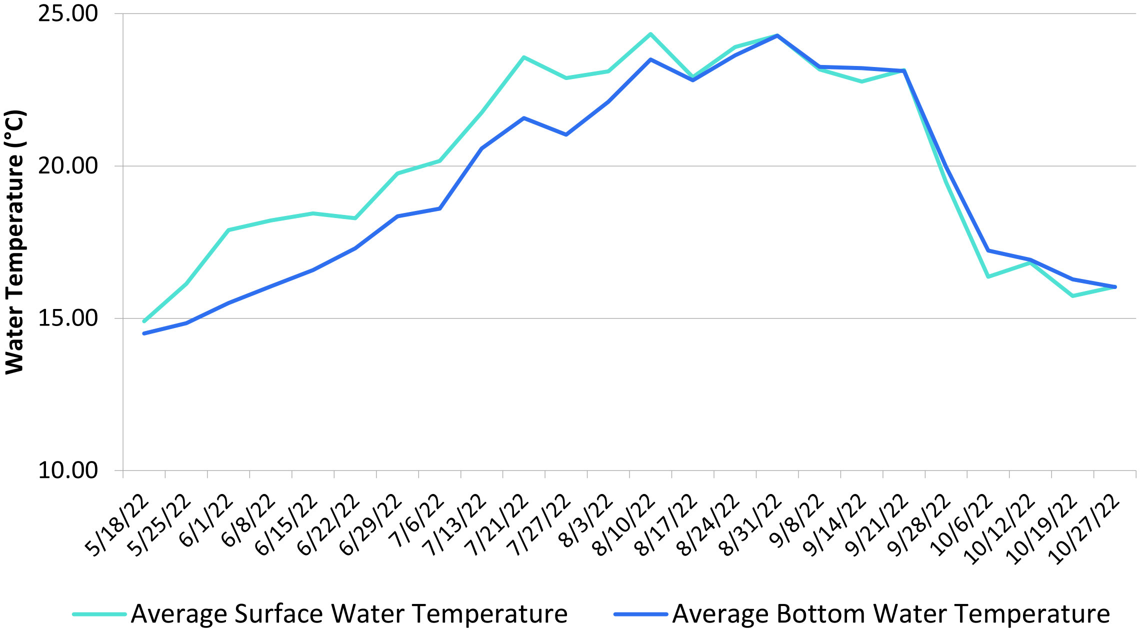
The average surface water temperature for the 2022 regular season was 20.33°C; the average bottom water temperature was 19.67°C. In the 2021 regular season, the average surface temperature was 20.91°C, and the average bottom temperature was 20.42°C. See *Appendix A* for additional water temperature monitoring data.

Many factors affect water temperature, but it is representative more of conditions that occur over several days and is not heavily influenced by daily variation in air temperature.

A warming trend has been observed in Long Island Sound (0.03°C per year in the central basin and 0.04°C for the eastern basin, for 1976-2010 data; see *Rice, E. and Stewart, G. (2013), Analysis of interdecadal trends in chlorophyll and temperature in the Central Basin of Long Island Sound)*. The western portion of Long Island Sound, influenced most by

Figure 7
2022 Harborwide Average Water Temperature

Average surface and bottom water temperature are depicted below.



freshwater inputs, is cooler than the eastern portion, influenced most by ocean water. The water temperature effects of climate change are not discernible in the data from Hempstead Harbor, likely due to the shallower water of the harbor, tidal flushing, and the cooler water of western Long Island Sound.

Temperature data from bottom waters at a station in western Long Island exhibited a warming trend of 0.8℃ for the years 1994-2018. Both surface and bottom water temperatures at this station were reported to have strong interannual variability *(Whitney, M. and Vlahos, P. (2021). Reducing hypoxia in an urban estuary despite climate warming).*

Similar to what we found with long-term DO data, long term (2000 to present) water temperature data for Hempstead Harbor show high interannual variability. A Mann-Kendall test, a statistical test used to detect trends in long-term data, was performed on monitoring data from 2000 to 2022, specifically using bottom water temperature values for the month of August at CSHH #1. (As was noted previously, CSHH #1 was chosen as a representative station because it is one of the earliest established stations, is generally the first station monitored during weekly surveys (making the timing of arrival relatively consistent), and is an open-water station.) The results of the test indicate that there is no statistically significant positive or negative trend in this dataset.

Air temperature affects aquatic temperature, which affects both DO concentrations and biological activity within an aquatic system. Because CSHH records temperature data only during monitoring events, air temperature more strongly reflects the time of day that CSHH monitored a certain location. However, because monitoring events begin at similar times each season and have similar durations (i.e., May through October, and measuring air temperature at stations from approximately 8-11:30 am), changes in air temperature averaged between sites during a season could be indicative of annual variability in weather conditions.

The beginning of the summer season saw persistent warm weather and a heat wave, lasting from July 19-24, with maximum temperatures reaching 97°F (according to Weather Underground). The average air temperatures recorded on the July 21 survey were the highest of the season for every station surveyed.

The average air temperature for the 2022 season was 20.4°C. This represents all data points taken using a long-stem digital thermometer throughout Hempstead Harbor for every sampling date. Despite the aforementioned heatwave, this was cooler than the average air temperature in 2021, 22.4°C.

3.3 Salinity

Salinity, the amount of salt dissolved in a body of water, can be influenced by tidal cycles, direct precipitation, and freshwater from the watershed (i.e., from streams, ponds, rivers, and lakes, as well as stormwater, wastewater, or other discharges). Like temperature, salinity influences water density and is an indicator of how stratified the water column is.

Key Findings – Salinity

- On average, harborwide salinity in 2022 was higher than in 2021 at both the surface and bottom.
- CSHH #8 and #13 typically exhibit lower salinity readings compared with other stations. This is due to their proximity to known sources of freshwater input. For this reason, the data from these stations are not included in the 2022 seasonal averages, which are meant to convey overall harbor conditions.

Salinity affects DO levels; there is lower DO saturation in saltwater than in freshwater. For example, the saturation level of dissolved oxygen at 25 ppt salinity is equal to approximately 85% of the saturation level of dissolved oxygen for freshwater. In Long Island Sound, salinity generally ranges between 21 ppt and 28 ppt (as compared with the typical salinity level of 32-38 ppt in the open ocean).

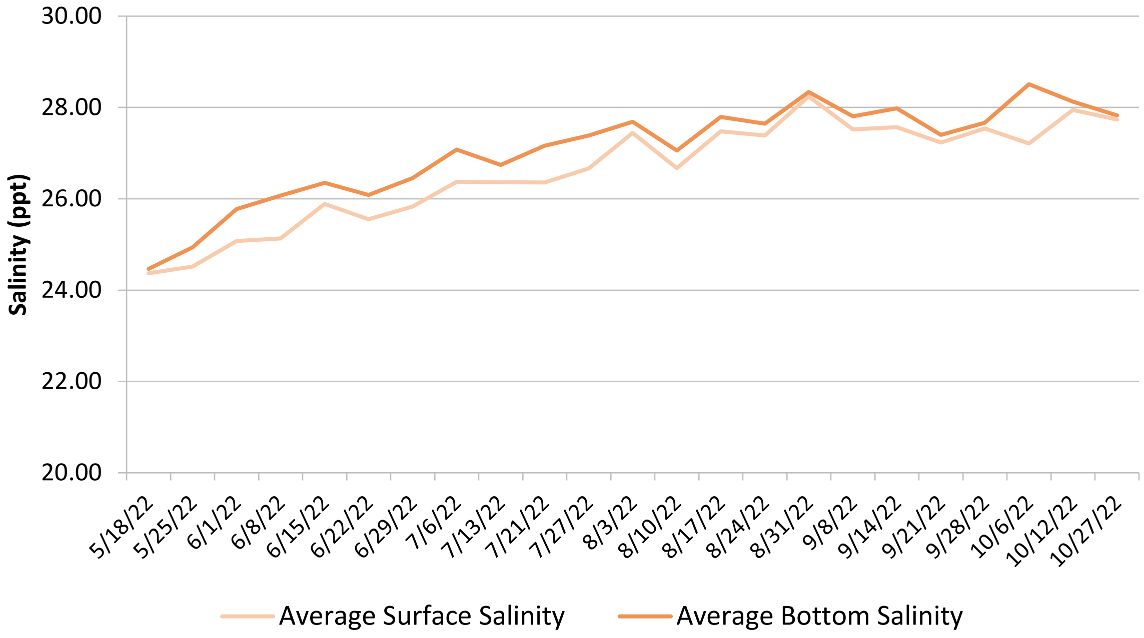
Salinity tends to be higher in winter, particularly at greater depths. In the summer season, salinity tends to be lower, driven by freshwater inputs. Generally, salinity levels increase over the monitoring season as air temperatures rise and evaporation increases (see *Figure* 8). Typically, salinity values throughout Hempstead Harbor are approximately 25 ppt, and surface salinity is generally lower than bottom salinity. In 2022, the average surface salinity for Hempstead Harbor was 26.58 ppt (25.22 ppt in 2021), and the average bottom salinity was 27.00 ppt (25.75 ppt in 2021).

A decrease in the amount of freshwater input to Hempstead Harbor during the 2022 monitoring season, through direct rainfall and runoff, may have contributed to elevated salinity levels (see *Section 3.9*). Long Island faced abnormally dry conditions throughout the summer and at times was in a moderate to severe drought (see NOAA/National Integrated Drought Information System at https://www.drought.gov/states/new-york).

See *Appendix A* for additional salinity data results.

Figure 8
2022 Harborwide Average Salinity

Average surface and bottom salinity data illustrate the seasonal trend. Data from CSHH #8 and #13 are not included in the graph, as they are uniquely impacted by known sources of freshwater input and are not necessarily representative of harborwide conditions.



3.4 pH

Monitoring pH (a measure of acidity or alkalinity) helps in following trends in aquatic life and water chemistry. Carbon dioxide (CO_2) released by respiration and uptake via plant photosynthesis affects aquatic pH over short periods (hours to days), whereas the increase in atmospheric CO_2 may affect aquatic pH over decades. Increasing amounts of CO_2 in seawater lowers pH, making conditions more acidic, which affects the growth of shellfish and other marine life. Also, research has linked the combination of both low pH and low DO levels with having a more detrimental impact on marine life than low DO alone. (See *Gobler, C.J., et al. (8 January 2014). Hypoxia and acidification have additive and synergistic*

Key Findings – pH

- Due to an equipment malfunction that was resolved late in the season, pH results for the 2022 season rely primarily on LaMotte pH test kit readings.
- Every week throughout the season, LaMotte pH test kit readings were 8.0, with the exception of one 7.5 reading on June 29, suggesting that pH was consistent with what is typical for Hempstead Harbor.

negative effects on the growth, survival, and metamorphosis of early life stage bivalves. Retrieved from *http://www.plosone.org/article/info:doi/10.1371/journal.pone.0083648*.)

In the 2022 monitoring season, pH values that were collected using the Eureka Manta+ 35 were noticeably lower than the LaMotte test kit used for data validation. It was observed each week that the meter readings would drift closer to expected values as the survey progressed. For this reason, data was flagged at CSHH #1 (see *Appendix A*). The suspected pH sensor malfunction was confirmed, and a new sensor was installed and put into use starting on October 6.

The LaMotte pH test kit is an essential part of assessing the precision of meter readings. Each week at CSHH #1, a water sample is taken, mixed with an indicator solution, and the resulting color is matched to a color on a comparator device indicating the pH value of the sample. In 2022, readings from this test kit were 8.0 every week with the exception of one 7.5 reading on June 29, suggesting that pH in 2022 was consistent with what is typical for Hempstead Harbor. Although there are fluctuations within each season and over the years, pH readings in Hempstead Harbor rarely drop below 7.0 and rarely exceed 8.5. To help confirm our ability to use this data, the LaMotte kit itself was checked using pH standard solutions.

Detailed information on recent pH results as well as typical spatial patterns and observations for Hempstead Harbor can be found in CSHH's *2021 Water-Quality Report.*

3.5 Water Clarity/Turbidity

In general, turbidity is a measure of water clarity. Suspended solids, dissolved organic matter, and plankton can cause increases in turbidity or the cloudiness of the water and may vary due to natural events such as tidal flux, rainfall, seasonal algal blooms, and ice melt. Human activities that cause eutrophication (excess nutrients) and sediment loading (e.g., from uncontrolled construction-site runoff) also increase turbidity.

Key Findings – Water Clarity/Turbidity

- The average Secchi depth for the 2022 season was 9.4% deeper than the 2021 average and 20.8% deeper than the 2020 average.
- Despite a deeper harborwide average, the range of Secchi depth readings in 2022 was comparable with typical harbor conditions.
- CSHH #7 had both the lowest average Secchi-depth reading and the highest average turbidity, indicating worse water clarity at this station in 2022 compared with other stations.

3.5.1 Secchi-Disk Measurements

Water clarity is commonly monitored through the use of a Secchi disk–a white (or white and black) plastic disk that is lowered into the water to determine the lowest depth at which ambient light can penetrate the water column. In most nutrient-rich waters, such as Hempstead Harbor and Long Island Sound, the depth at which the Secchi disk is visible is limited by the amount of plankton or other suspended matter in the water. Phytoplankton generally give the harbor its usual green to brown color. For Hempstead Harbor, Secchi-depth readings are typically 1 to 2 meters but can range from 0.25 to 3 meters during the monitoring season.

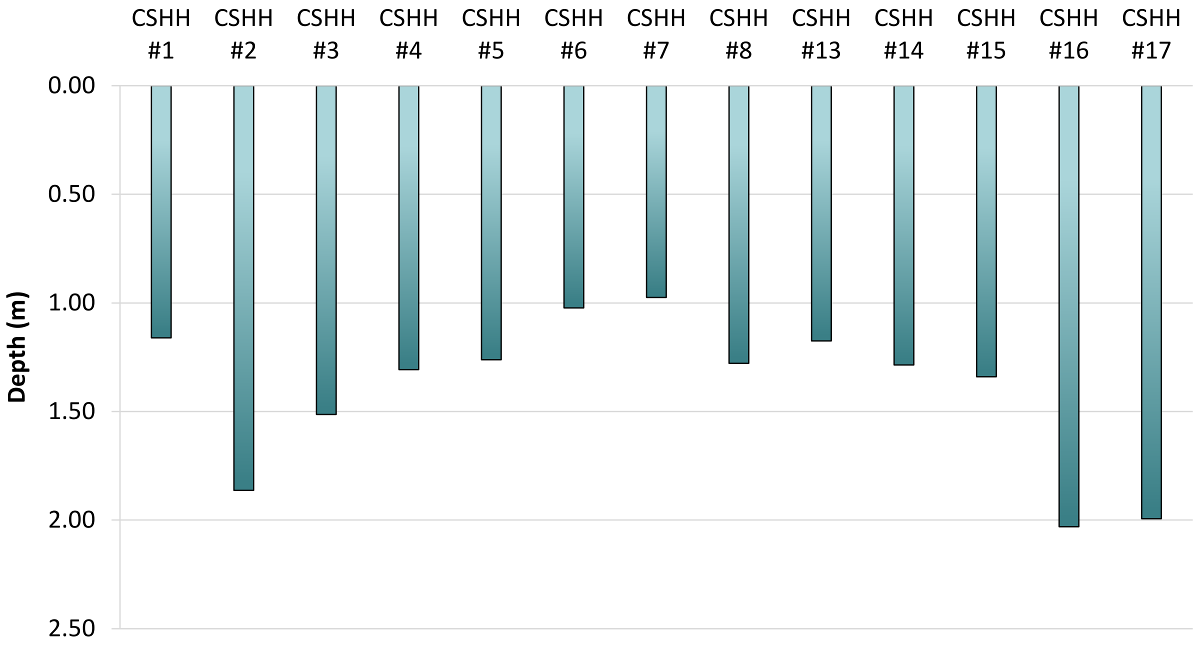
In 2022, the minimum Secchi depth recorded was 0.5 m, occurring on June 1 at CSHH #1. The maximum Secchi depth recorded was 3.25 m, a measurement that was recorded on two dates—May 18 at CSHH #16 and October 19 at CSHH #2 and #16.

The seasonal and harborwide average of all Secchi-disk measurements was 1.51 m. This is 9.4% deeper than the 2021 average of 1.38 m and 20.8% deeper than the 2020 average of 1.25 m. However, the range of Secchi-disk readings observed in 2022 is comparable with typical harbor conditions. We also observed the anticipated seasonal trend of harborwide water clarity worsening by June and improving in the late summer and into the fall.

Water clarity tends to vary spatially. On average, CSHH #6 and #7, both located in the lower harbor, had the lowest water clarity in 2022, while upper-harbor stations CSHH #2, #16, and #17 had the highest. Long-term Secchi-depth data support this pattern. Based on an analysis of data from 2000-2022 for CSHH #6 and #1 and from 2015-2022 for CSHH #16, long-term averages are 1.0 m, 1.15 m, and 1.75 m, respectively. (These stations were chosen as representative stations for assessing lower-, mid-, and upper-harbor areas.)

Figure 9
2022 Average Secchi-Disk Depth by Station

Each bar depicts the average Secchi-disk depth at each of CSHH's monitoring stations. Longer bars represent values deeper in the water column, which indicates higher water clarity.



3.5.2 Turbidity Meter Measurements

Although research related to the effect of turbidity on the marine environment is limited, there has been increased recognition of its significance and the need to standardize measurements of turbidity levels. For example, excessive increases in turbidity in both naturally low and highly turbid waters may cause harm to fish growth, gill function, and survival.

According to the US EPA's National Recommended Water Quality Criteria—Aquatic Life Criteria Table (referencing the 1986 Quality Criteria for Water) (https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table), turbidity could affect both freshwater and marine species of fish in the following ways:

1. Reduce their growth rate, resistance to disease, and life span
2. Prevent the successful development of fish eggs and larvae
3. Modify natural movements and migrations of fish
4. Reduce the abundance of food available to the fish

Elevated turbidity is generally harmful in most aquatic environments and for most species. Although some species may benefit (e.g., small increases in turbidity may afford some species increased camouflage), this increased advantage would be at the expense of other species (e.g., larger predators) and may upset the ecological balance.

It is thought that the effect of additional turbidity from human-generated sources on water bodies depends on the determined "background" turbidity level of the water body (see Johnson and Hines 1999; Meager 2005). At this time, regulatory agencies have not articulated a quantitative background turbidity level for Hempstead Harbor and Long Island Sound. However, the EPA provides narrative criteria for assessing turbidity. As stated in Title 6 New York Codes, Rules, and Regulations (NYCRR) Article 2: Classifications and Standards of Quality and Purity, "There shall be no increase in turbidity that will cause a substantial visible contrast to natural conditions."

Turbidity sampling was initiated for Hempstead Harbor stations in July 2008. At each station monitored, turbidity is measured in nephelometric turbidity units (NTUs).

Given that the Secchi-disk depth decreases as the water being sampled gets harder to see through, it follows that turbidity measurements should generally be inversely related. Measures of conditions at Hempstead Harbor stations clearly indicate an inverse relationship; that is, the greater the number for the depth at which the Secchi disk could be seen below the surface (better water clarity), the lower the number measured by the meter in NTUs (the lower the turbidity). (See *Appendix A* for additional turbidity data.)

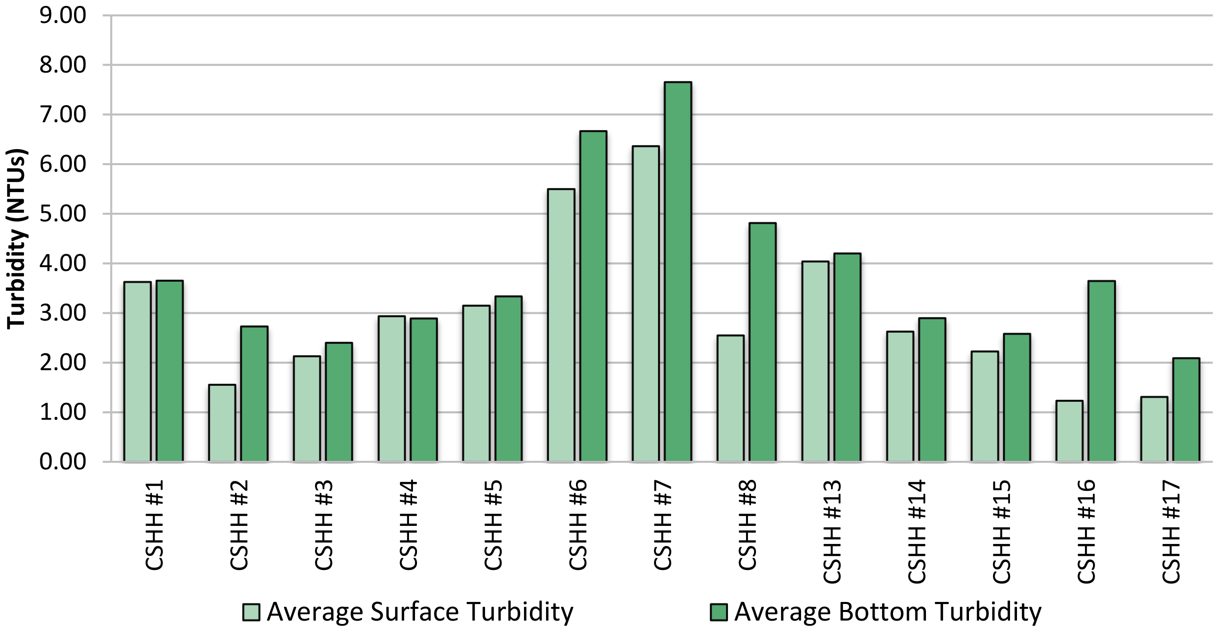
The Long Island Sound Report Card provides water-clarity reference cut-points for scoring this parameter, derived from the National Coastal Condition Report (NCCR) IV. For purposes of the report card, standards for turbidity are informed by the water body's ability to "historically" support submerged aquatic vegetation (SAV). Hempstead Harbor does not currently and has not recently supported SAV, and therefore when using these thresholds for comparative purposes, "good" conditions are achieved when surface turbidity is less than 7.90 NTUs (which was the case for 97% of all observations in 2022), and Secchi depth is greater than 0.62 m (which was the case for 99% of all observations in 2022).

The harborwide average surface turbidity for the 2022 regular-monitoring season was 2.62 NTUs. This is comparable to the 2021 harborwide average surface turbidity of 2.50 NTUs.

In addition to comparisons with available standards, turbidity can be compared between stations within Hempstead Harbor. Although surface turbidity is primarily assessed, both surface and bottom turbidity averages are utilized in the spatial comparison depicted in *Figure 10*. The highest averages (most turbid readings) for both surface and bottom turbidity were recorded at CSHH #7 (6.36 and 7.65 NTUs, respectively). The lowest average (least turbid readings) for surface turbidity occurred at CSHH #16 at 1.23 NTUs; the lowest average bottom turbidity occurred at CSHH #17 at 2.09 NTUs.

Figure 10
2022 Average Surface and Bottom Turbidity by Station

Each set of bars depicts the average surface and bottom turbidity for each of CSHH's monitoring stations. Higher turbidity values and higher bars correspond to lower water clarity.



3.6 Chlorophyll

Chlorophyll is a photosynthetic pigment that causes the green color in algae and plants. Chlorophyll a (Chl a) is the most abundant form of chlorophyll (others include type b, c, and d). Chlorophyll is essential to the process of photosynthesis, when energy from the sun converts carbon dioxide and water into oxygen and organic compounds. The concentration of chlorophyll present in water is directly related to the amount of suspended phytoplankton (including microscopic algae and cyanobacteria) (cyanobacteria, often called "blue-green algae," are bacteria, not algae). Phytoplankton can be used as an indicator organism to determine the health of a water body, and measuring chlorophyll is a way of tracking the growth of phytoplankton. Excessive concentrations of algae, typically accompanied by high concentrations of nutrients (e.g., nitrogen), can cause the water to have a green, brown, or red appearance and decrease the overall clarity. Significant concentrations of algae are considered a "bloom." As the algae cells die off and decompose, this process can deplete dissolved oxygen, which may result in fish kills. In addition to being simply aesthetically unpleasing because of discoloration of the water, some species of algae and cyanobacteria produce toxins that affect fish, shellfish, humans, livestock, and wildlife.

Chlorophyll a has been measured as part of the CSHH monitoring program since July 2016, when a FluoroSense handheld fluorometer was first used. The process to measure Chl a generally requires a field reading and then filtering a representative sample, collected the day of the monitoring event, to extract algae. This filter is analyzed by a laboratory with a calibrated fluorometer or spectrophotometer to determine the correlation between the extracted concentration and value recorded in the field. This correlation is then applied to all field readings for that monitoring event. In 2016, field readings were recorded, but filtrations were completed for only two monitoring events, and so the data are considered incomplete. From 2017 to present, Chl-a field readings were recorded for the core monitoring program using a multiparameter sonde and used only as a frame of reference.

In addition, to assess whether an algal bloom is in process, we record sonde values for Chl a (used as a frame of reference) and percent saturation for dissolved oxygen as well as make qualitative observations for the color, clarity, and other characteristics of the water. For example, on June 1, 2022, the water within Tappen Marina appeared abnormal and was distinctly brown. The Chl-a reading taken at CSHH #1, the closest station to Tappen Marina, was elevated from the previous weeks. Water samples were taken at both locations, and visual examination under a microscope identified *Prorocentrum minimum* as the likely species predominantly present.

Another probable algal bloom occurred in mid-July when rust-brown water was observed in Tappen Marina, Safe Harbor Marina, and parts of Glen Cove Creek. Chl-a levels were once again elevated in the locations where the water displayed abnormal coloration, and *Prorocentrum triestinum* was identified as the likely predominant species in another examination of water samples from CSHH #13 and Tappen Marina.

3.7 Nitrogen

Ammonia, nitrate, and nitrite are three nitrogen-based compounds that are commonly present in marine waters. Other nitrogen-based compounds include organic nitrogen and nitrogen gas.

Key Findings – Nitrogen

- In 2022, average total nitrogen was highest at outfall stations—CSHH #14A and #15A.
- In 2022, average total nitrogen ranged from 0.44 mg/L at CSHH #16 to 5.7 mg/L at CSHH #14A, indicating fair to very poor conditions.
- Average ammonia was lower at most stations in 2022 compared with average ammonia in 2021. The most notable decreases occurred at Glen Cove Creek stations (CSHH #8, #12, and #13).

3.7.1 The Nitrogen Cycle

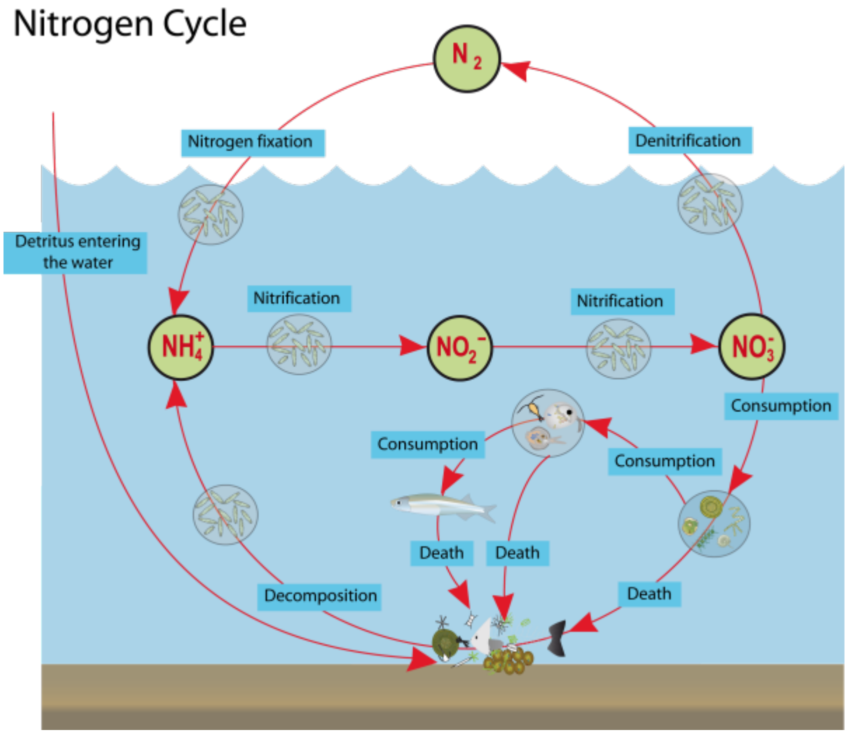
Nitrogen is generally made available to the marine environment through fixation, the transformation of nitrogen gas into ammonia by nitrogen-fixing bacteria. Nitrogen is also made available to the marine environment through inputs from the watershed. Inputs of nitrogen from the watershed are in the form of **ammonia** (NH_3), **nitrite** (NO_2), or **nitrate** (NO_3) (all of which are inorganic nitrogen). Inorganic nitrogen can be assimilated into organic forms, such as amino acids, proteins, and urea, that are needed for growth and reproduction. (*Figure 11* presents a diagram of the nitrogen cycle in the marine environment.) However, too much nitrogen can have adverse impacts on water quality. Nitrogen loading to the marine environment from the watershed generally originates from fertilizer and human or animal wastes transported to water bodies through stormwater runoff, old or failing septic systems, and wastewater treatment plants.

What is important for water-quality concerns is not only the quantity of nitrogen entering a water body, but also the form. For example, ammonia can be present in the un-ionized form as free ammonia, NH_3, which is toxic to fish (both freshwater and marine) or in the ionized form **ammonium** (NH_4+), which is innocuous. The relative concentration of these forms is pH and temperature dependent (and to a small extent the fraction of un-ionized ammonia is inversely related to salinity). Higher pH and temperature are associated with increased levels of the more toxic, free ammonia (NH_3).

Ammonia can also be converted to nitrite in the presence of oxygen as part of the nitrification process, but as more oxygen is added, nitrite (which is highly unstable) quickly transforms to nitrate. When anoxic conditions form, certain bacteria convert nitrate into **nitrogen gas** (N_2), which is released to the atmosphere.

Sewage treatment plants can be upgraded to provide biological nutrient (nitrogen) removal. The Glen Cove sewage treatment plant was upgraded to do so. Traditional wastewater treatment plants blow oxygen into the wastewater to promote the growth of microorganisms, which decay carbon-based waste rapidly and produce carbon dioxide. Ammonia is converted into nitrate as a byproduct. Treatment plants with nitrogen removal upgrades have an anoxic zone in the wastewater treatment tanks and circulate wastewater that has been previously treated with oxygen. Highly specialized bacteria remove the oxygen from the nitrate compound, releasing nitrogen gas and removing much of the nitrogen from the wastewater stream.

Figure 11
Nitrogen in Marine Environments
(Graphic from Sea Grant, University of Rhode Island, at https://seagrant.gso.uri.edu/nitrogen-cycle-lie/)
Note: N_2 is nitrogen; $NH_4^{(+)}$ is ammonium; $NO_2^{(-)}$ is nitrite; $NO_3^{(-)}$ is nitrate



3.7.2 Nitrogen Monitoring by CSHH

From 2004 to October 2016, CSHH collected samples weekly at CSHH #1-3, #8, #13, #16, and #17 and, when tidal and weather conditions permitted, at CSHH #4-7, #14, and #15 to test for inorganic forms of nitrogen—ammonia, nitrite, and nitrate. Over that period, differing testing equipment and methodologies were used to test for nitrogen.

Beginning in 2018, water samples were collected weekly at CSHH #1-3, #8, #13, #16, and #17 and, when tidal and weather conditions allowed, at CSHH #4-7, #14, and #15; samples were delivered to Pace Analytical Services, LLC for analysis of ammonia, nitrite, and nitrate. Starting in 2019, water samples for nitrogen analysis, including total Kjeldahl nitrogen, were collected biweekly at 10 stations: #1, #3, #6-8, #12-13, #14A, #15A, and #16 (with access to #6 and #7 being tide dependent).

As of 2020, water samples are collected biweekly from November to April at CSHH #14A and #15A as part of the winter monitoring program. These samples are also delivered to Pace Analytical Services, LLC for an analysis of both organic and inorganic nitrogen.
It is important to understand how the various forms of nitrogen are related and reported. Total nitrogen (TN) comprises organic nitrogen and inorganic nitrogen. Organic nitrogen includes compounds such as amino acids and urea; inorganic nitrogen consists of nitrate (NO_3), nitrite (NO_2), and ammonia (NH_3), in both dissolved and undissolved forms. Total Kjeldahl nitrogen (TKN) is the sum of organic nitrogen and ammonia.

The tidal indicator protocol established by the Mid-Atlantic Tributary Assessment Coalitions (*Wicks, et al., 2011, as cited in Taillie, et al., Water quality gradients and trends in New York Harbor, Regional Studies in Marine Science, Vol. 33, 2020, 100922*) identifies the following indicator thresholds for total nitrogen levels:

>1.2 mg/L, considered very poor (failing score)
0.8 - 1.2 mg/L, considered poor
0.6 - 0.8 mg/L, considered marginal
0.4 - 0.6 mg/L, considered fair
<0.4 mg/L, considered good (a passing score)

In 2022, **average total nitrogen** in Hempstead Harbor ranged from 0.44 mg/L at CSHH #16 to 5.7 mg/L at CSHH #14A, indicating fair to very poor conditions. In comparison, the 2021 range (0.72 mg/L to 5.3 mg/L) indicated marginal to very poor conditions. Additionally, in 2022, 6 of the 10 stations tested had average TN levels above the 1.2 mg/L threshold. This represents a slight improvement over 2021, where average TN levels exceeded the threshold at 8 of the 10 stations tested. (See *Appendix D* for total nitrogen graphs.)

Dissolved inorganic nitrogen (DIN), comprising NO_3, NO_2, and NH_4, are the forms of nitrogen most readily available to phytoplankton. As a result, it often controls the formation of algal blooms and is used by US EPA as an indicator of estuarine water quality (*U.S. Environmental Protection Agency. Office of Water and Office of Research and Development. (2015). National Coastal Condition Assessment 2010 (EPA 841-R-15-006). Washington, DC. December 2015. http://www.epa.gov/national-aquatic-resource-surveys/ncca*). In the most recent National Coastal Condition Assessment, the US EPA identifies DIN as an indicator of nutrient enrichment and estuarine water quality and states that DIN concentrations >0.5 mg/L are considered an indicator of poor water quality. Currently, CSHH does not test specifically for DIN; however, CSHH calculates total inorganic nitrogen (TIN). If TIN (which includes DIN) is less than 0.5 mg/L, this would indicate that DIN must also be below this 0.5 mg/L threshold. Most of CSHH's TIN measurements are above this threshold; elevated TIN levels may indicate elevated DIN levels.

In 2022, CSHH #14A had the highest **average total inorganic nitrogen** (5.9 mg/L). This was also the case in 2020 and 2021. Stations CSHH #16, #3, and #1 had the lowest average

TIN levels (0.04 mg/L, 0.10 mg/L, and 0.15 mg/L, respectively). At CSHH #1, #3, #6, and #16, average TIN concentrations and the majority of individual TIN values were below 0.5 mg/L.

The presence of ammonia in the harbor can indicate nutrient enrichment. Elevated ammonia levels can be present in the harbor from stormwater discharges or may even indicate a large presence of fish, such as Atlantic menhaden. As stated previously, ammonia can also be detected when wastewater systems, including septic systems, cesspools, and publicly owned treatment works (POTWs), are malfunctioning and discharging to the harbor. CSHH monitors the outflow of the Glen Cove sewage treatment plant (CSHH #8). In 2022, average ammonia at CSHH #8 was 0.19 mg/L. This represents a steep drop in average ammonia from 2021 at this station, which was 1.3 mg/L. Average ammonia also decreased from 2021 levels at all other Glen Cove Creek stations tested, CSHH #12 and #13. The highest average ammonia in 2022 was at CSHH #14A (0.65 mg/L), and the lowest was at CSHH #16 (0 mg/L), where ammonia was below the detectable limit for all samples.

Nitrate and nitrite occur in later stages of the nitrogen cycle and are normally present in the estuary. However, high concentrations indicate enrichment problems and can also be used to anticipate algal blooms and hypoxia.

Nitrite is frequently below the detectable limit of 0.050 mg/L as it quickly transforms into nitrate in the presence of oxygen. Values are consistently low across stations when nitrite is detectable. In 2022, nitrite was exclusively detectable in samples from outfall stations (CSHH #14A, #15A, and #8).

In 2022, average nitrate levels ranged from 0.03 mg/L at CSHH #16 to 5.2 mg/L at CSHH #14A. In 2021, average nitrate was lower at CSHH #14A (3.7 mg/L). The next highest average nitrate levels in 2022 were at CSHH #15A (2.5 mg/L), CSHH #13 (1.6 mg/L), and CSHH #8 (0.79 mg/L). It is important to note that the elevated average nitrate value at CSHH #13 appears to be driven primarily by an unusually high sample on September 8 of 9.0 mg/L.

Nitrogen contamination can potentially pose problems for drinking water quality. Nitrogen contamination of groundwater has the highest potential for health impacts in places like Long Island, where drinking water comes solely from groundwater. Excess nitrate levels present in drinking water due to contamination from fertilizers and septic systems can lead to “blue-baby” syndrome in infants.

The consistently high levels of nitrogen indicators at CSHH #14A, the powerhouse drain outfall, may be expected given that this station receives considerable stormwater runoff that could be contaminated by nutrient-heavy sources (fertilizer, pet waste, etc.).

Following years of studies and modeling around Long Island Sound, nitrogen discharge limitations were imposed on sewage treatment plants all around the sound to reduce nitrogen outputs, thereby reducing algal blooms and the frequency and duration of low oxygen levels throughout the sound. However, reducing stormwater inputs is more complicated because the sources of nitrogen and other pollutants are so diffuse.

3.8 Bacteria

Nassau County Department of Health (NCDH) and NYS Department of Environmental Conservation (DEC) are the agencies that have jurisdiction in Hempstead Harbor for opening or closing swimming beaches and shellfish beds, respectively. Both agencies use ***fecal indicator bacteria levels*** and other factors to determine whether beaches or shellfish beds require temporary or extended closures.

Fecal coliform and **enterococci** are the types of bacteria that are measured and used as indicators for water-quality standards. They are typically found in human and warm-blooded animals and are, therefore, used as indicators of fecal contamination and the potential for the existence of other organisms that may have an adverse impact on human health. **Total coliform bacteria** are widely present in the environment, whereas **fecal coliform** is most commonly found in the intestines of warm-blooded animals (such as birds), and **enterococci** are most prevalent in the human digestive system.

Key Findings – Bacteria

- Levels for fecal indicator bacteria were lower at outer-harbor stations than near-shore and outfall stations, likely because they are less influenced by stormwater and other discharges from the watershed.
- The outfall for the powerhouse drain had consistently high levels of bacteria for samples taken directly from the discharge.
- Results from both summer and winter monitoring at Scudder's Pond have shown lower bacteria levels for both fecal coliform and enterococci as compared with pre-restoration levels.
- Among operational beaches, only Morgan Beach was closed due to high bacteria levels (for two days) during the season.

3.8.1 Beach-Closure Standards

The Beaches Environmental Assessment and Coastal Act of 2000 (BEACH Act) gave US EPA the authority to set and impose water-quality standards for coastal beaches throughout the United States and compelled all states to adopt new criteria for determining beach closures by April 2004.

On June 23, 2004, New York State instituted revised beach-closure standards, presented in NYCRR Title 10, Section 6-2.15. The standards for marine waters include the following thresholds:

- Based on a single sample, the upper value for the density of bacteria shall be:
  a. 1,000 fecal coliform bacteria per 100 ml; or
  b. 104 enterococci per 100 ml.
- Based on the mean of the logarithms of the results of the total number of samples collected in a 30-day period, the upper value for the density of bacteria shall be:
  a. 2,400 total coliform bacteria per 100 ml; or
  b. 200 fecal coliform bacteria per 100 ml; or
  c. 35 enterococci per 100 ml.

Although coliform and enterococci are present in the human intestine and also in the intestines of warm-blooded animals, EPA considers the enterococcal standard to be more closely correlated with human gastrointestinal illnesses and, therefore, more protective of human health.

In 2008, enterococcus became the sole indicator organism recommended by the EPA and required by the New York State Sanitary Code for Bathing Beaches (Subpart 6-2) for evaluating the microbiological quality of saline recreational beach water. NCDH, therefore, discontinued analyzing beach water samples for fecal coliform.

On July 31, 2014, EPA issued an updated version of its National Beach Guidance and Required Performance Criteria for Grants. Key changes in the 2014 Beach Guidance include:

- Updating the science on pathogens, fecal indicator bacteria (FIB), and health concerns
- Updating the science on beach water-quality monitoring
- Providing guidance on when to issue or remove a notification
- Describing new beach notification and communication tools, such as social media, e-mail, and text messages
- Adding new performance criterion

The guidance was partially implemented, most notably with regard to communication and notification of precautionary administrative beach closures. In 2015, NCDH started issuing “advisories” to close beaches rather than administrative or preemptive closures when rainfall exceeds a half inch in a 24-hour period (see more below).

3.8.2 Beach Monitoring for Bacteria Levels

Each beach season, samples for bacteria testing are collected twice a week by the Nassau County Department of Health at beaches around the harbor. These bacteria samples are analyzed at the NCDH laboratory in conformance with beach-closure standards that were implemented in 2004. (Although NCDH discontinued the analysis of fecal coliform for beach closures in 2008, it continued both fecal coliform and enterococci analyses for the midharbor samples collected by CSHH to allow for more consistency in the comparison of data.)

During the 1980s, chronic raw sewage spills into Hempstead Harbor caused elevated levels of bacteria, affecting shellfish beds and recreational use of the harbor. Between 1986 and 1990, beaches around Hempstead Harbor were closed an average of eight days each beach season due to high coliform counts. Beach closures dropped off significantly during the early years of CSHH's monitoring program, and, for beach seasons 1994-1999, there were no beach closures due to high bacteria levels.

However, in 2000, NCDH initiated a preemptive (or administrative) beach-closure program. This means that in addition to closing beaches based on high bacteria sample results, NCDH closes beaches as a precautionary measure following rain events that exceed a threshold level and duration of precipitation. That threshold is established at the beginning of each season based on previous sample results, but typically, the threshold is a half inch or more of rain within a 24-hour period. Therefore, even though water quality has improved remarkably, beach closures started to increase because of the preemptive closures. The 2015 change to advisories left the actual closures up to the local municipal jurisdictions, amounting to the same result—beach closures following a half an inch of rain within 24 hours. Note that in calculating the total number of days beaches are closed for each season, NCDH totals the number of days that each beach is closed, even if several beaches around the harbor are closed for the same rain event. Also, the beach at the Village Club of Sands Point is considered “nonoperational,” and so it is not closed preemptively or otherwise.

NCDH continues to monitor Crescent Beach in Glen Cove, which has been closed since 2009 due to a known source of high bacteria from the stream that runs alongside the beach and into the harbor. In 2018, additional tests, including DNA/source tracking, were conducted that pointed to wildlife and two ponds on private property as the source of the bacteria. As part of the 2021 DEC-approved remediation plan, the structure for the helix water-filtration system was installed in the fall on private properties adjoining the stream. In addition, a bioswale and wetland plants were installed to aid in natural filtration. The installation of a double-helix water-filtration system was completed by April 2022. Bacteria levels at Crescent Beach remain elevated. Additional work is planned for 2023.

3.8.2.1 Comparing Bacteria Data for Beaches

Variability in bacteria concentrations from samples collected at individual beaches on a particular day is presented in the data contained in *Appendix C*. It is important to note that changes in government regulations, testing protocols, and methodologies for sample analysis make it difficult to compare water-quality conditions relating to bacteria levels over time.

In 2022, Hempstead Harbor beaches were closed on 7 dates as a precautionary measure following half an inch or more of rain in a 24-hour period (see *Appendix B*); in addition, Sea Cliff Beach was closed on two days as a precautionary measure following a sewage leak discharging into Glen Cove Creek. Morgan Beach was closed on two days due to high bacteria levels. By comparison, in 2021, only Sea Cliff Beach was closed due to high bacteria levels (for a total of 11 days).

Monthly average bacteria results for enterococci at Hempstead Harbor beaches in 2022 ranged from 0.82 CFU/100 ml, at Sea Cliff Beach in June, to 427.78 CFU/100 ml at Crescent Beach in September. Crescent Beach remained closed all season and had the highest average fecal indicator bacteria levels of all area beaches for the season—260.25 CFU/100 ml. Sea Cliff Beach had an average fecal indicator bacteria level of 12.89 CFU/100 ml for the season, the lowest among area beaches. See *Appendix C* for previous years’ comparisons.

Table 4
2022 Monthly Average for Beach Enterococci Data in CFU/100 ml*

	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	57.04	1.92	3.05	57.02	4.58	15.03	156.01
May	2.08	2.72	1.07	9.53	8.72	1.07	161.06
June	7.72	3.82	1.94	52.13	0.82	3.04	56.12
July	49.16	19.29	25.60	40.00	26.38	76.68	382.29
August	85.34	54.33	159.50	44.44	15.41	15.38	365.69
September	—	—	—	—	29.67	—	427.78
Season Averages	42.21	18.55	47.80	41.80	12.89	26.03	260.25

**The New York State standard sets the upper limits of enterococci at 104 colony forming units (CFU) per 100 milliliters of water for a single sample and 35 CFU for the 30-day logarithmic average. The units in the table above are calculated as an arithmetic average.*

3.8.3 Monitoring CSHH Stations for Bacteria Levels

CSHH collects samples for bacteria analysis at 21 monitoring stations in Hempstead Harbor (15 stations on a weekly basis and others depending on tidal conditions). Five of these (CSHH #9-13) started as temporary sites but became part of the regular sampling program to test for the presence of bacteria from discharge pipes in Glen Cove Creek in the vicinity of the STP.

Other areas of concern that CSHH regularly monitors for bacteria levels are those draining Scudder's Pond (CSHH #15A and #15B) and the outfall at the bottom of Glenwood Road and Shore Road (CSHH #14A) that drains what is referred to as the Powerhouse Drain Subwatershed. As previously stated, these stations have been monitored since 2009 during the regular monitoring season and have been the focus of the Hempstead Harbor winter monitoring program since 2013.

In 2015, three new stations (CSHH #16, #17, and #17A) were added to assess the water quality in the certified shellfishing area located in the outer harbor as well as near and in the restricted area off of Crescent Beach. Results from bacteria samples taken at these stations supplement the samples collected by NYS DEC and NCDH.

Regarding the outfall pipes monitored in Glen Cove Creek, there have been unusual and recurring discharges of brown flow from CSHH #9 and milky-white flow from CSHH #10 observed and reported over several years at these outfalls, which are near the Glen Cove STP outfall. Unusual discharges have been noted since 2004 and reported to Glen Cove city officials, NCDH, HHPC, Nassau County Department of Public Works (NCDPW), and NYS DEC. Despite efforts to identify the source(s) of these discharges, the results of the investigations provided inconclusive results.

In 2018, additional tests were performed on samples collected from the white discharge; results showed high levels of calcium carbonate, magnesium, and water hardness, but the source of the discharge was not conclusively identified.

In 2019, samples collected from the white flow from CSHH #10 and brown discharges from CSHH #9 were tested for bacteria. The brown discharges occurred on three dates in June and had elevated bacteria levels.

In 2021, additional instances of brown flow from CSHH #9 were observed. In response, in early June, Glen Cove DPW installed a filtration system inside the manhole behind the STP that drains water through to that outfall. There were still a few instances of discolored or brown flow; about half of the samples collected after the installation of the filtration system had exceedances in bacteria levels.

By October 13, 2021, the outfall at CSHH #9 was covered by construction of a new bulkhead. Bulkhead construction along the Glen Cove STP began in June 2021 and was completed December 2021. During that time, a bypass was constructed to divert the flow from the STP outfall (CSHH #8), and we continued to collect samples from the diverted flow (CSHH #8A). Once the work was completed at the western end of the STP, outfall pipes for both CSHH #8 and #9 were installed through the new bulkhead.

In 2022, there were no instances of brown flow from CSHH #9. A white flow was observed from CSHH #10 on five occasions: July 6 and 21, August 3 and 17, and September 14.

3.8.3.1 Comparing Bacteria Data for CSHH Stations

The bar graphs in *Appendix B* show bacteria results for CSHH monitoring stations. Stations CSHH #2, #16, and #17 are located in the outer harbor and are thus less influenced by discharges from the watershed, including from municipal stormwater systems, which a recent report by the US Geological Survey found to be the most likely transport mechanism of fecal contamination into the harbor (see *USGS, Using Microbial Source Tracking To Identify Fecal Contamination Sources in an Embayment in Hempstead Harbor on Long Island, New York, Scientific Investigations Report 2021-5042)*. The outer-harbor stations typically show lower bacteria levels than other stations, and that pattern held true in 2022.

Many factors can influence bacteria levels during any given sampling event, making it difficult to see clear and consistent influences from rainfall. Although data from the 2022 season at some stations display a positive correlation between bacteria levels and rainfall, there is variability in the strength of the correlation at different stations for each species and for 24-hour and 48-hour rainfall. For 2022, the clearest correlation for high bacteria levels following 24-hour rainfall of half an inch or more was observed for water samples collected on August 10 and September 14 (see *Appendix B* for bacteria graphs).

In 2021, **Glen Cove Creek stations** (CSHH #8-13) showed alarming bacteria levels. There were consistent exceedances in both fecal coliform and enterococci at the head of the creek (near Mill Pond) as early as July. CSHH continued weekly testing beyond the regular monitoring season through early December, adding new testing stations in order to locate the pollution source. The results from the samples collected enabled us to track the source of the problem to the vicinity of Bridge Street. Shortly thereafter, it was confirmed that there was a broken sewer line at that location.

Glen Cove DPW, Nassau County DPW and Department of Health, and the Hempstead Harbor Protection Committee were informed of the data results. Suez (the operator of the Glen Cove STP) scheduled work on November 29 and installed a bypass. On December 1, CSHH collected water samples in Glen Cove Creek, and lab results showed a dramatic decrease in the bacteria levels, although the sample collected at the head of the creek still had a very high fecal coliform count. The sewer line repair was completed by the end of the day on December 2, and CSHH collected another round of water samples from Glen Cove Creek on December 8; lab results showed dramatically lower bacteria levels, well below thresholds that are used for beach closure standards.

While there remain periodic exceedances of fecal coliform and enterococci thresholds at Glen Cove Creek stations (CSHH #8-13), neither showed the same pattern of high levels in 2022, indicating a recovery from the sewer line break (see *Appendix B*).

The **winter monitoring program**, which first focused on conditions at Scudder's Pond, currently focuses primarily on the outfall pipe (CSHH #14A) that drains most of the Powerhouse Drain Subwatershed. Monthly checks continue at Scudder's Pond (CSHH #15A and #15B). This program now has ten years of data for comparison of bacteria levels. (The Hempstead Harbor monitoring program is one of the few programs, if not the only program, testing for bacteria in the winter.)

Initially, there was some expectation that bacteria levels would decrease in the colder temperatures, but there are factors that may contribute to the continued higher bacteria levels during the winter (e.g., lower temperatures and UV conditions during winter months may promote slower decay and longer survival rates of the bacteria species).

There were no fecal coliform exceedances during the **2022-23 winter monitoring at CSHH #14A**. For samples taken directly from flow, enterococci levels were lower and had fewer exceedances in winter 2022-23 as compared with 2021-22. However, bacteria levels from discharges from the powerhouse drain outfall and the surrounding subwatershed remain a concern.

It was because of results from samples collected in the previous winter season (2021-22) that an **extended sampling schedule was developed for Glenwood Landing**. CSHH #14A had elevated levels of fecal coliform, which prompted an investigation similar to what occurred in Glen Cove Creek. The sampling in Glenwood Landing encompassed stations in

Table 5
Stations Exceeding Bacteria Standards[1]—Summer and Winter Monitoring

CSHH Stations	#15A[2]		#15B[3]		#14A[2]	
% of CFU[4] Exceedances	FC[5]	ENT[6]	FC	ENT	FC	ENT
5/5/13-11/13/13	17%	45%	29%	69%	32%	68%
11/18/13-5/14/14	13%	58%	13%	58%	50%	85%
Scudder's Pond Restoration Completed June 2014						
5/21/14-11/5/14	8%	36%	20%	28%	25%	100%
11/13/14-4/29/15	8%	33%	10%	30%	--[7]	--[7]
5/7/15-11/4/15	23%	31%	19%	23%	60%	64%
11/11/15-4/27/16	20%	15%	15%	10%	68%	89%
5/1/16-10/26/16	0%	29%	0%	24%	92%	69%
11/9/16-4/26/17	0%	23%	23%	15%	50%	75%
5/10/17-10/27/17	0%	26%	0%	17%	4%	67%
11/1/17-5/4/18	25%	38%	25%	25%	44%	59%
5/23/18-10/31/18	14%	26%	21%	25%	27%	65%
11/8/18-4/25/19	0%	0%	0%	0%	58%	17%
5/15/19-10-30/19	4%	29%	0%	33%	13%	58%
11/6/19-4/30/20	0%	38%	0%	38%	23%	46%
5/20/20-10/28/20	9%	26%	13%	25%	4%	74%
11/12/20-4/14/21	14%	29%	17%	33%	33%	67%
5/19/21-10/28/21	4%	38%	0%	33%	0%	57%
11/10/21-4/14/22	0%	0%	0%	0%	57%	79%
5/18/22-10/27/22	9%	30%	29%	57%	9%	48%
11/9/22-4/19/23	0%	17%	0%	20%	0%	42%

[1] *For purposes of comparison, beach-closure thresholds for fecal coliform and enterococci are used here.*

[2] *Percent of exceedances may not reflect the monitoring events when samples are collected during high tide and the discharge is mixed with harbor water and, thus, diluted.*

[3] *Starting in summer 2019 season, only monthly testing at CSHH #15B.*

[4] *CFU: colony-forming units.*

[5] *FC: fecal coliform.*

[6] *ENT: enterococci.*

[7] *Only one sample collected during this period.*

and around the small stream that runs through the lower part of Glenwood Landing and into Hempstead Harbor through the powerhouse drain outfall. (The stream daylights at Betty Lane to the east and runs to a culvert at the corner of Kissam Lane and Glenwood Road.) With the assistance of Nassau County DPW, CSHH collected water samples for bacteria analysis from selected manholes located on both sides of Glenwood Road. The investigation continued through the spring of 2022, accessing additional testing sites on feeder roads with the help of Town of Oyster Bay staff.

On April 11, 2022, an infrared drone survey was commissioned by the Hempstead Harbor Protection Committee and conducted by Harkin Aerial and Walden Environmental

Engineering to identify potential sources of pollution. Despite these efforts, the source of the bacteria remains inconclusive. CSHH sent a letter to Glenwood Landing residents on May 2, 2022, to inform them of the ongoing testing as well as actions they could undertake to help reduce bacteria loading into the harbor.

Extended monitoring in Glenwood Landing included lifting manhole covers and taking water samples from pipes running under Glenwood Road as well as from the stream that runs north of Glenwood Road (photos by Michelle Lapinel McAllister and Carol DiPaolo, 1/19/22-3/22/22)

3.8.4 Monitoring Bacteria Levels Near Shellfish Beds

Shellfish beds in most western Long Island Sound areas have been restricted or closed to harvesting for 40 to 70 years. In 2011, a portion of the shellfish beds in the northern section of Hempstead Harbor were reopened because of water-quality improvements. However, a large area of the harbor remains restricted from shellfish harvesting. Pathogen contamination is the main concern with shellfish beds because of the risk to humans who consume shellfish contaminated by harmful bacteria or viruses present in the water. Fecal coliform is the indicator organism that is used to determine whether certain water bodies are safe for shellfish harvesting. It is associated with human and animal waste and is used to indicate the presence of other more harmful bacteria, similar to the processes used to measure water quality for beaches (see the Beach-Closure Standards in *Section 3.8.1* above).

3.8.4.1 Shellfish Pathogen TMDLs

In August 2007, DEC announced the release of a report on “Shellfish Pathogen TMDLs for 27 303(d)-listed Waters” (including Hempstead Harbor). Under Section 303(d) of the federal Clean Water Act, states are required to develop plans to decrease the total maximum daily loads (TMDLs) of all pollutants that cause violations of water-quality standards. The DEC had listed 71 “Class SA” water bodies as being pathogen impaired. Class SA is applied to marine and estuarine waters that are considered to have ecological, social, scenic, economic, or recreational importance. Class SA waters have the highest level of protection and must, by law, be suitable for recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, and as habitat for fish and other marine life. Hempstead Harbor overall is divided into three categories: Class SA north of the sand spit, SB south of the sand spit, and SC for Glen Cove Creek. For Class SB, primary contact recreation is the highest best use of the water; the highest best use of Class SC waters is fishing.

The TMDL report called for a 95% pathogen load reduction, which contradicted DEC test results that showed that a portion of the harbor's shellfish beds could be reopened. At a meeting on October 16, 2008, DEC stated that the ultimate objective of the TMDL is to open the harbor to shellfishing, and, therefore, in the event that the entire area of Hempstead Harbor’s Class SA waters is opened, the TMDL would be satisfied, and no additional remedial actions (other than monitoring) would be required. However, a portion of the harbor’s SA waters may not be reopened–even in the long term. Therefore, efforts to reduce bacteria will be required along with continued monitoring.

In 2018, DEC rescinded the pathogen TMDLs and created a pathogen TMDL workgroup (of which CSHH and HHPC are members) to discuss formulation of new TMDLs and prioritization of water bodies around the state; Hempstead Harbor is expected to be among the first waterbodies to have a new TMDL.

3.8.4.2 Monitoring Shellfish Growing Areas in Hempstead Harbor

In 2009, in an attempt to assess water quality and determine whether opening mid- and lower sections of the harbor to shellfish harvesting should be pursued, CSHH partnered with DEC to collect water samples. Thirteen of the 19 stations sampled were the same stations established by DEC in 1988 for shellfish growing area (SGA) #50. The samples were delivered to the DEC lab in East Setauket, where they were analyzed for fecal coliform. The results showed that the sampling stations exceeded single-sample standards (49 MPN/100 ml) 37% of the time with DEC #13 (outside of Glen Cove Marina in Glen Cove Creek) exceeding at the highest rate, 53%.

Before this type of testing can be initiated once again, there would have to be some indication of additional water-quality improvements, e.g., from structural changes completed around the harbor to reduce runoff and bacteria loading.

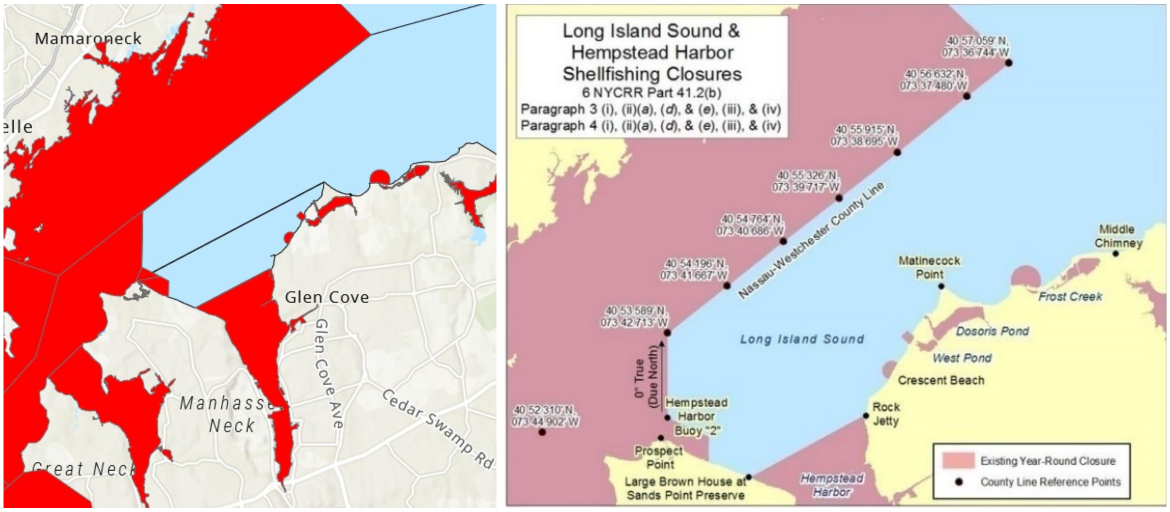
3.8.4.3 Certifying Shellfish Beds in Outer Harbor

On June 1, 2011, 2,500 acres of recertified shellfish beds were opened in the outer section of Hempstead Harbor. This followed five years of rigorous water-quality testing, as well as testing of samples of hard-shell clams from the area. For the first time in more than 40 years, clams, oysters, mussels, and scallops could be taken from this area by both commercial and recreational clammers, consistent with the size and quantity limits set for state waters. The rest of the harbor and East Creek, West Pond, and Dosoris Pond, which empty into the outer harbor, remain closed to shellfishing. A small semicircular area around Crescent Beach is also closed to shellfishing. (Crescent Beach has been closed for swimming since 2009; see *Section 3.8.2*.) In May 2018, approximately eight acres outside the mouth of West Pond, on the eastern shoreline of outer Hempstead Harbor, were reclassified as uncertified (closed) for shellfish harvesting because of an increase in bacteria levels. On November 22, 2021, 134 acres of Hempstead Harbor adjacent to Prospect Point were downgraded from certified year-round to uncertified year-round. However, 6,150-acres of Long Island Sound east of Prospect Point and south of the Nassau-Westchester County Line were upgraded from uncertified year-round to certified year-round. See *Figure 12*.

Signs have been posted along the shoreline in areas that remain uncertified. Three buoy markers delineate the 250-yard radius around Crescent Beach that remains closed to shellfishing.

NYS DEC posting near Sea Cliff Beach (photo by Michelle Lapinel McAllister, 8/5/22)

Figure 12
NYS DEC's Map of Hempstead Harbor and LIS Uncertified Shellfishing Areas
Areas in red (map below at left) and pink (map below at right) designate uncertified areas.



The DEC continues to monitor the water quality of the reopened shellfish area and make necessary changes to the area's classification as conditions warrant. Similar to NCDH's protocol for closing beaches, DEC's protocol for temporarily closing certified shellfish beds uses a rainfall threshold amount (generally 3 inches) during a 24-hour period or an exceedance of 14 MPN/100 ml for fecal coliform, to protect against health risks associated with high bacteria levels caused by stormwater runoff. In 2022, there were no emergency closures of shellfish beds in Hempstead Harbor. Information about shellfish-bed closures is disseminated through a prerecorded phone message at 631-444-0480, the DEC website (http://www.dec.ny.gov/outdoor/7765. html), and through press releases to local media outlets.

3.8.5 Bacteria Source Tracking

Because water quality has greatly improved over the years, increasing numbers of water birds are now seen on and around the harbor. This raises a question as to whether the birds and other wildlife are a significant factor in bacterial levels in Hempstead Harbor. Bacteroides analysis, along with other types of monitoring, would help answer that question so that appropriate strategies could be formulated.

In 2018, US EPA along with US Geological Survey and NYS DEC began using new methods of source tracking for several areas around Hempstead Harbor, including Crescent Beach (see *Section 3.8.2*).

In 2018-2019, USGS worked with NYS DEC and used microbial source tracking (MST) to assess potential sources of fecal contamination entering Hempstead Harbor. Water samples were collected in Glen Cove Creek (near CSHH #8), Tappen Beach (near CSHH #15A), at the powerhouse drain outfall (CSHH #14A), and an outfall and spillway in the lower harbor at the end of Skillman Street in Roslyn. MST was used to determine whether genetic material (from *Bacteroides* and *Heliobacter* bacteria) in samples collected for the study was consistent with that found in humans, dogs, ruminants (e.g., deer), or water fowl. The report concluded that (1) a substantial number of samples showed markers from humans, dogs, and water fowl, (2) stormwater from municipal stormwater systems was the most likely transport mechanism for fecal contamination to Hempstead Harbor, and (3) outfalls at the end of Glenwood Road and Skillman Street contributed a substantial amount of fecal contamination to Hempstead Harbor (see *USGS, Using Microbial Source Tracking to Identify Fecal Contamination Sources in an Embayment in Hempstead Harbor on Long Island, New York, Scientific Investigations Report 2021-5042*).

3.9 Precipitation

Precipitation affects Hempstead Harbor water quality directly on the harbor's surface and through stormwater runoff. Both of these inputs can reduce the harbor's salinity. Direct precipitation tends to also dilute the quantity of pollutants within the harbor, although it can carry airborne pollutants. Stormwater runoff increases pollutant loads by washing bacteria, chemicals, and nutrients that have accumulated on the ground surface in the watershed into the harbor.

CSHH collects precipitation data using a rain gauge located in Sea Cliff. (See *Appendix B* for 2022 monthly precipitation and 1997-2022 monthly rainfall totals.) Total precipitation measured during June through October 2022 was 21.15 in (537.21 mm). Total precipitation measured over the same time period in 2021 was 36.15 in (918.21 mm).

Washouts along the west shore (photo by Carol DiPaolo, 6/29/22)

Total precipitation for the 2022 summer season (June 21-September 22) was 12.11 in (307.59 mm). This is less than half of the total precipitation for the 2021 summer season, which was 27.83 in (708.88 mm). There were no tropical storms or hurricane events during the 2022 regular monitoring season, while there were four major storms in 2021, which brought with them heavy precipitation over relatively short periods of time. Despite the fact that Long Island faced abnormally dry conditions throughout the summer of 2022, and at times was in a moderate to severe drought (see NOAA/National Integrated Drought Information System https://www.drought.gov/states/new-york), there were five rain events that resulted in over an inch of rain. The highest rainfall for the 2022 regular monitoring season occurred on September 13, with 2.40 inches of rain for that day. These rain events worsened the condition of washouts that occurred after storms in 2021.

Links between precipitation and salinity are described above in *Section 3.3*.

4 Observations

The 2022 water-monitoring season for the Hempstead Harbor core program began on May 18 and extended through October 27 (monitoring for the Unified Water Study began on May 31 and extended through October 6); winter monitoring of shoreline outfalls ran from November 9, 2022, through April 19, 2023.

During all monitoring surveys, wildlife observations are noted. These observations along with information from formal fish surveys and studies help fill out the picture of the health of the harbor's habitat. Local residents also play an important role in providing information on what they see throughout the year not only in and on the water, but also close to the harbor's shores.

4.1 Biological Monitoring Report and Impact of Powerhouse Substation Removal

In 2015, the old brick powerhouse building (which had been part of the Glenwood Landing power plant operation since the early 1900s) was demolished, following the dismantling of the adjacent Substation 3 (in 2013). The substation operated at minimum capacity as a "peaking plant" and was the subject of a marine-life monitoring report–the Glenwood Power Station Entrainment and Impingement Monitoring Report (by ASA Analysis & Communication, Inc., September 2005). The power station monitoring report has been referenced in the Hempstead Harbor annual water-monitoring reports since 2005 because it provides a baseline of marine species that live in the harbor. Thirty-four types of fish and several other marine animals were found in the samples collected for that report.

In June 2012, LIPA and National Grid released the Environmental Impact Statement (EIS) for the demolition of the peaking plant (see http://www.hempsteadharbor.org/applications/DocumentLibraryManager/HHPCupload/Glenwood_EIA_Final%20June%202012%20.pdf).

CSHH #14A, powerhouse drain outfall (l) adjacent to the lot that was the site of the old brick powerhouse building; demolition of brick structure (r) on east side of the road (photos by Carol DiPaolo, 9/2/21, and Michelle Lapinel McAllister, 10/22/22, respectively)

The EIS projected that the demolition of the plant would provide water-quality improvements: elimination of the thermal discharge from the plant; preservation of 11 million to 18.5 million gallons annually of freshwater that no longer had to be pumped from on-site wells and the municipal system; and an estimated 5,300 fish and 190 million fish eggs, larvae, and early juveniles would no longer be destroyed annually in the plant's intake system. It's possible that this change has contributed to the increase in fish populations noted over the last several years in Hempstead Harbor.

4.2 A Study of Striped Bass in NYS Marine District

Seine surveys for the NYS DEC's striped-bass study have been conducted in western Long Island bays since 1984 and in the Hudson River since 1979. Every year, the DEC prepares a report on the previous season's surveys entitled "A Study of the Striped Bass in the Marine District of New York State."

The study first found that striped bass spent their first year of life in the lower Hudson River, over recent years the nursery for young-of-the-year striped bass has expanded to bays around western Long Island. Although the purpose of the study is to examine the striped bass that have migrated out of the Hudson River as one- and two-year-old fish, the report provides important information on other species as well.

Most of the seining for western Long Island occurs in Jamaica, Little Neck, and Manhasset Bays, but Hempstead Harbor, Cold Spring Harbor, and Oyster Bay are also surveyed. The crew seines at six stations in Hempstead Harbor monthly, May through October. The catch totals for the harbor included in *Table 6* were provided by Zachary Schuller, marine biologist at the NYS DEC Division of Marine Resources, Diadromous Fisheries Unit.

Significant seine catches in Hempstead Harbor for 2022 included bluefish (421), northern puffers (114), scup (aka porgies) (1,870), silversides (24,479), and killifish (1,190). Also of note, the number of blue crabs (35) was up significantly from previous years and corresponds with our monitoring observations. In 2022, there were 1,660 Atlantic menhaden (bunker) counted in the seine survey.

The numbers for many of the fish caught in Hempstead Harbor seines have increased since 2013 (the year that the power plant substation that was located along the shore of the lower harbor was dismantled; see the previous section on the Glenwood power station monitoring report). Most significantly, the Atlantic menhaden (young of the year), which were not included in the 2013 seine catch, were up to a stunning count of 203,932 in 2015. In 2017-2019, the "bunker" totals were 12,086, 3,165, and 1,386, respectively; in 2021, the total was up to 7,815. (Note that in 2020, no seining was conducted in May and June because of COVID-19 delays; therefore, total catches and the number of species represented for the entire season are reduced compared with other years' seasonal totals.)

Table 6
2022 NYS DEC Western Long Island Beach-Seine Survey for Hempstead Harbor

NYS DEC Western Long Island Survey- Hempstead Harbor 2022

			MONTH						
Type	Common_name	AGE	5	6	7	8	9	10	TOTAL
Diadromous:	BLUEBACK HERRING	99					1		1
	STRIPED BASS	0				31	1		32
	STRIPED BASS	1	3		2		2	3	10
Marine:	ATLANTIC HERRING	99	2						2
	ATLANTIC MACKEREL	99					6		6
	ATLANTIC MENHADEN	0		25	101	25	497	6	654
	ATLANTIC MENHADEN	1			34			972	1006
	ATLANTIC NEEDLEFISH	99						2	2
	BAY ANCHOVY	99		2	2			1	5
	BLACKFISH (TAUTOG)	0			1	14	17	11	43
	BLACKFISH (TAUTOG)	1	17	8	3		7	4	39
	BLUEFISH	0		1	6	1	372	39	419
	BLUEFISH	1						2	2
	GRUBBY SCULPIN	99	2	83	12				97
	NAKED GOBY	99		9	1	3	2	1	16
	NORTHERN KINGFISH	99				10	2		12
	NORTHERN PIPEFISH	99	10	15	6	1	1	1	34
	NORTHERN PUFFER	99				113		1	114
	ROCK GUNNEL	99		1					1
	SAND LANCE SPP.	99		2					2
	SCUP	99			38	1174	646	12	1870
	SILVERSIDE SPP.	99	866	366	2631	12070	4595	3951	24479
	SMALLMOUTH	99	1	3		1			5
	STRIPED SEAROBIN	99				25	4	4	33
	SUMMER FLOUNDER	99	1						1
	WEAKFISH	99				64	1		65
	WHITE MULLET	99						2	2
	WINTER FLOUNDER	0		15	16	5		3	39
	WINTER FLOUNDER	1	1	1					2
Estuarine:	KILLIFISH SPP.	99	2	5	55	920	60	148	1190
	SHEEPSHEAD MINNOW	99				1			1
Invertebrate:	BLUE CRAB	0	1	1					2
	BLUE CRAB	1		3	8	22			33
	GREEN CRAB	99		1					1
	HORSESHOE CRAB	99	3	1	1		1	1	7
	MUD CRAB	99	1	4			1		6
	SPIDER CRAB	99	6		2	2	1		11
	SEA STAR	99					1		1
		# of hauls	6	6	6	6	6	6	36

*0= young of the year; 1= older; 99 = unknown

4.3 Shellfish Beds Recertification, Surveys, and Reports

As mentioned in *Section 3.8.4.3,* June 1, 2011, marked the first time in over 40 years that the shellfish beds in the northern section of Hempstead Harbor were reopened for harvesting. The 2,500 acres of recertified shellfish beds extend in a wide strip from the east to west shore of the harbor. The recertification of the shellfish beds is the best indicator of the dramatic water-quality improvements that have been made in Hempstead Harbor and enhances the harbor's productivity through commercial and recreational shellfish harvesting.

Clammer offshore of the Webb Institute in outer Hempstead Harbor (l) and sorted clams from the harbor on opening day of the shellfish area (r) (photos by Carol DiPaolo, 6/8/22 and 6/1/11, respectively)

The southern boundary of the recertified area extends from a rock jetty north of the Legend Yacht and Beach Club community (the site of the former Lowe estate) on the east shore to the large "brown house with chimneys" on the west shore (noted on navigational charts), which is Falaise, part of the Sands Point Preserve. (All areas south of this line remain closed to shellfishing.) The northern boundary of the recertified area runs from Matinecock Point on the east shore to Prospect Point on the west shore. However, Dosoris Pond, West Pond, and a semicircular area extending 250 yards off of Crescent Beach on the east shore remain closed to shellfishing. As of November 22, 2021, 134-acres of shellfish beds were closed in waters adjacent to Prospect Point, while 6,150-acres were opened for the first time just outside of Hempstead Harbor in the open waters of Long Island Sound. (See *Figure 12.*)

In the first few weeks after the 2011 opening of the shellfish beds in Hempstead Harbor, large numbers of clam boats could be seen daily, clustered in essentially the same northeast area of the recertified beds and loaded with large mesh bags of clams. CSHH began incorporating trips to the area during weekly monitoring surveys to record the number of boats harvesting clams throughout the season. (In 2015, station CSHH #17 was established at the boundary of the uncertified area of the harbor outside of Crescent Beach.) Most of the commercial clammers work the area near Matinecock Point, and fewer are near Crescent Beach. In 2022, we observed an average of 6 clammers on most monitoring dates, with a high of 13 clammers on June 8 (mostly located around Matinecock Point with 5 in the area just beyond the mouth of the harbor, in Long Island Sound, that was recertified in 2022). The number of clammers in Hempstead Harbor varies with weather and water-quality conditions in other bays further east; e.g., if shellfish beds in eastern bays are closed, we notice more clammers in Hempstead Harbor.

Shellfishing is historically significant for Hempstead Harbor because it was an important commercial endeavor from about the first quarter of the nineteenth century into the first quarter of the twentieth century. Clams and oysters were shipped regularly from Hempstead Harbor to New York City until restrictions were imposed because of dwindling resources. By 1928, the lower portion of the harbor was closed to shellfishing because of increasing levels of bacteria in the water (as was the case for most bays in western Long Island Sound and other New York waters). For a time, clam dredgers were used to harvest clams in Hempstead Harbor; the clams were then transported to the Peconic Bay, where they were transplanted and remained for several weeks for purification so they could be sold commercially.

By the late 1990s, clams, oysters, and mussels were abundant throughout the harbor, and because of improved water quality, it seemed time to pursue one of our longstanding goals of reopening the harbor's shellfish beds. But the long, complex process of recertifying shellfish beds required tremendous collaboration as well as adherence to strict protocols for water-quality testing and retesting.

In 1998, CSHH initiated the first step and worked with the Interstate Environmental Commission, DEC, Town of North Hempstead (TNH), and local baymen to conduct a **hard-clam density survey** to determine the extent and condition of the clam population; the survey showed a healthy population of hard clams. From 2004 through 2008, DEC collected water samples from Hempstead Harbor. Several samples of the shellfish from the harbor were collected and tested for chemical contamination, but the results from those analyses were not completed and released until 2010.

Falaise, "the brown house with chimneys," marks the western point of the southern boundary of the certified shellfish beds in Hempstead Harbor (photo by Carol DiPaolo, 6/29/22)

On September 28, 2009, DEC–Bureau of Marine Resources (BMR) in conjunction with the US Food and Drug Administration (FDA) conducted a **hydrographic dye study** in Glen Cove Creek and Hempstead Harbor to test the dilution, dispersion, and time of travel of the sewage effluent discharged by the Glen Cove STP. A shoreline survey of the harbor was completed in the autumn of 2010, and at that point everything was lined up for the reopening of the shellfish beds in Hempstead Harbor in 2011.

4.3.1 Shellfish Landings Reports

The NYS DEC publishes annual reports of shellfish landings by species and area in waters all around Long Island. (See https://www.dec.ny.gov/outdoor/103483.html for shellfish areas.) The reports are generated from tags filled out by shellfish "diggers." Records of the amounts of each type of shellfish and harvest location are kept by distributers and provided to the DEC. Once Hempstead Harbor was included in the landings reports, we began comparing annual landings from the harbor with those of other areas. One of the standout years for the harbor was 2014, when the hard-clam harvest totaled 17,424 bushels. That represented the second largest harvest of hard clams for that year out of all of the harvest areas around Long Island, with an economic value of over $1.36 million. For subsequent years, there have been fluctuations in the numbers of shellfish landings from Hempstead Harbor (as with neighboring bays), due to economic as well as environmental factors.

In 2022, the Hempstead Harbor hard-clam haul remained relatively high at 11,248 bushels (up from 11,111 bushels in 2021 and still ranking the third highest haul for the Long Island shellfish harvesting areas) and oyster hauls were up significantly at 657 bushels. There were no hauls reported for soft shell clams.

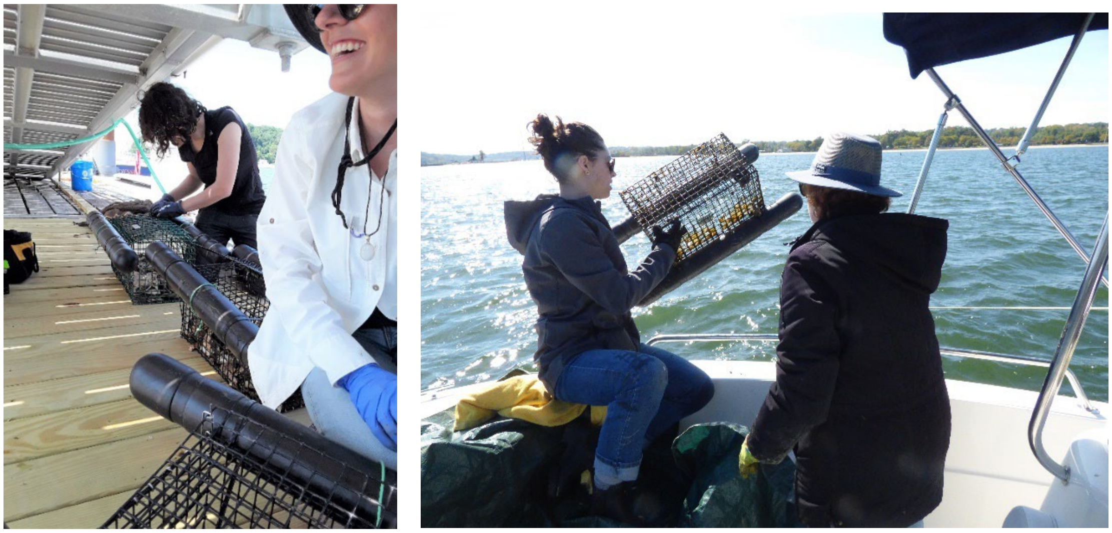
In 2020, the hard-clam haul was near the 2014 high—at 12,741 bushels of hard clams for a value of $1.04 million. In the same year, numbers of hard clams, soft clams, and oysters dramatically decreased for Oyster Bay and Huntington Bay.

4.3.2 Shellfish Restoration and Seeding Projects

Harborwide shellfish habitat restoration projects were first considered as it became clear that Hempstead Harbor would once again have areas recertified for shellfish harvesting. The first project was the October 9, 2007, shellfish seeding that was conducted for the harbor. It was a joint initiative that included Nassau County, TNH, TOBAY, Cornell Cooperative Extension, Frank M. Flower & Sons Oyster Company, as well as HHPC and CSHH. The project was intended to add biomass–clams and oysters–to the harbor to help improve water quality and restore shellfish populations. An adult oyster can filter approximately 50 gallons of water per day, and an adult hard clam can filter about 24 gallons per day. More than 1.3 million seeds, consisting of two types of hard-shell clams (*Mercenaria* and *M. mercenaria notata*) and oysters were planted. (The *M. mercenaria notata* has markings that are different from the northern quahog stock normally found in Hempstead Harbor, which would later help in gauging the survival rate of the seeds.)

On October 15, 2009, Nassau County conducted the second shellfish seeding in Hempstead Harbor, which included 1.1 million clams and oysters. Funding for the 2009 shellfish-seeding operation was provided by the Long Island Sound Study, through the Long Island Sound Futures Fund.

Sustainability of the harbor’s shellfish population remains a concern, and the Tappen Marina aquaculture project described at *Section 2.3*, along with other initiatives, may provide the stock of shellfish needed for seeding Hempstead Harbor in the future.



Setting up oyster cages at Sea Cliff Yacht Club dock (l) and planting oysters in Hempstead Harbor (r)
(photos by Carol DiPaolo, 7/14/22, and Michelle Lapinel McAllister, 10/12/22, respectively)

For example, in 2022, CSHH initiated an oyster gardening program. During that first season, approximately 30,000 spat-on-shell oysters were raised in cages at three sites around Hempstead Harbor, and approximately half of those were planted in the newly established conservation management area in Hempstead Harbor. Although the oysters from this project are not suitable for harvesting, they will eventually spawn and help to provide a growing community of oysters that will improve water quality and habitat for Hempstead Harbor.

4.3.3 Surveys to Assess Survival of Seed Clams and Oysters

Surveys to assess shellfish populations help determine the health of existing shellfish species and the areas within a waterbody that are most hospitable for them to thrive. Knowing the composition of bottom sediments is an important element in understanding why different densities of shellfish are found in different areas of the harbor. Four large-scale shellfish population density and sediment surveys have been conducted for Hempstead Harbor—the first one in 2008 and the most recent in 2021.

In October 2021, HHPC used Cashin Associates to conduct a shellfish density survey for Hempstead Harbor. The survey included 183 samples that were collected from stations throughout the harbor and were consistent with those used for earlier surveys that were conducted in 2013 and 2008 (both also conducted by Cashin Associates). The final survey report (issued on April 13, 2022) concluded that, overall, clam density had increased, with the highest number of clams per square meter in the lower harbor. The percent of seed clams was still very low compared with the 2008 finding, and the mean size of clams had also increased, overall indicating an older and therefore unstable clam population. No oysters were obtained in grab samples, although some were observed by divers who assessed the harbor bottom to create a sediment survey map.

The Town of Oyster Bay had contracted with Cashin Associates to conduct the 2013 survey. The survey encompassed 120 bottom grab samples at the same 61 stations used in the 2008 survey. Among the findings in the survey report (July 9, 2014) were the following: (1) hard clams in the harbor were widespread and fairly abundant; (2) although clam density was lower than in the 2008 survey, it had not changed significantly; (3) the density of seed clams decreased and represented a smaller percentage of the overall clam population; (4) the density of the clam population in the certified area of the harbor was less than what it was in 2008 but not by a statistically significant amount; (5) overall, the size of the clams were larger than in the 2008 survey and this could be because commercial harvesting focuses on the smaller little neck clams. A cautionary note concerned the decline in seed clams: a decrease over several consecutive years could indicate an overall decline in the resource.

The first (2008) density survey conducted for Hempstead Harbor was coordinated in the autumn by the Town of Oyster Bay and HHPC. The density of seed clams found was concerning–0.51 clam/sq m. This meant that there was an aging clam population and that Hempstead Harbor could benefit from seeding projects (see *Section 4.3.2*).

Other surveys included a Sediment Suitability Assessment of Hempstead Harbor for Nassau County's Shellfish Restoration Program (October 14, 2009). Cornell Cooperative Extension Marine Division staffers, Matthew Sclafani, Neal Stark, and Gregg Rivara, chose a scuba survey to evaluate the bottom and delineate the boundaries between mud and harder-type of bottom such as sand and sand-mud-shell mixes in the area off of Morgan Park. The assessment helped determine suitable sites to plant seed clams and oysters in preparation for 2009 shellfish seeding.

A limited shellfish-density survey focusing on the area of the 2007 seeding project was conducted by CSHH in late summer 2008 at seven sites.

4.3.4 Mussel-Watch Project

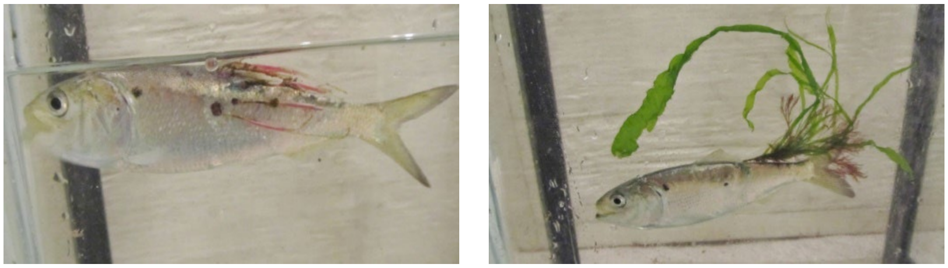
As part of the Long Island Sound Study's indicators program, blue mussels were collected in November 2011 to continue previous efforts through the National Oceanic and Atmospheric Administration's (NOAA) Mussel Watch project to measure levels of contaminants in local blue mussels. A site in Hempstead Harbor off of the Village Club of Sands Point (formerly the IBM Country Club/Guggenheim Estate), was used as part of NOAA's National Status and Trends Mussel Watch program since 1986. Data from a 2000 mussel collection showed abundant blue mussels at the site with a dramatic decrease in contaminant levels for a variety of heavy metals, pesticides, and hydrocarbons. Prior to the November 2011 mussel collection, CSHH visited the site to determine access to and the density of the current mussel population. The site seemed to have a healthy population of mussels, despite reports from local residents that the mussel beds had shrunk after Tropical Storm Irene hit in late August 2011.

Ribbed-mussel colonies on Hempstead Harbor's eastern shore (l) and a close-up of ribbed mussels around spartina roots of the former Bar Beach cove (r) (photos by Skip Dommin, 5/17/21, and Carol DiPaolo, 7/15/17, respectively)

In March 2012, CSHH helped locate potential sites to collect **ribbed mussels** in Hempstead Harbor in preparation for another NOAA mussel-collection program. Ribbed mussels were present on the eastern shore of Hempstead Harbor, just south of Rum Point (north of the Tappen Beach park and pool). They continue to be densely packed around spartina roots in that area but are also present in Mott's Cove and on the western shore below the Bar Beach sand spit.

4.4 'Saladbacks'–A Local Phenomenon

"Saladbacks" is the term that local resident and aquatic conservation biologist John Waldman used to describe the unusual looking Atlantic menhaden (bunker) he first observed in December 2015. The mild autumn temperatures that year seemed to have kept the large population of bunker in the harbor much later than usual, and in mid-December John noted that many of the bunker he saw had parasitic copepods streaming off of them along with red algae and ulva that seemed to be directly attached to the parasites. He saw them again in the same area on December 24, despite the drop in temperature.



Peanut bunker with parasitic copepods (l) and a "saladback" bunker (r) with algae attached to the copepods (photos by John Waldman, 12/15/15)

On January 4, 2016, although most of the fish had left Glen Cove Creek, a large number of bunker swam between the bulkhead and the dock near the STP outfall. Large adult fish were swimming with juveniles that were about 5-6 inches long; the juveniles had red and green algae attached to them. Both groups also had parasitic copepods attached to them.

Photos and descriptions of the saladbacks were sent to a wide group of scientists, and the consensus was that this was a very unusual phenomenon. CSHH arranged to meet NYS DEC staffers at the dock on Glen Cove Creek on January 8, 2016, and they were able to collect a few fish with a drop net.

Saladbacks have been seen in Hempstead Harbor every year since that first observation in 2015, except for 2018, but in smaller numbers. In 2022, bunker with parasitic copepods attached were observed four times over the monitoring season, with evidence of algae growth observed on two of those occasions (once in September and again in October). (See also, Waldman, J., "A Novel Three-Way Interaction Among a Fish, Algae, and a Parasitic Copepod," Ecology, 98(12), 2017, pp. 3219–3220.)

4.5 Monthly Field Observations and Recreational-Fishing Reports

Even before our regular monitoring season begins, we receive reports about observations around the harbor. Starting off our 2022 reports was Thomas Kaelin's sighting of a Cooper's hawk perched in a tree in Sea Cliff on January 14.

On January 23, Sanjay Jain reported:

> *The eagles are doing fine - they are still in the area and have not gone anywhere this year. You are right about the migratory waterfowl numbers - there have not been as many birds as I have seen in previous years. In the past, there used to be large numbers of greater and lesser scaup seen and also buffleheads. This year, there seem to be a lot of geese that are hanging around in comparison to previous years.*

By late January, Scudder's Pond was frozen over, and local residents were able to skate on its surface. Although we had not seen the large rafts of migratory waterfowl that were often observed a few years ago, Skip Dommin observed a few of these visitors on January 25 off the eastern shore of Hempstead Harbor near Tappen Beach:

> *A great way to brighten up a cold, wintery day is to head down to Hempstead Harbor with a pair of binocs to check out our visitors from the north. These amazing birds travel from as far away as the Arctic to enjoy our 'balmy' winters.*

All within a half hour, Skip was able to get photos of lesser scaups (males and a female), buffleheads (male and female), common goldeneyes (females), and a common loon. By January 31, Hempstead Harbor had frozen over.

The adult bald eagles stayed through the winter, and on February 1, John Grucci reported seeing an adult bald eagle on the breakwater in Glen Cove. On February 9, Skip Dommin

From left to right, female bufflehead, male bufflehead, and common loon (photos by Skip Dommin, 1/25/22)

again saw migratory waterfowl and in about the same location as where he had observed them in January:

> *Hard to believe with this morning's beautiful weather we had freezing temps and an iced-over harbor last week...photos taken this morning of a male (immature) and female lesser scaup, a male (mature) lesser scaup, and a female common goldeneye. All were relatively close to the eastern shoreline just north of Tappen with a low tide. A sunny day shows off how beautiful these winter migratory birds are!*

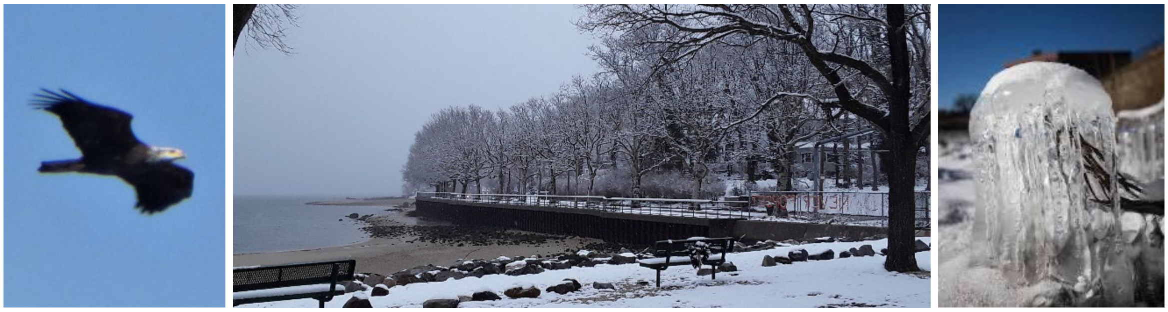
Juvenile male and female lesser scaups (l), female goldeneye (c), and adult male lesser scaup (r) (photos by Skip Dommin, 2/9/22)

Further away from the shore and by a backyard bird feeder, gold finches, house finches, chickadees, dark-eyed juncos, white- and red-breasted nuthatches, downy woodpeckers, and a variety of sparrows shared pieces of sunflower seed with larger blue jays, cardinals, red-bellied woodpeckers, and northern flickers. A flock of robins showed up suddenly in nearby trees in January.

Sanjay Jain reported on February 11:

> *The bald eagle couple is around, and I suspect they will be nesting again this year. I have seen some of the adolescents every now and then–usually see them when harbor is frozen but not seeing them as much lately. Have seen a few buffleheads and smaller scaup every now and then. Seeing large flocks of geese. No large flocks of other waterfowl. Have seen mallard ducks as well.*

Martha Braun saw one of the adult bald eagles flying over Glen Head on February 23. Other reports received in February included sightings (in mid-February) of two turkey vultures–one flying over Sea Cliff and one over Glen Head–and buffleheads, which continued to spend time in waters off of Sea Cliff Beach. On February 26, a dead harbor seal was discovered on Stehli Beach.



Bald eagle over Glen Head (l), view north from Tappen Beach pool (c), jellyfish formed in winter ice (r) (photos by Martha Braun, 2/23/22, Carol DiPaolo, 2/13/22, and Charlie Weinstein, 2/13/22, respectively)

By the end of the first week of March, the osprey nests seemed to be in the process of being reinforced for the season, although we had not seen the ospreys at work on them. On March 17, we received the first report of an osprey sighting, from a resident on Foster Place overlooking Sea Cliff Beach. We then received a report that a pair of ospreys were seen the weekend before on a platform nest near Morgan Island.

On March 14, Charlie Weinstein reported seeing a large red-tailed hawk flying along the shoreline below Bay Avenue, Sea Cliff; he said it was a stunning sight in the mid-day sunlight.

On March 20, Mike Schweiger reported seeing two or three dolphins in Hempstead Harbor at about 8:45 am. He said they seemed to be swimming across the harbor towards Sea Cliff from the Port Washington shore. (We received an earlier report that on March 14 a pair of dolphins were spotted in Northport Harbor.) On March 30, Michelle Lapinel McAllister noticed lots of small lion's mane jellies in Tappen Marina. On the same day, Charlie Weinstein (a member of the local Polar Bear Club) reported:

> *Saw a lot of jellyfish while swimming (wading, really) today. A lot! At Sea Cliff Beach at low tide, 4:30. We were in about 7+ minutes…no stings. Biggest were about 4" body, very light orange. Many very small ones.*

Dolphins in Hempstead Harbor and early arrival of lion's mane jellies observed in Tappen Marina (photos by Mike Schweiger, 3/20/22, and Michelle Lapinel McAllister, 3/30/22, respectively)

From mid- to late March, we received numerous reports of bird sightings around the harbor. On March 15, Kenny Neice reported seeing an adult eagle perched on one of the pilings at Safe Harbor Marina in Glen Cove. On March 21, Lynda Schroeder reported seeing two turkey vultures swoop down from a tree in Glen Head to land near the carcass of a rabbit. Kathleen Haley and Ashley Pichon kept us updated with bird activity they photographed in Bailey's Arboretum (Locust Valley), Welwyn Preserve (Glen Cove), and other shoreline areas around the harbor.

On March 20, Asley Pichon reported:

> *The mated couple of great horned owls in Welwyn Preserve have relocated to a new nest this year (not uncommon). While I could hear them every single late afternoon/early evening in their mating display, I could not determine where the new nest site is. They are currently somewhere up in the pines…. This beautiful pair of bald eagles have been soaring and perching over Welwyn (perching on West Island in three specific trees) since October. I witnessed them mating twice–2/10/22 and about a week after that. They are now nesting. I only see one of them at a time, as one must always guard the eggs. There are a handful of subadults and juvies around the area as well. And…the ospreys are BACK!!!!!!*

Bald eagle couple (l), ospreys on nest in progress (c), and a great horned owl (r) were all seen at Welwyn Preserve (photos by Ashley Pichon, 3/20/22)

Also on March 20, Kathleen Haley reported:

> *Three ospreys at Welwyn/Welwyn Beach (pond) today…. Ospreys also back at Lilco [National Grid] nest at Glenwood Landing, one in tree at Scudder's…. Terrible lighting for pics today!*

On March 31, Kathleen Haley photographed an osprey at Bailey's Arboretum feasting on a fish (later ID'd by John Waldman as likely a large-mouth bass from one of the ponds at Bailey's). Kathleen also photographed a pair of red morph screech owls in the hollow of a tree at Bailey's and noted osprey nest-building activity in April all along the shore in Bayville to Center Island.

Mating ospreys at Welwyn Preserve (l), osprey with wide-mouth bass at Bailey's Arboretum (c), and pair of screech owls in a tree hollow at Bailey's Arboretum (r)
(photos by Kathleen Haley, 3/20/23 and 3/31/23)

Ashley Pichon further reported April 3:

> *Notwithstanding the frigid temps at the beginning of this past week, the ospreys are back in the swing of things. Late last summer a major storm took down three-quarters of their nest, and they are busy rebuilding… the ospreys are busy reclaiming their territory from the bald eagles who have had the run of the place all winter in their absence! I've witnessed two different ospreys (one from the nest site on the bridge to Morgan Island, and one from the resident pair in Welwyn) chasing what I believe to be the male bald eagle away from their nests. In other news, two new spring migrants have arrived! … lone great egret, midweek… and all at once the woods are full of eastern phoebes…. Starlings are busy building their nests as well — this one inside a cavity of a dead tree on the marsh. Everything is starting to sound like mating season around the marsh.*

Great egret (l), eastern phoebe (c), and starling in a tree hollow (r) at Morgan Island
(photos by Ashley Pichon, 3/31/22)

On March 31, John Waldman reported on a fishy incident that occurred the day before at the Queens College campus:

> *A strange sighting! Colleague Karl Fath found this fish in front of the Queens College library yesterday. It's an adult gizzard shad. Its mid-body wounds indicate it*

> *was nailed by an osprey or eagle (and then accidentally dropped). Eagles were seen near campus over the past two days. Likely source of this brackish water fish species are the two nearby Flushing Meadow lakes.*

Grizzard shad dropped in at Queens College campus (photo by Karl Fath, 3/30/22)

In early spring, the bunker population started out large but remained in deep water. When the bunker came up to the surface, adults were often observed in large, tight schools in local marinas, Glen Cove Creek, and other parts of Hempstead Harbor, and other larger fish followed.

In April, Skip Dommin reported the sighting of a snowy owl in Glen Cove, which he stated was likely a visiting juvenile brushing up on its hunting skills.

We received two reports of coyote sightings—one by a resident in Glen Head who saw a coyote in his yard and another by a manager at the North Shore Country Club who said he has seen a coyote on the golf course frequently but at a distance. On April 11, there was a report of a dead muskrat on Sea Cliff Beach. (We have received previous reports of muskrats busy at the water's edge in Roslyn Harbor—last year Joanna Keenan had seen one at the Swan Club, and in 2020 Sanjay Jain reported seeing a pair also along the east shore of the lower portion of Hempstead Harbor.)

Kenny Neice noted the continued presence of lion's mane jellies seen in Safe Harbor Marina and Glen Cove Creek since March. Kenny also reported that a friend fishing off of Matinecock Point in April caught three Atlantic cod on two separate occasions and released them—they were each about 18 inches long. Kenny's friend said that the last time he caught cod was about 20 years ago. John Waldman commented on the catch:

> *Pretty amazing, a real rarity in western Long Island Sound. There was a minor fishery in the late 1960s in December, mixed with silver hake (whiting). There have been a couple of other oddball cod catches this spring including one in WLIS and one in Peconics.*

The fisherman who caught the cod also reported catching a number of sea horses (about 5" long) this past April; he saw them last season as well.

Atlantic cod (l, c) and sea horse (r) caught off of Matinecock Point in April 2022

On April 12, John Waldman reported:

> *I was fishing at Tappen Beach this evening and witnessed an osprey chasing and driving off a bald eagle about 100 feet overhead. There was no apparent cause for this I could discern (but I'm sure they have their reasons).*

Ashley Pichon's favorite place for birding is Welwyn Preserve, and she reported on woodland as well as shore birds she had seen in April. Woodland birds sighted on multiple occasions and photographed included American goldfinch, chipping sparrow, eastern phoebe, eastern towhee, brown creeper, pine warbler, red-winged black bird, and red-tailed hawk. Among the water/shore birds sighted in April were the common loon, greater yellowlegs, and snowy egret.

On April 28, Ashley reported:

> *The upcoming weeks will likely be filled with new species as the migration comes into full swing. ...though I have seen ruby-crowned kinglets, among others, they are IMPOSSIBLE to [photograph]. They move so fast they mock me!!!*

Common loon in breeding plumage (l), greater yellowlegs (c), snowy egret (r)
(photos by Ashley Pichon, 4/21/22, 4/23/22, and 4/7/22, respectively)

In late April, a family of deer were seen traveling through Sea Cliff.

May

Weekly surveys for the core monitoring program began in May and were conducted on May 18 and 25. During these surveys, we saw a large white carp in the middle of Glen Cove Creek; we have seen large carp in previous years (starting in 2019) at the head of the creek, likely coming from Mill Pond. Large numbers of lion's mane jellies were still present in the harbor and Glen Cove Creek. Comb jellies (large sea walnuts) were also seen.

Ospreys were present, and many were observed on nests throughout the harbor. A new nest was built on a platform that was constructed on the beach below Garvies Point Preserve. Mallard ducks and ducklings were in Glen Cove Creek; cormorants and swans were seen in small numbers; Canada geese, great egrets, terns, and Bonaparte gulls were all noted during the first two surveys, as were red-tailed hawks flying over Glen Cove Creek. On May 11, Martha Braun saw a remaining flock of migratory brants south of Rum Point, Sea Cliff.

On May 25, during our monitoring survey of the lower harbor, we saw an adult bald eagle perched high in a tree along the shore and a juvenile bald eagle flying in the area as well. A surprise sighting occurred during the survey of the outer harbor: a young red fox on the shore of Crescent Beach faced a phalanx of Canada geese that emerged from the water and slowly marched in the direction of the fox. The fox seemed perplexed at first and then decided to run for cover in nearby vegetation.

On May 29, Carole Berglie reported:

> *The other day I saw two turkey vultures circling over the woods in back of the RXR property. Also saw a killdeer on my run along the grassy hill on Shore Road in Glen Cove, near the harbor patrol station. Goldfinches visited my yard–bright spot!*

Brants off shore of Rum Point (l) and geese parents looking after five goslings at Safe Harbor Marina (r) (photos by Martha Braun, 5/11/22, and Carol DiPaolo, 5/20/22, respectively)

The new outfalls were visible along the bulkhead that was completed at the end of 2021 below the Glen Cove STP on the south side of Glen Cove Creek. The new brewery that was being constructed near the head of the creek on the north side was close to completion.

New bulkhead below STP on south side of Glen Cove Creek (l) and Glen Cove Brewery near completion on north side of Glen Cove Creek (r) (photos by Carol DiPaolo, 5/18/22)

The news from local fishermen included another catch of Atlantic cod during the first week of May. After that, it was all about the striped bass. BJ Lizza reported, via Kenny Neice on May 10: "…they are crashing tons of bass all sizes 28" to 45 lbs in Stepping Stones area."

Paul Boehm provided more details on May 15:

> *Fishing has been excellent. Gotten over 20 big bass, including a lot of females chock full of eggs. Biggest I've gotten was 42" 32 lbs. There is a maximum size limit of 35" so the big girls are released to spawn. So far, best bass season I've ever seen. Been*

> *fishing in Eastchester Bay. The fish are moving east now off Manhasset and will be in Hempstead Harbor in short order. Fluke season has also started. I haven't fished for them, but I've heard of guys catching a few keepers. Bunker arrived about a week ago. Big schools outside of Manhasset.*

On May 26 Paul reported:

> *Got 5 more bass today, ranging in size from 30-36. Were caught in the sound from Stepping Stones light to outside Manhasset Bay….Was talking with Bob Chaputian…who has been fishing around here for 40 years…he and I agree we've never seen fishing like this in this area.*

Bob Chaputian was fishing off of Manhasset Bay on May 26 and caught a 38" striped bass, which he released. On May 28, Kenny Neice reported seeing "tons of big and small bass and weakfish" in Hempstead Harbor. A little farther from home, Paul Boehm said he spotted a dolphin within a hundred feet of a buoy at Hewlett Point (Manhasset Bay) on May 29. Paul said "Saw him once coming up for air then directly back down. Undoubtedly feeding on bunker."

On May 31, Paul Boehm reported:

> *Medium to large bass continue to be present in large numbers in the western sound. Large schools of bunker staying deep. Also reports of sand eels.... There are big porgies all over the place, which is consistent with last several years of a very robust porgy population.*

Atlantic cod (l) and large striped bass catches by Paul Boehm (c) and Bob Chaputian (r) (photos of Atlantic cod, 1st week of May, striped bass photos, 5/15/22, and 5/27/22, respectively)

June

Weekly monitoring dates were conducted on June 1, 8, 15, 22, and 29. On June 1, we noticed a newly installed dock below the Cove Restaurant. The washout north of Morgan Beach appeared worse than it had been previously. The water color appeared very brown in Tappen Marina and around Beacon 11. This was similar to the brown seen the previous day in Safe Harbor Marina that presented as brown striations of suspended sediment. The brown color was also in Glen Cove Creek, although heading eastward up the creek the color turned to a green-brown.

On June 3, Paul Boehm reported:

> *I was out today and can confirm the presence of what I assume is a very thick brown algal bloom covering the harbor from Mott Point south. As Bob said, looks like chocolate milk in the boat wake.*

By June 8, the water was much clearer, possibly due to the high winds from the previous day. However, color variations persisted throughout the month, mostly brown, although a thick, pea-green color was noted at Beacon 11 on June 22. Also on June 22, a crane was seen adding rocks to the breakwater adjacent to the outside of the Legend Yacht and Beach Club (formerly the site of the Loew estate).

Brown water in Safe Harbor Marina (l) and washouts along Sands Point (r)
(photos by Ken Neice, 5/31/22, and Carol DiPaolo, 6/29/22, respectively)

During the June surveys, the usual birds were observed, including ospreys, cormorants, mallard ducks and ducklings, great egrets, a few snowy egrets, Canada geese (up to a count of 96 on one trip), swans, terns, Bonaparte gulls, one belted king fisher, and two killdeer. We saw the first blue heron for the season on June 22 and an adult bald eagle, both in the lower harbor. A red-winged black bird was seen at Crescent Beach.

On June 27, an osprey entangled in a nest at Morgan Beach breakwater was rescued by Volunteers for Wildlife. Garbage was found in the nest with the baby ospreys. The female osprey suffered deep tissue wounds from the entanglement but was thankfully rescued and rehabilitated over the following months. While water monitoring on June 29, we were able to confirm that the remaining adult and two chicks continued to thrive and did so through the rest of the season. Meanwhile, two more ospreys attempted to rebuild a nest on top of a piling at the end of a dock at Sea Cliff Yacht Club (same place as last year); ultimately their attempts were unsuccessful.

On June 3, Sebastian Li photographed two turkey vultures and reported his close encounter:

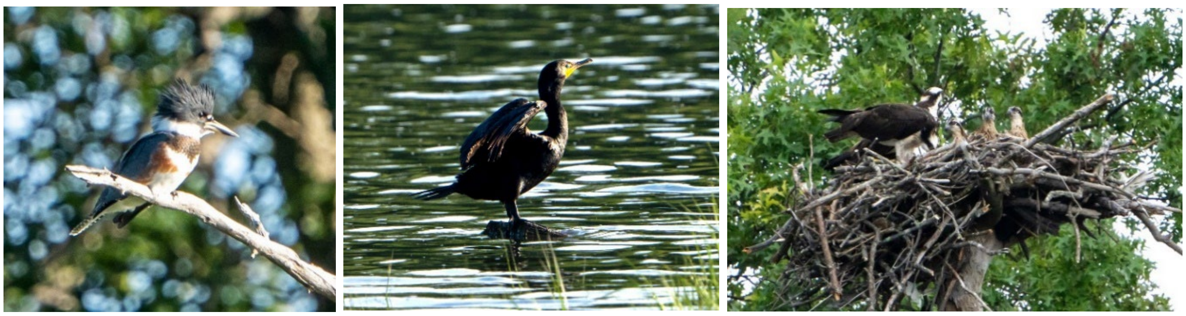
> *These two were scavenging a squirrel carcass on Sea Cliff Avenue just up from the train station. They were too interested in getting a meal to be bothered by the photographer!*

Turkey vultures near Sea Cliff train station (l), ospreys on nest at Glen Cove breakwater (c), great egret (r) (photos by Sebastian Li, 6/3/22, Carol DiPaolo, 6/1/22 and 6/29/22, respectively)

In June, ospreys all around the harbor were busy taking care of their chicks. On June 24, Ashley Pichon reported:

> *There are two nesting ospreys on either side of the marsh in Welwyn. The oldest nest has three chicks in it, and from what I can discern across the way there are two chicks in the other one.*

Ashley also kept us posted about her observations of other birds seen at Welwyn and Sands Point Preserves, including bank swallows, a belted kingfisher, cedar waxwing, common tern, double breasted cormorant, house finch, house wren, and marsh wren.



Belted kingfisher (l), double-breasted cormorant (c), osprey family with three chicks (r), all seen at Welwyn Preserve (photos by Ashley Pichon, 6/23/22)

Comb jellies were seen throughout the month. There was plenty of activity along the bulkhead near the Cove Restaurant, including one eel about 18 inches long, one Asian shore crab, and the usual baitfish. By June 29, bunker were seen near the surface throughout the harbor, with larger groups in Glen Cove Creek. On June 9, Paul Boehm reported:

> *The fishing has switched over into Hempstead Harbor. A lot of bass and blues around. I got a couple of big bass in the middle of the harbor. Bob hit several nice blues and two bass just north of Mott's Point.*

On June 10, Elaine Neice watched a great egret at Safe Harbor Marina make several awkward plunges from its perch on a dock piling and successfully catch a few meals. Paul Boehm and Kenny Neice relayed reports they received June 10 regarding dolphin sightings in the outer harbor and the sound. Kenny said someone came into Safe Harbor

Marina around noon and said that dolphins were "everywhere in the sound." On June 12, Karen Papasergiou also reported seeing dolphins in Hempstead Harbor at 10:30 am, and Louis Madura took the photo below of dolphins seen from Sands Point.

Dolphins in Hempstead Harbor (photo by Louis Madura, 6/12/22)

On June 11, two deer were seen swimming across the outer harbor.

Joanna Greenspon reported seeing mating horseshoe crabs at Sea Cliff Beach on June 14 and 15. Paul Boehm offered fishing updates for June 30:

> *Bass still in harbor, have caught fish up to 38" in last few weeks in the mouth of HH. Also, bluefish are around and regularly seen mauling bunker schools, especially in early morning. These are big blues—I picked up a 34" 13-lb blue in early evening on 6/28. My buddy, Kevin (Rusty) Roth has regularly seen schools of blues chasing bunker off Prospect Point in the early AM. In addition, a great many sand sharks have moved into the harbor and are a regular PIA bycatch for me. Porgies remain numerous all over the north shore, as they have for the past several years. Fluke have been a disappointment this year…. Sea robins have moved in also, although I do not get many of them…and I usually get them as a bycatch when fluke fishing. Sea bass are also around, though the best fishing is east of HH, in area of buoy 32a.*

July

Monitoring surveys were conducted on July 6, 13, 21, and 27. On the first outing, the water appeared to be normal green in most areas, although the brown color persisted in Tappen Marina. July 11-14 there were many reports of reddish-brown coloration in the water seen at Tappen Marina, below Bay Avenue in Sea Cliff, and in Safe Harbor Marina in Glen Cove. On July 14, Martha Braun said Tappen Marina was still somewhat brown and did not notice any abnormally colored water by the Hempstead Harbour Club or the Sea Cliff Yacht Club on the following day. By July 21, water color was determined to be its normal greenish-brown and remained that way through the end of the month. Hypoxia first occurred this season on July 6.

We continued to see lots of birds including cormorants, mallard ducks and ducklings (one duck had a large tumor on its head in Glen Cove Creek), great egrets, Canada geese and goslings, blue herons, a black-crowned night heron, a green heron at the head of Glen Cove Creek, ospreys, mute swans, terns, one kill deer, a turkey vulture, and two hooded gulls. Although we had been seeing fewer snowy egrets in recent seasons, seven were spotted at

Crescent Beach. Kathleen Haley reported that during the July 4 weekend, a great egret and green heron spent time near the shore at Cedarmere.

Green heron near Cedarmere (l), great egret fishing (c), great blue heron and geese in Glen Cove Creek (r) (photos by Kathleen Haley, 7/4/22, Elaine Neice, 7/10/22, and Carol DiPaolo, 7/27/22, respectively)

In mid-July we saw three ospreys flying over Town of North Hempstead Beach Park South. We continued to monitor the progress of the remaining ospreys at the Morgan Beach breakwater nest, and all were doing well. An update regarding the wounded osprey came from Skip Dommin, a Volunteers for Wildlife volunteer, on July 8:

> *…there is extensive damage to the shoulder joint which will require lengthy rehab. Plans are being discussed to possibly transport the bird to a rehabber that has a large flight aviary where it can build up strength.*

A few comb jellies (sea walnuts) were seen this month throughout the harbor. The usual baitfish were also present. Skilletfish were seen in and around CSHH oyster gardening cages. On our water-monitoring trip on July 6, we saw our first blue-claw crabs for the season including a large one swimming through Tappen Marina; we continued seeing them all month long.

Bunker were seen splashing at the surface throughout the month. On July 8, Skip saw a large school of bunker just north of Tappen Beach, he noted that they had an unusual swimming behavior and took a video. They looked like they were pushing waves and swimming outwards from a circle—behavior John Waldman described as "worried bunker," possibly due to the nearby presence of striped bass or blue fish. During the third week of July there was lots of splashing around Beacon 11, which coincided with surface and bottom low dissolved oxygen readings. On July 27, a large school of large bunker were finning near the Glen Cove STP, and about half of them had parasitic copepods attached.

On July 13 and July 21 (pre-storm), we noted that there was no stream flow into Crescent Beach as we usually see. This was after a period of no rain and a reported rain deficit regionally of two inches reported by News 12 Long Island. Heavy rain occurred on July 18 and July 21 (after sampling). However, the stream was still not present a week later. For the period of July 19-24, a heat wave occurred in the region. This coincided with low rainfall (about a third of the rain amount of July 2021).

On July 12, Paul Boehm reported on fishing conditions in Hempstead Harbor:

> *2022 continues to be the best year of fishing I have ever experienced. A lot of big bass and bluefish in HH feeding on bunker, which are plentiful. Keeper fluke are also around. I personally caught 37" and 41" bass on evening of 7/10. [Friends] actually did me one better landing 4 bass up to 42" 35 lbs on the same evening. Although I have not been fishing for fluke at all, Bob also caught three keeper fluke up to 21" the same day. On a sidenote, was washing down the boat at around 10PM on 7/10 with miner's lamp on my head and observed a blue claw swimming by, netted him and took a pic. He was all of 1-1/2" long but still determined to make me pay for my transgression with a hunk of thumb.*

On July 15, Paul added:

> *Fishing continues to be excellent. The west shore of the harbor from Mott to Prospect is the center of it. Was out with Rich on 7/13 got four bass 41"-38"-35"-34" as well as a 12-lb bluefish. On the scope saw big clouds of bait under the boat that took 4-5 minutes to complete passing by... I found water temp near bottom north of Mott Point to be 68 degrees, getting close to being out of stripers comfort range, yet they're still hanging there in numbers....*

Rich Boehm with large striped bass catch (photo by Paul Boehm, 7/13/22)

The white-tailed deer population around Hempstead Harbor is growing. Deer have been seen in Glen Cove at Welwyn Preserve and in residential areas in Glen Cove, Sea Cliff, and Port Washington. On July 31, Linda Rabiner saw a large buck. Linda described her observations of deer over the last few years:

> *Maybe four years ago there was a large buck [in a neighbor's] side yard, maybe the same one from yesterday? Three years ago, a very calm doe let me approach her while she munched on the hostas; they have been coming back to the same spot...I don't always see them but find the remains of their breakfast. At the end of last summer there were four in back of the patio, maybe mom and younger ones. When I approached, the larger doe started stomping her front feet. I slowly moved backwards, and they walked away.*

Buck in Glen Cove (photo by Linda Rabiner, 7/31/22)

August

Weekly monitoring took place August 3, 10, 17, 24, and 31. Instances of extreme heat continued in August, and dissolved oxygen levels dropped to hypoxic levels at most stations for the first two monitoring dates. Limited fish kills were observed in Hempstead Harbor, as well as in Manhasset Bay, Oyster Bay, and Huntington Harbor. Through July and August, we had seen a few to several dead bunker on each of our water monitoring trips, but that number increased over the last two weeks of August. However, during the third week of August, we received a report from someone who saw “hundreds maybe thousands of dead bunker” in Manhasset Bay. The Town of North Hempstead’s head of harbor patrol confirmed hundreds of dead bunker in Manhasset Bay.

On August 24, while we were doing a full harbor monitoring survey (on an incoming tide with a westerly wind), we saw hundreds of dead bunker throughout the harbor and hundreds stretched across the Sea Isle shoreline near the entrance of Glen Cove Creek. Most of what we saw floating were badly decomposed adult bunker, although in a couple of areas we saw some peanut bunker floating, and they looked as though they had died recently. We saw an enormous live school of peanut bunker in Glen Cove Creek along with other baitfish. We also saw live schools of bunker breaking the surface in different areas of the harbor. A single bunker in Glen Cove Creek displayed curious behavior, swimming at the surface sideways and turning perpendicular with its head out of the water; its mouth was opening and closing as it went sideways again. We had a report of this behavior during the preceding week with some bunker that were observed in Safe Harbor Marina in Glen Cove Creek.

Corresponding with the quantity of fish observed in Hempstead Harbor on August 24, we also observed the highest number of birds we had seen all season–all grabbing live fish as well as some of the fish washed up on the shore.

There were dozens of dead bunker from the start of the month that increased to the hundreds as the month progressed. The dead fish we saw in Hempstead Harbor seemed to be a result of a combination of low dissolved oxygen and predator activity.

Large school of bunker crowded in Glen Cove Creek (l) and limited bunker kills throughout August (r) (photos by Carol DiPaolo, 8/3/22 and 8/24/22, respectively)

Construction continued on the north side of Glen Cove Creek to replace the bulkhead near the new location of the Garvies Point Brewery. Hypoxia persisted in various areas of Hempstead Harbor. Another heat wave occurred August 6-9.

The usual birds observed in Hempstead Harbor were seen in August, including cormorants, mallard ducks (and a few ducklings), great and snowy egrets, Canada geese, blue heron (mostly in the lower harbor), ospreys, and mute swans (in low numbers). We continued to see three ospreys, possibly juveniles, perched on the Morgan Beach breakwater nest.

Cormorants along north shore of Glen Cove Creek (photo by Carol DiPaolo, 8/17/22)

Two adults and two juvenile bald eagles were seen on two trips to the lower harbor. On August 16, we received a report that a juvenile bald eagle was discovered on the ground near its nest. The eagle did not survive; it was later confirmed that it had contracted the avian flu. Hooded gulls were seen flying near Crescent Beach on August 10 and two on August 17. One to two dozen small plover type birds were in Motts Cove mid-month We saw one tern on August 10 and one belted kingfisher on August 17.

Ashley Pichon reported on the activity of an osprey nest at Welwyn Preserve on August 1 and photographed other birds in the area:

> *Two of the juvie ospreys have fledged, and the third is in position to do the same. Unfortunately, the nest their parents rebuilt after last year's storm didn't make it through the rain we got on Monday. It's completely gone, but the birds will be ok. The parents will have their work cut out for them next spring. Yesterday, at daybreak, I witnessed two of the osprey juvies practicing their fishing skills, hovering high in the sky and dunking down into the water over and over (to no avail yet from what I saw).*

Osprey fledglings at Welwyn Preserve (photo by Ashley Pichon, 8/1/22)

Sanderling (l) and semipalmated plover (r) at Welwyn Preserve (photos by Ashley Pichon, 8/1/22)

On August 28, Ashley Pichon further reported:

> *So it's been a busy fishing season for all nine of Welwyn's ospreys. Watching the young ones learning to fish was fascinating! The migration season has begun and will be ramping up in September. Every day we get a new species of warbler trickling in as they feed themselves on their journey southward. The lack of rain has unfortunately brought the water level in the vernal pond in Garvies terribly low, but we hope that a decent amount of rain will remedy that, if it comes….Leaves are falling off trees faster than ever with the lack of rainfall.*

Some of the warblers that Ashley photographed August 24-27 at the Garvies Point Preserve included a magnolia warbler, a black and white warbler, a chestnut sided warbler, and a Cape May warbler.

A few sea walnuts were seen on weekly surveys at various locations throughout the month. Small baitfish and peanut bunker were observed on August 10 near Glen Cove STP outfall. We saw blue crabs on August 24 and 31 in Glen Cove Creek. White sea anemones grew along the bulkhead near the Cove Restaurant.

Blue crabs (l) and sea anemones (r) along the sea wall in Glen Cove Creek photographed with an underwater camera (photos by Michelle Lapinel McAllister, 8/31/22)

On August 30, Sebastian Li reported:

> *There was a bluefish on bunker feeding frenzy right in front of our beach! The water was churning as the blues corralled the bunker against the shoreline... Before the blitz there were large schools of peanut bunker skirting the shoreline. When the blues started hitting, there was a rush of large bunker to the shallows— the tide was still high and a lot of bunker were getting jammed into the rocks in front.... Didn't see any large mortality per se, but the feeding went on a good 40 minutes.*

Bluefish caught by Sebastian Li offshore below Bay Avenue, Sea Cliff (photo by Matthew Nichols, 8/30/22)

September
In September, the four sampling trips (on September 8, 14, 21, and 28) included two trips to the lower harbor. On September 14, Scudder's Pond was still brown from the previous day's heavy rainfall and lots of debris was scattered in Glen Cove Creek.

The usual shore birds were present: cormorants, mallard ducks, great egrets, Canada geese, blue herons, and mute swans (in small numbers). On September 8, there was a peregrine falcon on the Gladsky Marine crane and a dozen terns by Beacon 11. Ospreys were seen in highest numbers earlier in the month. Bald eagles were spotted on the last two outings of the month over Sea Cliff Beach, Beacon 11, and in Mott's Cove.

On September 2, a Cooper's hawk was rescued after being stunned from flying into a window on Prospect Ave in Sea Cliff. A few days later, we received a report that a red-tailed hawk landed in a tree in Morgan Park.

Peregrin falcon on a crane cable (l) and swans behind cormorants on a boom near the Powerhouse Drain in Glenwood Landing (r) (photos by Martha Braun, 9/8/22, and Carol DiPaolo, 9/13/22, respectively)

Fewer dead bunker were observed in September than had been seen during August; a few were seen throughout the month on each of the monitoring surveys. Large schools of baitfish were seen throughout the harbor. On September 14, we saw large schools of very large bunker in Tappen Marina (and elsewhere in the harbor). They were circling close to the surface, and we could see that about 30-50% of them had copepods on them. About a dozen had algae attached to them as well—mostly red algae. A number of fish had signs of interactions with predators, and some had red areas on their bodies—not open wounds. One fish was almost entirely red. This was observed in Glen Cove Creek as well. It seemed that the fish suffered from contusions. During the preceding week, we had received reports of big bluefish blitzes and catches of 10-14-pound fish.

Large schools of bunker in Tappen Marina included individuals with red bruise-like areas on them (l) and others with copepods and algae attached to them (r) (photos by Carol DiPaolo, 9/14/22)

On September 8, Sebastian reported that he was fishing for snappers and wound up with a small mackerel. He said that there were so many large schools of peanut bunker around that they seemed to be present in larger numbers than the adults, and lots of gulls and terns were skimming the surface for them.

On September 9, four “tinker” mackerel were caught off of the Sea Cliff Yacht Club dock. Mackerel had also been seen in Tappen Marina on September 21.

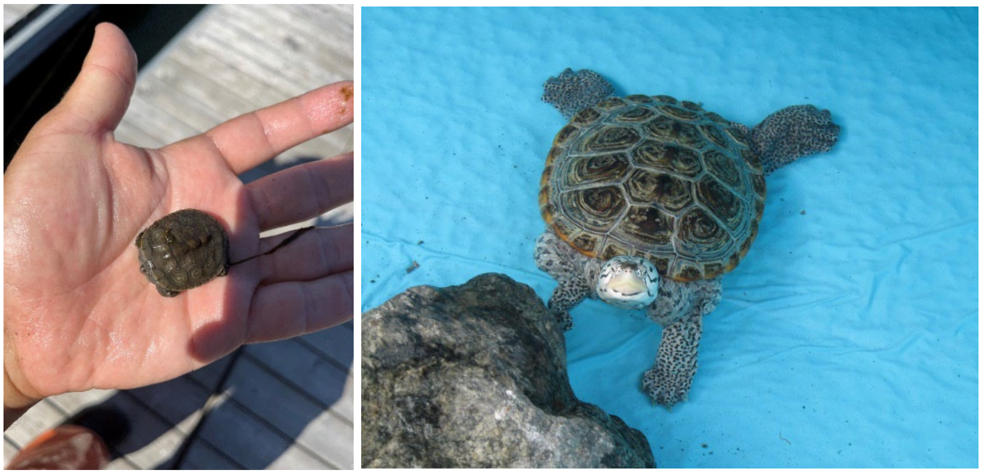
Mackerel caught offshore below Bay Avenue (l) and small school of mackerel in Tappen Marina (r) (photos by Sebastian Li, 9/8/22, and Alex Drew, 9/21/22, respectively)

John Waldman commented that he hadn’t seen a mackerel in western Long Island Sound in years, although there used to be a big run in May of adults out in the open sound. John thought that the mackerel Sebastian caught might be a yearling. John noted that the summer and autumn yearlings were long known as "tinker" mackerel.

On September 9, Sebastian Li reported:

> *The past two weeks there has been intermittent bunker blitzes out by the buoy near the mouth of the harbor. Today I went out on the kayak with my fishing rod because there was so much action in the water— the gulls were going crazy. I lost four lures in 30 minutes.... I saw blues chase bunker into Sea Cliff Beach, churning up the water like it was on a high boil. It's exciting to have schools of blues around again—it's been a while.*

On September 20, Alex Drew saw a diamondback terrapin hatchling swimming in Tappen Marina.



Diamondback terrapin hatchling (l) and adult diamondback terrapin "Jasper" (r) visiting with Volunteers for Wildlife during the CSHH/Hempstead Harbor coastal cleanup (photos by Alex Drew, 9/20/22, and Carol DiPaolo, 9/17/22, respectively)

On September 28, large schools of baitfish, peanut bunker, and adult bunker were observed with a few snappers trying to get a bite. A few of the bunker had copepods attached to them. We received reports that a number of bluefish blitzes were occurring in the harbor.

During September, only one blue-claw crab and one Asian shore crab were seen. Only two sea walnuts were observed near Beacon 11 at the beginning of the month; no comb jellies were observed during surveys for the rest of the monitoring season.

Work continued on the bulkhead in Glen Cove Creek, now east of the new Garvies Point Brewery. Construction work also took place at the Shore Realty site in Glenwood Landing.

October

CSHH's regular-season weekly monitoring surveys on October 12, 19, and 27 included one trip to the lower harbor. We also sampled on October 6, but this was a combined monitoring event with the Unified Water Study program for Hempstead Harbor, and no wildlife observations were recorded on this day.

In October, we saw the usual birds, including cormorants, mallard ducks, great egrets, Canada geese, blue herons, few swans, and one belted kingfisher. One osprey was seen flying over Tappen Marina on the last monitoring date for the season. Although most ospreys had migrated at this point, it seemed that this osprey decided to stay longer and spent some time perched in a tree over Scudder's Pond.

On October 4, Carole Berglie reported on the large number of cormorants she observed in the harbor:

> *….we have had about 250 cormorants together in the harbor at various times—I'm just guessing the amount, but it's a lot more than the gang that hang on out the little raft in the harbor. This morning, the cormorants were dipping about while the bald eagle was circling overhead.*

Kathleen Haley made several visits between Tappen Beach and Scudder's Pond, watching a late-staying osprey catch bunker by the beach and bring the catch to a tree branch at Scudder's Pond. On October 20 and 21, she saw great blue herons, an immature yellow crowned night heron, wood ducks, a peregrine falcon, and the osprey back at the favorite tree branch overlooking the pond.

Wood ducks and a great blue heron (l), an osprey (c), and an immature yellow-crowned night heron (r) at Scudder's Pond (photos by Kathleen Haley, 10/15/22, 10/15/22, and 10/20/22, respectively)

On October 26, when the weather had warmed and insects reemerged over the pond, fish were jumping to catch the insects and herons stood by the shoreline to catch fish. About 40 wood ducks swam at the back of the pond.

The bunker population in Hempstead Harbor remained extremely large through the end of the monitoring season. During most of October, Tappen Marina was filled with very large bunker swimming near the surface, finning. The majority of bunker observed in the marina were covered with large numbers of copepods. One bunker had a large clump of red algae attached to it. The bunker often rolled over sideways and then would right themselves. One was vertical and spinning, with its head out of the water and mouth opening and closing, as if gasping for air. Only three dead bunker were seen on monitoring days in October, although two bunker were observed on October 27 whirling close to the surface of the water.

However, a fish kill occurred during the weekend of October 23 at the head of the harbor in Roslyn, and that seemed to be a result of predators chasing the bunker into the shallows. Dissolved oxygen levels were above 7 ppm at all stations tested in October, except for one: CSHH #13 had a DO reading of 4.66 ppm.

Fish kill at the head of the harbor north of the Roslyn viaduct (photos by Michelle Lapinel McAllister, 10/23/22)

The NYS DEC's seine catch for Hempstead Harbor on October 11 reflected what we were seeing with respect to the number of bunker and bluefish present. Caitlin Craig, Diadromous Unit Leader, Division of Marine Resources, reported preliminary results:

> *We caught two very large bluefish and a school of adult menhaden (only ~1000, luckily) on Tuesday. The bunker were all very lively. They had a typical amount of anchor worms, and I saw a few small lesions but nothing out of the ordinary.*

On our last monitoring trip for the season, the school of bunker that were normally seen near the Glen Cove STP were gone. While we were at that spot in Glen Cove Creek, a local fisherman caught two large bluefish (7-8 lbs each); when we went to the head of the creek, we saw a large school of bunker circling there and also saw someone with a drop net catching them.

Bunker school (l), bluefish catch (c), and bunker being caught with a drop net (r), all in Glen Cove Creek (photos by Carol DiPaolo, 10/27/22)

No crabs or comb jellies were observed in October; however, we did continue to see white sea anemone attached to the bulkhead below Cove Restaurant in Glen Cove Creek.

Other marine life seen or reported in October included small black fish and skilletfish that were in the CSHH oyster cages that were being hauled in for the season and squid that were caught between Tappen Marina and Town of North Hempstead Beach Park, signaling a larger squid population that was later reported in the harbor.

Small blackfish (l) and skilletfish (c) living in oyster cages and squid (r) caught in Hempstead Harbor (photos by Carol DiPaolo, 10/11/22, and Nick D'Ambrosia, 10/15/22, respectively)

On October 29, John Waldman reported on the scene at Tappen Marina:

> *Thursday [10/27] there were thousands of bunker in the marina. Not being chased. All about 9 inches and what I would say were yearlings, not YOY [young of the year] peanuts. Heavily infested with copepods, some with ~10 on them. Friday the blues had found them. Saw a 8 to10 pound blue leap all the way out of the water in pursuit. Witnessed one bunker separate from school and disappear in a big swirl. About half the bunker had left by this time. Today, no more than 10% of the original numbers. Blues were not bothering them.*

November-December
Unseasonably warm weather in November was accompanied by a lot of fish and bird activity throughout Hempstead Harbor. Kathleen Haley reported:

> *The osprey [seen regularly at Scudder's Pond] stayed on until November 5. When things finally settled down at the pond, a bald eagle made an appearance on November 12 and 13.*

We received several reports between November 19 and 22 about large flocks of gulls and other birds covering different parts of the harbor fishing for whatever was available near the surface.

On November 22, Skip Dommin reported that a small flock of buffleheads had arrived in Hempstead Harbor, and Ashley Pichon reported on the birds she saw locally that were part of the fall migration:

> *Many of these birds come up north to breed, rear their young, and then head back south for the winter. I had the opportunity to see so many of them, daily, while they feasted on berries and fueled up for their journey. Garvies Point Preserve is a warbler Mecca. I missed it in the spring migration because I was so focused on*

> *Welwyn. Garvies is the place to be for warblers, and it didn't disappoint….Then, the warblers left and the sparrows came….Now it's on to the wintering fowl. I saw six common loons on the sound from Welwyn last week, and I'm expecting the mergansers and brants to arrive shortly.*

John Waldman saw a post about local fishing in the online November 14, 2022, edition of *Long Island Fisherman:*

> *Phil from Duffy's Bait and Tackle in Glenwood Landing reports bass fishing has been excellent under the Throgs Neck Bridge and inside Hempstead Harbor for those using live or dead squid. Blackfish have moved off the shallow grounds into deeper water and have been a bit more difficult to locate. Green crabs have been the top choice. Phil said he has not been selling any sea bass or porgy rigs, which tells him that both species are finished for the year. Squid fishing inside Hempstead Harbor at night has been incredible on pink squid jigs working under the lights.*

On December 10, we received the final November wrap-up on birds sited at Welwyn Preserve from Ashley Pichon:

> *In November, 65 bird species were documented in Welwyn. Towards the end of the month, long-tailed ducks, white-winged scoters, red-breasted mergansers, common and red-throated loons all began appearing and are increasing in number. The resident great-horned owl couple has begun its courtship as well! They can be heard at the tail-end of the day, about an hour before sunset. Bald eagles can be seen almost daily—adults, juveniles, and sub-adults.*

4.6 Crustaceans

An assortment of crustaceans can be seen around Hempstead Harbor. This group of marine organisms is characterized by, among other things, a segmented body, paired appendages, and a hard external skeleton that has to be shed to accommodate growth. Crabs, lobsters, shrimp, and barnacles are examples of this group of marine creatures. We mention a variety of crabs that are either seen during weekly sampling or caught during the DEC seining that

Lady/calico crab (l), blue-claw crabs (c), and spider crab (r) (photos by Michelle Lapinel McAllister, 7/27/17, and Carol DiPaolo, 8/26/20, 7/24/19, respectively) is conducted around the harbor; the crabs include blue-claw, lady (or pink calico), green, spider, mud, fiddler, and Asian shore crabs. Some are walking crabs, and others are swimmers, like the blue-claw crabs, which have back legs that are shaped like paddles.

Blue-claw crabs have been present in Hempstead Harbor and other areas of Long Island Sound, but the numbers have varied from year to year for both monitoring-date observations and NYS DEC seine hauls. Large numbers of blue crabs were observed in 2007 and 2010 in Hempstead Harbor, but in other years since 2007, numbers of blue crabs observed on monitoring dates have been sporadic. In 2022, blue-claw crabs were included in monthly DEC seine catches for May through August for Hempstead Harbor (none collected for September and October). They were also observed during our 2022 monitoring season starting on July 6 (8 blue crabs were observed, which was the highest number for the season); September 8 was the last sighting of blue crabs for the season. In August 2021, we saw a high number of 18 blue-claw crabs on a single monitoring date.

Horseshoe crabs mating (photo by Joanna Greenspon, 6/14/22)

Although **horseshoe crabs** are included in the group of crustaceans seen around the harbor, they are not true crabs but are more closely related to spiders. They are noted mostly during the spring mating season and in the fall when the beaches are covered with molted shells.

The ubiquitous **acorn barnacle** is so plentiful that it is overlooked in weekly monitoring reports. These barnacles take up residence on rocks, bulkheads, pilings, docks, and boat bottoms all around the harbor.

A rarely seen crustacean along the shores of Hempstead Harbor and Long Island Sound is the **mantis shrimp**. That's because mantis shrimp hide at the bottom in rock formations or burrow several feet into the bottom of the harbor or sound. They have been nicknamed thumb-splitters because of their strong front claws, and they should be approached cautiously. Many years ago (1996) during a low DO event, mantis shrimp and other bottom-dwelling creatures were driven to the surface for air. They have also been seen in raked samples for Hempstead Harbor shellfish population density surveys (e.g., four small mantis shrimp in the 2008 survey and a large one in the November 2013 survey; none were reported in the October 2021 survey). Increasingly, mantis shrimp have been found in the bellies of striped bass caught by local fishermen.

Mantis shrimp found in a striped bass (photo by Peter Emmerich, 6/6/14)

On August 24, 2016, numerous tiny crabs (about 0.7 cm) were observed in the water column at one of the outer-harbor stations (CSHH #16). Samples were collected, and an attempt was made to preserve the crabs, which seemed to include two larval stages. The crabs had prominent front claws that were very long compared with the rest of the body. We later identified the crabs as **long-claw porcelain crabs**, megalops stage; this was confirmed by a marine-invertebrates expert, David Lindeman. Although porcelain crabs are found along the Atlantic coast, this sighting in Hempstead Harbor was considered very unusual.

On July 8, 2020, a bloom of tiny shrimp occurred in Tappen Marina. They were later identified as **mysid shrimp** by John Waldman and Gillian Stewart. Mysid shrimp are a benefit to marine health as they are known to eat anything, including harmful dinoflagellates.

The **Asian shore crab** is an invasive species that started showing up around Long Island Sound in the late 1990s. It can tolerate a wide range of salinity and is now commonly seen in bays around Long Island Sound. Another nonnative crab species—the **Chinese mitten crab**—has shown up in the Hudson River as well as the lower Housatonic River in Connecticut, but the last report of mitten crabs in our area was in 2019 in Oyster Bay. Invasive species can upset the ecosystem and drive out native species. Marine scientist Dick Harris reported that large numbers of mitten crabs can create havoc when they burrow into riverbanks and can cause the banks to collapse. Both CT DEEP and NYS DEC have requested that anyone who sees a mitten crab (distinctive looking with its six spider-like legs and two claws that look like hairy mittens with white tips) capture the crab and put it on ice, freeze it, or preserve it in alcohol, note the date and location of capture, and report it; for NYS DEC, report to isinfo@dec.ny.gov or 518-402-9425.

4.7 Jellies

Two types of **comb jellies** (which are classified separately from the stinging-celled jellyfish) are seen in Hempstead Harbor: the larger egg-shaped sea walnuts and the tiny, rounder sea gooseberries. The **sea walnuts** have lobes that are rimmed with short comb-like appendages that are phosphorescent. They can be seen at night glowing as the water is moved around them, as in the wake of a boat. **Sea gooseberries** have a pair of tail-like appendages that can be seen when they are up close to the surface. Comb jellies do not sting.

In 2022, comb jellies (mainly sea walnuts) were observed in small numbers on monitoring trips in May through August. On September 8 we saw one sea walnut, and no more after that. Comb jellies had usually appeared in large numbers in Hempstead Harbor in late June and through mid-October. Monitoring observations generally reflected this pattern up until 2015, when no comb jellies were observed on monitoring dates; only a few were observed on some monitoring dates in 2016-2020, with more incidences of abundances “too numerous to count” in 2021. The decrease in comb jellies observed in Hempstead Harbor and Long Island Sound seemed to correspond with the increased presence of Atlantic menhaden, which may be feeding on young comb jellies.

Two types of tentacled jellyfish that may be seen in the harbor are the **lion's mane jellyfish**, with long tentacles that sting, and the round, bell-shaped **moon** jellyfish, which have short tentacles around their rim that do not produce a stinging sensation**.** Both types of jellyfish are usually observed in spring in Hempstead Harbor.

Early stages of lion's mane jellyfish (l) and (c) and fully developed (r) (photos by Joanna Keenan, 5/17/21, Carol DiPaolo, 5/19, and Kenny Neice, 4/13/21, respectively)

Moon jellies are easily identified by the four, whitish, horseshoe-shaped gonads on the top of the bell. There have been no reports of moon jellies since 2017.

We received our first reports of lion's mane jellyfish in March 2022, seen in Safe Harbor Marina (Glen Cove Creek) and Tappen Marina. This was earlier than the first report received in April 13, 2021. Early stages of lion's mane jellyfish (i.e., clear in color and without long tentacles) have been seen in Hempstead Harbor starting in 2021. Most of the lion's man jellyfish that are observed in Hempstead Harbor are relatively small and orange-colored, rather than purplish brown.

In 2013, mixed among the lion's mane jellyfish and moon jellies in Hempstead Harbor, we observed hundreds of unfamiliar jellies that were later identified as **salps**.

In September 2021, we began seeing white sea anemones attached to docks in Safe Harbor Marina and along the bulkhead below the Cove Restaurant in Glen Cove Creek. We continued seeing these along the bulkhead in September and October of 2022.

Sea anemones (photo by Quentin Tyree, 9/28/21)

4.8 Diamondback Terrapins and Other Turtles

Diamondback terrapins are the only turtle found in estuarine waters and generally grow to about 10 inches long. In spring of 2005, diamondbacks were observed in large numbers in the lower harbor, near the Roslyn viaduct. Diamondbacks typically converge by the hundreds in one area in the spring and mate for several weeks. Information about their presence in Hempstead Harbor was used to support efforts to extend the harbor's designation as a "significant coastal fish and wildlife habitat" to include the area south to the Roslyn viaduct.

In 2006, dramatic changes occurred in the area near the viaduct with the construction of the large buildings at Bryant Landing and the new viaduct (which was completed in 2011). Although there were no diamondback sightings reported for the lower harbor since 2006, they had been seen in other parts of the harbor since then, particularly around what is now Safe Harbor Marina (formerly Brewer Yacht Yard) and the Sea Isle sand spit.

Most recently, on September 20, 2022, a diamondback terrapin hatchling was seen swimming in Tappen Marina. Prior to that, the last report received of a sighting of a live diamondback terrapin in Hempstead Harbor had been at Brewer Yacht Yard in Glen Cove on June 17, 2014.

Diamondback terrapin below the outfall north of Tappen Beach pool (photo by Carol DiPaolo, 6/27/12)

Earlier sightings of diamondback terrapins in Hempstead Harbor included:

- In June 2008, the DEC seine crew caught an adult diamondback terrapin (255 mm across and 275 mm long–about 11 inches long–which is longer than the average size recorded) near the sandbar at the southern end of North Hempstead Beach Park.
- On July 11 and August 19, 2009, a diamondback was seen in Brewer Yacht Yard.
- In 2010, a large (about a foot long) diamondback was seen swimming also in Brewer Yacht Yard, near the Sea Isle sandspit.
- The diamondback pictured above was seen on June 27, 2012, north of the Tappen Beach pool and was more than a foot long.

Occasionally, large sea turtles have made their way into Long Island Sound and have been spotted in local bays. In 2019, a dead ridley turtle washed up on the beach near Tappen Marina. On August 13, 2015, a large sea turtle was seen in Long Island Sound near Hempstead Harbor. On October 24, 2011, Paul Boehm, who was fishing for black fish about a half a mile north of the Glen Cove breakwater, reported that he had seen a sea turtle, which he identified from photos as being a **Kemp's ridley turtle.** On August 2, 2011, a large sea turtle was seen at the Shelter Bay Yacht Club in Manhasset Bay.

We also often see snapping turtles (a fresh water species) in Scudder's Pond and other ponds around the harbor. However, there were no turtle sightings reported for 2020-2022. In June 2019, a Scudder's Pond turtle chose to make a nest on nearby property. The homeowners were happy to protect the 36 turtle eggs that hatched on August 30; the tiny snapping turtles were then released to Scudder's Pond.

4.9 Marine Mammals

Although long-time residents share stories of harbor porpoises visiting Hempstead Harbor and Long Island Sound during the mid-1900s, their appearance became less frequent, and for decades there were no reported sightings of these or other marine mammals in the harbor (see http://longislandsoundstudy.net/wp-content/uploads/2010/03/fall2009.pdf). Marine mammals are classified into four different taxonomic groups: **cetaceans** (whales, dolphins, and porpoises), **pinnipeds** (seals, sea lions, and walruses), **sirenians** (manatees and dugongs), and **marine fissipeds** (polar bears and sea otters). There are many species within each of the groups (see https://www.fisheries.noaa.gov/species-directory/marine-mammals). Some of the characteristics marine mammals share with other mammals include being warm blooded, having lungs to breathe air, giving birth to live young, and producing milk to feed their young.

Seal in the mooring field near the Hempstead Harbour Club (l) (10/23/21) and fluke of an Atlantic right whale near the Throgs Neck Bridge (r) (11/23/21)

Beginning in 2005, we received reports of seals in Hempstead Harbor followed by bottlenose dolphins in 2009 and whales in 2015. Sightings of these marine mammals were also increasing in other bays around Long Island Sound as well as along the south shore of Long Island.

In February 2022, a dead harbor seal washed ashore at Stehli Beach. On March 20, two or three dolphins were seen swimming between Port Washington and Sea Cliff; this was six days after a pair of dolphins was seen in Northport Harbor. On May 29, a dolphin was spotted near a buoy off of Hewlett Point in Manhasset Bay. Between June 10-12, a large number of dolphins were seen all over the sound and in Hempstead Harbor. In August, nearly a dozen humpback whales were spotted near New York City.

See *Table 7* below for a listing of marine mammal sightings for Hempstead Harbor, nearby bays, and western Long Island Sound that were reported to CSHH for years 2005 through 2021.

Table 7
Marine Mammal Sightings

Marine Mammal	Date	Description
Atlantic right whale	November 23, 2021	Spotted near the Throgs Neck Bridge
Seal	October 23, 2021	Seen in the mooring field near the Hempstead Harbour Club
Dolphins	July 5-6, 2021	Dolphin reports in Oyster Bay; the next day a pod of 50 dolphins were seen in Hempstead Harbor near the Legend Yacht and Beach Club (former Loew estate)
Dolphin	March 30, 2021	Stranded and rescued from mud flats at low tide, Manhasset Bay
Seal	November 21, 2020	Seen off of Sea Cliff Beach
Minke whale	May 15, 2020	Found on private beach in Oyster Bay in poor health, had to be euthanized
Seal	February 2020	Seen in the lower harbor
Seal	February 2019	Seen on a jet ski float in Safe Harbor Marina in Glen Cove
Seal	December 14, 2018	Seen surfacing in front of the Tilley stairs in Sea Cliff
Pilot whale	July 11, 2018	Seen in Oyster Bay
Whale and bottlenose dolphins	September 17, 2016	Seen off of Matinecock Point
Humpback whale	July 21, 2016	Seen breaching outside Hempstead Harbor, near Execution Rock lighthouse
Whales	May 5, 2016	2 whales, one large and one small, seen approximately one mile east of Prospect Point
Humpback whale	April 29, 2016	Seen mid-sound, between the outer section of Hempstead Harbor and the Rye/Westchester area
Dolphins	April 12, 2016	Seen in Oyster Bay
Humpback whale	December 7-9, 2015	Seen near red bell buoy off Sands Point, and again near Glen Cove Creek entrance
Humpback whales	October 5-6, 2015	Several reported to be in or near Hempstead Harbor
Humpback whales	September 18, 25, 28, 2015	2 seen at multiple locations across Long Island Sound and Hempstead Harbor over several days
Beluga whales	May 2015	Confirmed sightings of 3 young beluga whales in Manhasset Bay, Oyster Bay
Bottlenose dolphins	August 17, 2015	About two dozen seen near Glen Cove breakwater and Morgan Beach; another report received the next day of dolphins in the outer harbor
Bottlenose dolphins	August 9, 2015	About 100 seen over several hours in Long Island Sound, Hempstead Harbor near Morgan Beach, and outer harbor
Seals	November 16, 2013	Multiple seen at different locations—midharbor, Crescent Beach, and near Matinecock Point
Bottlenose dolphins	July 19, 2013	8 seen in Hempstead Harbor, near Sea Cliff Beach
Seals	April 27-29, 2013	Seen off the west shore of the upper Harbor and off the jetty at Morgan Park

Marine Mammal	Date	Description
Bottlenose dolphins	August 11, 2011	About 100 entered Hempstead Harbor, were seen near Morgan Park
Bottlenose dolphins	August 5, 2011	Seen in Long Island Sound
Bottlenose dolphins	June 27, 2009	Around 200 seen in western Long Island Sound, 100 near Tappen Beach
Seal	January 2008	Seen off of Sea Isle, near Tappen Marina, in Glen Cove Creek, and off of Centre Island
Seal	November 2005	Seen eating striped bass in Hempstead Harbor

4.10 Birds

Since the inception of the monitoring program, we have seen an increase in the variety of birds that have become residents or regular visitors to Hempstead Harbor. **Belted kingfishers, blue herons, Canada geese, cormorants, great and snowy egrets, gulls, mallards, ospreys, swans, terns,** and most recently, **bald eagles** are generally observed throughout the season, along with the usual swallows, pigeons, crows, and other land-based birds that are frequently seen along the shores of the harbor but not counted or specifically noted on data sheets during monitoring. Increasingly, **red-winged blackbirds** are noticed around the edges of Scudder's Pond and grassy areas on top of the bulkhead near the head of Glen Cove Creek.

A belted kingfisher, stunned after flying into a glass door (l), terns on a buoy (c), and a great egret (r) (photos by Carol DiPaolo, 5/3/19, 6/26/19, and 8/4/21)

Each year we see new, young members of the harbor's duck, Canada goose, and mute swan populations. Although the adult Canada goose population remains high, we have seen fewer numbers of young birds over the last few years. In 2022, we observed three goslings during two monitoring trips in June.

In 2022, the highest number of swans observed on a single monitoring date was 12 on August 24; no cygnets were seen this season. In 2020, up to 37 swans were counted on June 17. The observed mute swan population in Hempstead Harbor has varied from a high of 55 swans counted on a single monitoring date in August 2019 to about a dozen observed on any single monitoring date in 2011-2017 and 2021.

Observed less frequently during monitoring are **black-crowned night herons, brants**, **green herons, killdeer** and other **plover-type birds,** and **falcons** or **hawks**. Sightings of these are included on weekly data sheets and also noted in the monthly field observations at *Section 4.5*.

Three ospreys on Beacon 11 nest (photo by Elaine Neice, 8/3/21)

Osprey populations, once threatened because of the effects of widely used pesticides that were banned in the 1970s, have made a remarkable comeback to Hempstead Harbor and Long Island Sound. These beautiful "fish hawks" can be seen diving for prey in harbor waters. As the harbor's ecosystem improved, the ospreys and other water birds have been able to find plenty of food for them to thrive. The ospreys migrate long distances (as far as South America) in the fall and return in March–generally to the same nesting places they had been to previously.

Osprey nests have been visible from our monitoring stations in Hempstead Harbor since at least 1995. Over the years the osprey population continued to increase along with nesting sites around the harbor. Despite additions of nesting platforms around the harbor, ospreys have built nests on top of cell towers, other electrical equipment, and even construction cranes. We have also seen nests on top of duck blinds and abandoned boats. Currently, 17 osprey nests are within easy view around the harbor’s shoreline. One of the oldest nesting sites in Hempstead Harbor is Beacon 11, the navigational light between Tappen Beach Marina and Town of North Hempstead Beach Park. In 2022, two new nests were discovered, one atop a constructed platform on the beach of Garvies Point Preserve and the other on a dolphin piling at the end of the decommissioned dock at the Town of North Hempstead Beach Park North.

Since about 2004, **peregrine falcons**, a protected species, have been sighted near the Glenwood Landing power plant. In 2022, a peregrine falcon was observed on the Gladsky Marine crane in September and near Scudder’s Pond in October. On October 6, 2021, a peregrine falcon was seen on a crane in the lower harbor. In 2019, there was a sighting of what seemed to be a peregrine falcon in the vicinity of the vacant lot that was the site of the old brick powerhouse in Glenwood Landing.

Although **red-tailed hawks** are seen often in wooded areas around Hempstead Harbor, we see them only occasionally during water monitoring. In 2022, red-tailed hawks were observed in March from Sea Cliff, again in April in Glen Cove, on both monitoring trips in May, and in early September in a tree at Morgan Park.

Cooper’s hawks were also present in 2022, one sighting in a tree in mid-January and a rescue that occurred in early September following a collision with a clear-glass window; both took place in Sea Cliff.

We had our first sighting of a **turkey vulture** near Hempstead Harbor on a monitoring date in May 2008 flying over Glen Cove Creek. Since then, they have been seen frequently throughout the year near the eastern shore of the harbor, flying over East Hills, Greenvale, Roslyn Harbor, Mott's Cove, Sea Cliff, and Glen Cove. In mid-February of 2022, two were seen flying over Glen Head and Sea Cliff. Two were seen again on March 21 in Glen Head and June 3 near the Sea Cliff train station, both times scavenging for rabbit and squirrel remains. We saw one in July on a water monitoring trip.

Red-tailed hawk flying over Welwyn Preserve (l), osprey in flight (c), and turkey vulture (r) (photos by Ashley Pichon, 4/24/22, and Jim Moriarty, 9/11/10; turkey vulture photo retrieved from en.wikipedia.org/wiki/Turkey Vulture, 6/17/12)

Bald eagles have been moving toward western Long Island Sound over recent years, and we started receiving regular reports of them around Hempstead Harbor in 2015 during the monitoring season. In 2018, it was confirmed that there was a nesting pair of bald eagles in a large tree along the shoreline in Roslyn Harbor and at least one chick was in the nest on May 28, 2018.

In 2022, bald eagles were seen in February from Glen Cove, Glen Head, and Roslyn Harbor. We saw up to two adults and two juveniles during the monitoring season. However, in August we received a report that a juvenile bald eagle became ill with what was later confirmed to be avian flu.

Two bald eagle fledglings (l) and adult with a fish (r) in the lower harbor (photos by Rich Boehm, 7/21/21)

In winter, many migratory waterfowl can be seen around Hempstead Harbor, including **brants**, **buffleheads**, **common goldeneyes**, **common loons**, **common mergansers**, **red-**

breasted mergansers, **greater scaup**, and **lesser scaup.** All of these were seen in 2022, with the exception of the greater scaup. The brants stayed the longest, until mid-May.

From left to right, brants, bufflehead, greater scaup, and red-breasted merganser (photos by Skip Dommin, over several days in January 2021)

There have been some unusual visitors over the years as well. In 2018, we received our first report of a **black vulture** (a southern variety) flying off of Sea Cliff Beach and two pairs of **long-tailed ducks** swimming near the same area in the harbor. In 2017, we saw **black skimmers** for the first time during a monitoring date, and then had a report of a skimmer doing some nighttime fishing in Tappen Marina in 2018. In 2011 (August 28), a **south polar skua** (a dark, gull-like bird), showed up on Sea Cliff Beach, brought in with the hurricane winds; in mid-December, a **brown pelican** was seen off of Sands Point at the Execution Rocks Lighthouse.

Over recent years, we have received reports of **northern gannets** diving into the harbor and Long Island Sound for food. Although there were no sightings reported in 2022 for Hempstead Harbor, we received reports of gannets in the spring of 2021 and 2019. On April 19, 2021, gannets were seen diving for bunker in eastern Long Island Sound. On April 14, 2019, a large number of gannets were seen diving for bunker in Hempstead Harbor.

4.11 Algal Blooms

The color and turbidity of water within Hempstead Harbor vary by season. Hempstead Harbor Secchi-disk depths (an indicator of light penetration into the water column and therefore water clarity) in the harbor most often range from 0.5 m to 3.0 m, with the higher numbers in the range generally recorded in spring and autumn. Lower Secchi-disk depths along with supersaturated DO levels are strong indicators of the presence of algal blooms, i.e., the accelerated growth and density of phytoplankton. Algae absorb light and give off oxygen in the growth phase. The dominant type of algae present in the harbor gives the water its color, which is typically brown or green.

During most seasons in Hempstead Harbor, we see the effects of algal blooms, such as unusual and dramatic water color and clarity changes, often followed by low DO levels as the algae decomposes and uses up oxygen in the process. An indicator of an algal bloom in process is a high reading for DO percent saturation, which we record during weekly monitoring using a multiparameter meter. Chlorophyll a (Chl a) readings are also used from the meter to help determine the presence of an algal bloom (see *Section 3.6*).

On June 1, 2022, the water within Tappen Marina appeared abnormal and was distinctly brown. Water samples were taken at CSHH #1 and Tappen Marina identified *Prorocentrum minimum* as the likely dominant species.

Another probable algal bloom occurred in mid-July when rust-brown water was observed in Tappen Marina, Safe Harbor Marina, and parts of Glen Cove Creek. *Prorocentrum triestinum* was identified as the likely dominant species in another examination of water samples from CSHH #13 and Tappen Marina.

Pollen slick—not sludge (l) and stripe of pollen across outer harbor surface (r) (photos by Carol DiPaolo, 5/7/15, and Michelle Lapinel McAllister, 5/19/21, respectively)

In addition, pollen slicks, which are commonly seen on the harbor's surface in spring, can change the appearance of the water surface and color. The slicks are usually lighter in color when first formed and then, as the organic matter within the slick decays, turn a darker brown. A pollen slick may also be mixed with algal cells and form a thick coating over the water surface. A dramatic example of this occurred in May 2015, when the decaying pollen mixed with algae cells and created a mat on the water surface that covered a large area of the harbor as well as many areas around Long Island Sound. Many local residents were prompted to report the appearance of the slicks as the release of "sludge" or sewage spills. Water samples taken from the slick that spread across a section of Hempstead Harbor confirmed that no sewage was mixed in the mat of organic matter.

Duckweed at Scudder's Pond (photo by Michelle Lapinel McAllister, 8/17/22)

A mix of algal cells with other vegetation at Scudder's Pond often creates a mat at the surface that generally persists through the warmer months. Most often duckweed growth accelerates and covers the pond and moves from side to side as the wind direction changes.

Excess amounts of nitrogen released from failing septic systems, overfertilization of lawns and gardens, and other sources, have been implicated in causing more frequent and longer-lasting algal blooms in waters around Long Island and other areas. These blooms can affect other marine species through light reduction and oxygen depletion. Some types of algae contain biotoxins, and if the algal cells are present in high densities, these harmful algal blooms (HABs) may cause a risk to human health through consumption of shellfish taken from affected areas.

Excess nitrogen can also fuel the growth of macroalgae (also known as macrophytes, or, more commonly, seaweed). An overabundance of seaweed can further reduce light penetration, deplete oxygen, make it difficult for some species of marine life to thrive, and create aesthetic issues for beaches. In some bays, seaweeds can create deep mats on bay bottoms.

In Hempstead Harbor, the seaweed is generally present in smaller amounts, sparsely covering portions of the shoreline at low tide or collecting around rocks or jetties. Seaweed may be observed in greater amounts after high winds and rain storms both on the surface of the water and on the shoreline during a receding tide. Common seaweeds found around Hempstead Harbor and Long Island Sound include sea lettuce (*Ulva lactuca),* red wooly grass *(Agardhiella subulata*), rockweed (*Fucus distichus)*, and Irish moss (*Chondrus crispus*) and the similar looking Turkish washcloth (*Mastocarpus papillatus*).

Seaweeds commonly found around Hempstead Harbor include (from left to right) sea lettuce, red wooly grass, rockweed, and Turkish washcloth (photos by Sebastian Li, 7/6/21)

At the very end of 2022, Rob Rich, a local photographer, reported seeing a widespread growth of an orange algae off of the end of the boardwalk at the bottom of Dock Hill/Sea Cliff Park that he had not seen before. On further investigation, we saw that what was being described looked like a ferny type of algae/seaweed that seemed to grow with other types,

"Ephemeral" algal bloom along eastern shore of Hempstead Harbor (photos by Rob Rich (l), 12/28/22, and Carol DiPaolo (r), 1/1/23)

such as rockweed. The color ranged from orange to a peachy/rosy color. The seaweed was present from areas near Sea Cliff Beach all the way to the rocks near Tappen Beach pool.

When asked for a possible identification of the seaweed, Dr. Jamie Vaudrey, Research Coordinator for the Connecticut National Estuarine Research Reserve offered the following: "…without looking at it under a microscope…my guess would be *Antithamnion pectinatum* or *Antithamnion cruciatum* (a native) or possibly a *Callithamnion* species (*C. tetragonum* or *C. corymbosum* – or similar looking species). All are found year-round, with the *Antithamnion* cited as being open coast, subtidal, and often epiphytic on other algae…. The *Callithamnion* is found in lower intertidal and subtidal zones often growing on other algae or eelgrass – it is finer looking to me, than what I can see in your photos."

Appendix A

2022 CSHH Field-Monitoring Data

Red numbers indicate that the readings were unusually low or high but reflect station conditions.

Green lines indicate replicate surveys.

Purple lines indicate survey using YSI Pro Plus and LaMotte 2020e turbidity meter. Depth between sensor at bottom reading to sea floor is 0.15 m.

Blue lines indicate data supplemented by UWS data due to sampling restrictions for core program.

Highlighted numbers indicate possible equipment malfunction.

*Sonde surface levels are taken at a half meter below the surface.

**Bottom levels are read by the sonde depth sensor, which is 0.3 m off the harbor floor.

***Total depth accounts for the 0.3 m distance between the Eureka sonde depth sensor and the harbor floor.

Date	**Water Temp (°C)**		**Salinity (ppt)**		**DO (ppm)**		**pH**		**Air Temp**	**Secchi**	**Chl-a (ug/L)**		**Turbidity (NTU)**		**Depth(m)**	**Time**
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	**(°C)**	**(m)**	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #1–Beacon 11																
10/27/22	15.92	15.98	27.08	27.42	8.09	7.21	7.70	7.77	14.9	1.25	29.62	23.03	3.26	2.65	3.36	7:25
10/27/22	15.96	15.93	27.22	27.58	7.22	7.12	7.73	7.76	N/A	N/A	30.47	25.53	2.77	3.78	3.44	N/A
10/19/22	16.01	16.36	24.62	24.67	8.55	8.98	7.91	7.89	9.4	2.25	14.31	16.14	1.28	1.27	4.70	9:20
10/19/22	Replicate performed at CSHH #7.															
10/12/22	16.52	16.66	27.40	27.68	8.28	8.29	7.90	7.94	11.7	1.5	23.96	28.04	2.47	2.01	3.39	7:51
10/12/22	16.50	16.65	27.24	27.64	8.29	8.25	7.91	7.95	N/A	N/A	21.71	24.81	2.61	1.94	3.34	N/A
10/6/22	14.98	16.82	25.05	28.15	8.30	8.43	7.81	7.91	16	N/A	9.51	10.55	3.25	1.55	6.24	8:51
10/6/22	Replicate performed at CSHH #7.															
9/28/22	19.2	19.3	26.73	26.90	5.83	5.91	7.69	7.76	14.2	1.5	N/A	N/A	N/A	N/A	2.95	7:47
9/28/22	19.2	19.2	26.74	26.93	5.73	5.99	7.72	7.78	N/A	N/A	N/A	N/A	N/A	N/A	2.95	N/A
9/21/22	22.76	23.27	27.28	27.43	8.16	7.16	7.98	7.87	19.3	1.0	68.68	67.53	2.14	1.87	4.96	7:55
9/21/22	22.68	23.17	27.14	27.43	7.80	7.68	8.01	7.87	N/A	N/A	62.00	65.66	1.90	2.06	4.97	N/A

2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #1–Beacon 11 (continued)																
9/14/22	22.68	22.86	26.71	27.15	4.46	3.63	6.53	7.08	19.1	1.3	13.84	19.69	2.70	3.38	3.17	7:52
9/14/22	22.63	22.85	26.80	27.15	3.63	3.57	7.15	7.20	N/A	N/A	15.31	17.42	3.07	3.02	2.97	N/A
9/8/22	23.04	23.46	27.55	27.82	3.59	3.05	7.20	7.31	19.3	1.25	33.72	28.67	2.08	2.82	5.94	7:24
9/8/22	23.05	23.43	27.49	27.80	3.47	3.00	7.36	7.35	N/A	N/A	28.38	24.97	2.38	2.17	6.43	N/A
8/31/22	24.18	24.15	27.73	28.07	3.64	3.53	7.13	7.27	23.4	1.25	36.95	33.54	3.23	3.26	3.46	7:58
8/31/22	24.18	24.18	27.73	27.96	3.61	3.48	7.32	7.33	N/A	N/A	35.24	43.84	2.67	3.23	3.26	N/A
8/24/22	23.47	23.20	27.48	28.07	3.78	2.68	7.23	7.28	24.0	1.3	30.17	13.12	1.53	1.48	4.32	7:54
8/24/22	23.83	23.15	27.53	28.05	5.19	3.25	7.50	7.36	N/A	N/A	34.76	12.50	1.41	1.81	4.34	N/A
8/17/22	23.13	23.13	26.89	27.06	3.73	3.21	6.71	7.27	21.6	1.25	42.79	47.69	2.85	3.31	3.64	7:50
8/17/22	23.14	23.15	27.18	27.23	3.24	3.16	7.30	7.32	N/A	N/A	44.99	41.39	3.14	3.20	3.55	N/A
8/10/22	24.45	23.41	26.70	27.35	4.30	1.33	7.27	7.11	25.1	1.25	54.43	20.98	2.49	3.08	4.45	7:52
8/10/22	24.41	23.42	26.62	27.34	3.19	1.38	7.22	7.11	N/A	N/A	65.33	21.89	2.59	2.92	4.53	N/A
8/3/22	22.52	22.51	26.94	27.01	2.37	1.79	7.09	7.19	24.3	1.2	43.63	42.91	2.81	2.84	3.39	7:54
8/3/22	22.51	22.51	27.04	27.10	1.89	1.84	7.20	7.19	N/A	N/A	39.59	35.20	2.79	2.90	3.48	N/A
7/27/22	22.42	21.72	26.21	26.77	3.19	2.68	7.18	7.20	21.2	0.75	143.02	70.30	3.35	3.53	3.61	7:44
7/27/22	22.40	21.69	26.05	26.80	2.89	2.12	7.23	7.18	N/A	N/A	132.49	66.06	4.59	3.77	3.70	N/A
7/21/22	23.18	22.02	26.34	26.85	2.79	2.55	7.27	7.34	27.1	1.0	99.45	58.21	2.19	1.77	3.69	7:56
7/21/22	23.16	22.07	26.42	26.86	3.35	2.34	7.38	7.34	N/A	N/A	99.73	57.57	2.42	1.67	3.78	N/A
7/13/22	21.58	20.88	25.85	26.50	5.97	4.29	7.56	7.41	24.1	0.65	230.00	116.90	7.49	4.37	3.57	8:08
7/13/22	21.42	20.95	26.09	26.41	6.15	3.95	7.60	7.38	N/A	N/A	149.19	78.40	5.08	4.32	3.66	N/A
7/6/22	19.46	17.59	26.40	27.01	2.84	1.93	7.10	7.16	25.3	1.25	58.95	43.63	3.38	2.14	3.99	7:52
7/6/22	19.42	17.55	26.33	26.99	2.43	1.97	7.18	7.19	N/A	N/A	56.47	76.29	3.31	2.27	3.88	N/A
6/29/22	19.59	18.47	25.22	26.00	6.08	5.84	7.06	7.36	20.4	0.8	75.95	71.20	4.67	4.32	2.92	7:51
6/29/22	19.67	18.42	25.17	26.06	5.90	5.56	7.46	7.45	N/A	N/A	82.70	74.04	4.57	5.46	2.97	N/A

2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #1–Beacon 11 (continued)																
6/22/22	17.94	16.65	25.74	26.33	6.31	5.27	7.66	7.55	18.0	0.9	57.71	33.29	5.05	6.99	4.54	8:55
6/22/22	Replicate performed at CSHH #7.															
6/15/22	18.97	18.28	25.23	25.57	8.05	7.95	7.43	7.61	21.3	0.8	51.31	50.28	6.07	6.02	2.73	7:52
6/15/22	18.82	18.29	25.29	25.57	7.96	7.83	7.69	7.70	N/A	N/A	55.94	48.75	8.35	7.51	2.75	N/A
6/8/22	17.01	14.42	25.26	26.14	6.19	5.00	7.66	7.55	22.2	1.25	19.69	21.17	4.02	7.39	4.30	7:43
6/8/22	17.29	14.58	25.13	26.12	5.44	5.44	7.59	7.60	N/A	N/A	23.13	14.65	4.78	3.81	3.95	N/A
6/1/22	19.11	19.05	24.52	24.67	8.25	8.87	6.95	7.71	17.0	0.5	154.75	57.71	8.65	9.06	3.31	7:41
6/1/22	19.11	19.00	24.60	24.74	8.81	8.71	7.71	7.78	N/A	N/A	108.50	43.73	8.51	9.27	3.38	N/A
5/25/22	16.20	13.92	24.28	25.14	8.14	6.85	7.08	7.54	16.8	1.25	16.64	11.10	3.33	3.90	4.94	7:54
5/25/22	16.24	13.80	24.22	25.19	7.12	6.91	7.60	7.64	N/A	N/A	18.12	11.47	3.20	4.83	5.16	N/A
5/18/22	15.29	15.17	23.65	23.88	8.36	8.32	7.55	7.83	14.4	1.25	8.08	11.14	5.06	4.93	2.57	7:57
5/18/22	15.29	15.15	23.68	23.95	8.49	8.36	7.88	7.90	N/A	N/A	10.60	10.12	3.69	3.48	2.61	N/A

2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #2–Bell Marker 6																
10/27/22	16.00	16.00	28.03	28.04	8.60	8.44	7.95	7.95	14.0	2.5	13.29	13.29	0.36	0.41	4.82	8:48
10/19/22	16.35	16.31	25.01	24.96	8.68	9.22	7.99	7.98	10.1	3.25	5.30	12.14	2.32	1.62	9.53	9:53
10/12/22	16.67	16.70	28.18	28.22	9.36	9.52	8.12	8.03	13.9	2.25	25.59	13.03	0.72	0.62	6.08	8:29
10/6/22	17.17	17.38	28.59	28.69	7.89	8.30	7.95	7.92	16	N/A	6.42	8.80	1.30	1.60	9.08	9:18
9/28/22	20.2	19.9	27.85	27.80	6.79	5.95	7.92	7.89	14.4	2.75	N/A	N/A	N/A	N/A	8.40	8:18
9/21/22	23.10	22.98	27.79	27.82	7.17	6.89	7.86	7.83	20.4	2.25	12.32	19.11	0.89	0.95	10.20	9:53
9/14/22	22.98	23.30	28.09	28.52	5.94	4.10	7.44	7.39	19.2	2.0	13.53	10.67	1.01	1.21	8.35	8:12
9/8/22	23.15	23.13	28.62	28.47	6.54	5.13	7.68	7.59	21.1	1.5	8.77	11.93	1.79	3.65	7.64	9:31
8/31/22	24.08	23.94	28.35	28.38	5.21	4.68	7.60	7.58	23.5	1.75	20.27	24.39	1.19	0.87	5.93	8:46
8/24/22	23.88	23.50	28.03	28.08	6.66	5.19	7.76	7.61	25.1	2.0	21.22	11.05	0.95	1.28	10.17	10:01
8/17/22	22.66	22.57	27.76	27.97	5.69	3.16	7.59	7.43	22.6	1.6	21.14	10.19	1.15	2.77	8.20	8:16
8/10/22	23.83	21.35	27.47	27.88	6.26	1.75	7.56	7.21	26.8	1.3	52.43	10.22	1.71	1.19	9.82	9:26
8/3/22	23.63	21.02	27.47	27.91	8.08	1.23	7.90	7.28	24.2	1.5	14.11	12.01	1.32	3.44	8.07	8:20
7/27/22	22.80	19.55	26.79	27.62	6.07	1.18	7.54	7.19	22.3	1.5	17.96	4.05	1.16	0.39	8.48	8:19
7/21/22	23.11	20.29	26.62	27.23	6.07	1.71	7.69	7.33	28.1	1.3	38.38	49.48	1.74	1.65	9.97	8:16
7/13/22	21.77	19.67	26.45	26.84	8.09	4.06	7.89	7.43	24.2	1.65	47.93	9.69	2.38	4.44	9.01	8:28
7/6/22	19.38	17.00	26.53	27.18	5.86	3.11	7.39	7.36	24.6	1.5	32.68	48.29	1.90	2.86	9.19	8:18
6/29/22	19.13	16.67	25.84	26.64	7.70	3.59	7.70	7.39	20.1	1.25	32.90	44.32	2.99	6.37	8.48	8:17
6/22/22	17.38	15.97	26.09	26.49	8.09	6.00	7.86	7.62	17.5	1.5	34.98	36.69	2.23	7.26	9.71	9:24
6/15/22	18.01	14.76	25.96	26.65	8.91	5.99	7.88	7.62	22.7	1.25	21.32	19.87	3.01	5.46	7.96	8:22
6/8/22	17.01	13.47	25.35	26.44	8.44	5.49	7.92	7.62	22.8	1.75	14.78	9.86	1.47	6.07	9.80	8:20
6/1/22	18.84	13.09	25.00	26.02	11.69	6.65	8.27	7.63	17.1	1.25	69.36	11.75	2.20	5.59	7.56	8:11
5/25/22	15.32	14.65	24.96	25.15	8.83	8.15	7.90	7.86	15.4	2.5	4.44	7.58	0.85	1.41	6.82	9:40
5/18/22	13.94	13.71	24.53	24.58	9.20	9.35	7.98	8.05	14.4	2.75	6.35	6.61	1.11	1.62	7.77	8:38

2022 CSHH Field-Monitoring Data

Date	**Water Temp (°C)**		**Salinity (ppt)**		**DO (ppm)**		**pH**		**Air Temp**	**Secchi**	**Chl-a (ug/L)**		**Turbidity (NTU)**		**Depth(m)**	**Time**
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	**(°C)**	**(m)**	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #16–Outer Harbor, Midway Between E/W Shore and N/S Boundary of Shellfish Harvesting Area																
10/27/22	15.98	15.92	28.11	28.24	8.27	7.54	7.92	7.87	15.3	3.0	11.20	10.23	0.48	7.64	8.95	7:54
10/19/22	16.40	16.41	24.92	24.94	8.52	8.38	7.96	7.95	11.2	3.25	6.73	12.82	1.07	0.89	9.96	10:12
10/12/22	16.74	16.95	28.19	28.34	9.61	8.52	8.11	7.95	15.5	2.25	29.58	12.15	0.92	1.96	9.01	8:46
10/6/22	Ran out of time for sample.															
9/28/22	20.4	20.4	28.10	28.12	6.30	6.13	7.89	7.86	14.7	2.75	N/A	N/A	N/A	N/A	8.90	8:39
9/21/22	23.15	23.02	27.93	27.96	7.30	6.68	7.89	7.80	20.4	2.25	15.93	13.55	0.52	2.89	10.53	10:17
9/14/22	23.10	23.16	28.30	28.43	5.33	5.04	7.52	7.50	19.4	2.5	9.64	7.76	0.86	2.30	8.75	8:27
9/8/22	23.16	23.15	28.59	28.59	5.30	4.82	7.65	7.63	22.0	1.75	4.71	8.44	1.83	2.75	11.25	9:50
8/31/22	24.26	23.84	28.49	28.60	5.61	4.40	7.70	7.60	23.2	1.75	15.32	13.76	1.12	2.84	8.87	9:10
8/24/22	24.18	22.93	28.08	28.27	7.09	3.00	7.77	7.43	25.8	2.0	10.92	6.57	1.35	1.58	10.62	10:16
8/17/22	22.94	22.53	27.81	28.03	5.95	3.37	7.67	7.48	22.1	1.8	20.55	7.14	1.02	3.18	9.02	8:33
8/10/22	24.23	20.95	27.52	27.98	7.77	1.32	7.72	7.23	25.0	1.3	61.41	8.37	1.58	0.29	10.85	9:41
8/3/22	23.40	20.93	27.75	28.02	7.53	1.13	7.81	7.25	24.6	1.5	16.95	8.27	1.23	1.32	8.78	8:44
7/27/22	22.85	18.95	26.71	27.87	6.66	0.87	7.63	7.17	22.3	1.5	12.58	2.59	0.90	0.29	9.83	8:34
7/21/22	23.49	18.69	26.67	27.63	7.21	2.48	7.90	7.44	27.8	1.5	25.54	40.45	1.19	1.97	10.33	8:33
7/13/22	21.79	18.99	26.54	26.94	7.99	4.17	7.88	7.46	24.8	2.35	15.63	12.01	1.43	2.26	9.91	8:45
7/6/22	19.40	16.73	26.76	27.35	6.20	3.09	7.58	7.39	23.0	2.0	12.35	29.99	0.92	8.89	9.42	8:33
6/29/22	19.30	16.42	26.14	26.80	8.48	4.60	7.86	7.48	19.9	1.5	21.34	20.28	1.37	3.89	9.03	8:39
6/22/22	17.52	15.71	26.09	26.58	8.93	6.06	7.94	7.63	17.3	1.5	42.55	31.17	1.76	9.89	10.03	9:41
6/15/22	18.07	14.95	26.13	26.63	8.76	6.64	7.91	7.66	22.4	1.5	15.53	22.14	1.60	8.57	8.56	8:35
6/8/22	17.27	13.23	25.49	26.60	8.17	5.92	8.00	7.67	21.4	1.75	12.67	7.47	2.19	3.62	10.16	8:43
6/1/22	17.20	12.72	25.30	26.34	10.94	7.02	8.03	7.65	16.5	1.5	48.08	12.98	2.05	4.79	8.87	8:35
5/25/22	15.80	12.72	25.09	25.76	9.07	7.39	7.94	7.79	15.2	2.25	9.17	6.83	0.96	7.07	10.67	9:58
5/18/22	13.88	13.47	24.62	24.69	9.36	9.36	8.09	8.07	14.6	3.25	7.89	7.33	0.72	1.34	8.23	9:00

2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #17–Outer Harbor, Outside Restricted Crescent Beach Boundary																
10/27/22	15.99	16.00	28.06	28.04	8.71	8.71	8.00	7.99	15.3	2.25	16.75	18.45	0.69	0.61	3.51	8:23
10/19/22	16.30	16.29	25.01	24.98	8.74	8.67	8.01	7.99	10.2	3.0	12.00	10.60	0.57	0.36	5.34	10:33
10/12/22	16.82	16.77	28.18	28.19	10.00	9.62	8.14	8.06	16.7	2.25	15.84	17.04	0.82	0.53	4.23	9:10
10/6/22	17.74	17.71	28.72	28.78	7.89	8.77	7.91	7.89	17	N/A	3.16	3.75	1.08	1.04	6.66	9:36
10/6/22	17.74	17.71	28.78	28.80	7.57	7.67	7.91	7.90	N/A	N/A	3.07	4.95	1.03	1.26	6.63	9:42
9/28/22	20.4	20.1	28.14	28.10	6.62	6.26	7.89	7.89	14.9	3.0	N/A	N/A	N/A	N/A	3.95	9:00
9/21/22	23.23	22.81	27.94	27.99	7.34	6.68	7.92	7.78	20.4	2.25	10.93	8.21	0.70	1.47	6.12	10:40
9/14/22	23.18	23.18	28.32	28.36	5.80	5.45	7.57	7.54	19.4	2.25	9.89	9.48	1.23	1.37	3.95	8:44
9/8/22	23.05	22.94	28.56	28.56	5.30	4.24	7.63	7.54	22.2	2.0	4.29	5.69	1.38	1.97	6.13	10:12
8/31/22	24.18	24.15	28.43	28.50	5.31	5.10	7.66	7.64	23.3	1.75	23.61	21.80	1.30	1.08	4.08	9:24
8/24/22	24.48	23.98	28.01	28.10	7.14	6.01	7.81	7.68	25.8	1.5	22.40	10.34	1.06	1.88	6.12	10:37
8/17/22	22.73	22.55	27.97	27.97	4.95	3.64	7.59	7.48	22.0	1.75	11.86	7.67	1.67	1.90	4.76	8:53
8/10/22	23.79	22.10	27.69	27.75	6.93	3.83	7.69	7.40	25.2	1.5	37.02	7.15	1.28	0.81	6.81	10:00
8/3/22	22.53	22.02	27.81	27.85	5.16	4.46	7.58	7.50	24.9	1.5	14.52	13.49	1.27	1.35	4.35	9:01
7/27/22	22.99	20.70	27.06	27.31	7.81	2.64	7.83	7.36	22.6	1.75	8.73	8.84	0.67	0.30	5.67	8:58
7/21/22	23.93	21.94	26.72	26.98	9.67	7.84	8.20	7.89	29.0	1.75	15.98	6.93	0.98	2.14	6.08	8:55
7/13/22	21.48	20.25	26.63	26.79	7.30	5.98	7.78	7.65	24.7	1.9	8.24	10.01	2.72	3.06	6.64	9:08
7/6/22	19.58	19.39	26.94	26.92	7.11	6.63	7.71	7.73	23.8	1.9	26.92	24.47	1.35	1.01	4.39	8:52
6/29/22	20.16	18.74	26.17	26.47	9.62	9.30	8.04	7.91	21.5	2.15	6.78	14.40	0.86	2.61	5.26	8:58
6/22/22	17.62	15.91	26.10	26.50	8.80	6.65	7.96	7.70	17.5	1.5	28.49	18.25	1.50	7.09	5.86	10:00
6/15/22	17.04	15.75	26.36	26.50	8.21	7.29	7.85	7.74	22.0	1.5	11.78	22.24	2.11	3.18	5.23	8:58
6/8/22	17.99	17.42	25.41	25.47	8.69	7.67	8.14	8.01	21.2	1.9	13.61	23.02	1.88	3.66	5.90	9:03
6/1/22	15.59	13.20	25.59	26.16	8.25	6.68	7.78	7.62	16.3	1.5	37.47	7.48	2.40	4.50	4.50	8:57
5/25/22	15.01	13.72	25.31	25.33	8.21	7.76	7.87	7.82	15.3	2.25	12.46	5.09	1.08	4.25	5.30	10:25
5/18/22	14.06	13.95	24.66	24.67	9.33	9.41	7.99	8.01	14.9	2.75	2.77	5.39	1.45	1.90	3.66	9:23

2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #3–Glen Cove Creek, Red Channel Marker																
10/27/22	15.95	15.95	27.40	27.40	8.73	8.65	7.98	7.97	15.8	2.0	19.73	22.60	0.97	2.23	3.50	9:04
10/19/22	15.85	15.97	24.60	24.85	9.44	9.31	8.06	8.06	11.3	2.5	13.10	10.43	0.60	0.74	4.49	10:54
10/12/22	16.79	17.00	27.78	28.22	9.31	9.65	8.17	8.05	17.0	2.25	25.21	11.83	1.01	0.87	3.87	9:38
10/6/22	15.56	16.97	26.48	28.42	8.70	8.22	7.90	7.86	14	N/A	15.50	10.20	1.50	1.25	5.05	7:50
9/28/22	19.4	20.0	26.89	27.43	6.85	6.29	7.94	7.86	14.9	1.75	N/A	N/A	N/A	N/A	3.75	9:30
9/21/22	23.51	23.00	27.52	27.83	8.66	7.70	8.08	7.85	20.8	N/A	35.57	19.74	1.53	1.54	5.05	10:58
9/14/22	22.66	23.08	26.43	27.44	6.03	5.48	7.58	7.53	20.1	1.5	21.75	16.89	1.95	1.86	3.46	9:05
9/8/22	23.40	23.16	27.77	28.38	4.57	3.70	7.56	7.50	23.2	1.75	8.82	7.96	1.10	1.38	5.86	11:22
8/31/22	24.46	24.39	28.21	28.16	5.97	5.57	7.71	7.67	22.2	1.3	37.87	43.89	1.56	1.53	3.38	9:53
8/24/22	24.74	23.53	27.46	28.08	7.06	4.05	7.80	7.51	27.0	1.25	29.47	14.21	1.51	1.53	5.28	10:55
8/17/22	23.05	22.75	26.96	27.92	4.42	3.43	7.52	7.44	23.0	1.7	22.69	12.30	1.35	1.37	3.49	9:17
8/10/22	24.80	22.75	26.55	27.60	5.34	2.02	7.50	7.24	27.8	1.5	18.58	13.54	1.75	1.88	5.76	10:17
8/3/22	22.98	22.33	27.23	27.66	4.95	3.55	7.55	7.42	23.8	1.25	52.19	17.56	2.25	2.96	3.25	9:21
7/27/22	23.20	20.33	26.54	27.37	7.46	1.22	7.78	7.28	23.2	1.6	22.68	16.04	1.25	1.28	4.85	9:20
7/21/22	24.47	21.02	25.45	27.13	7.78	3.61	8.04	7.56	28.4	1.0	56.08	13.45	2.41	1.12	4.79	9:20
7/13/22	21.62	20.83	26.35	26.63	9.72	5.55	8.00	7.61	24.9	0.8	165.73	26.46	7.97	1.85	5.28	9:35
7/6/22	20.97	18.46	25.21	26.94	7.34	3.29	7.80	7.38	24.7	1.0	123.05	73.02	3.66	2.81	3.87	9:12
6/29/22	19.95	18.24	25.80	26.35	7.27	8.21	7.82	7.74	21.1	1.25	29.17	66.93	1.69	6.68	4.08	9:20
6/22/22	18.40	16.31	25.26	26.45	8.62	6.20	7.90	7.65	17.9	1.25	47.37	26.66	3.50	4.06	4.53	10:19
6/15/22	18.64	16.11	25.76	26.40	9.15	7.50	7.94	7.71	23.3	1.1	43.54	26.13	2.87	3.72	4.16	9:24
6/8/22	19.01	16.42	24.16	25.69	8.15	6.74	8.07	7.84	23.0	1.25	29.74	22.68	3.07	3.53	4.40	9:27
6/1/22	18.17	14.97	24.98	25.69	9.92	8.22	7.99	7.64	18.2	1.0	66.56	49.89	2.92	4.38	3.98	9:24
5/25/22	16.38	13.97	24.84	25.37	8.66	7.71	7.89	7.80	17.0	2.3	2.37	9.01	1.29	4.75	4.68	10:55
5/18/22	14.63	14.35	24.39	24.51	9.14	9.24	8.09	8.10	15.5	2.0	4.54	5.62	1.20	1.78	3.10	9:45

2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #8–Glen Cove Sewage Treatment Plant Outfall																
10/27/22	16.36	16.23	23.94	27.23	8.04	7.34	7.73	7.79	15.0	1.75	16.87	17.68	0.89	1.62	2.46	9:20
10/19/22	15.05	16.91	17.74	24.51	9.15	7.35	7.69	7.84	11.0	2.0	12.65	12.42	1.33	2.07	2.63	11:17
10/12/22	17.21	17.16	26.98	27.69	8.81	9.22	8.07	8.08	17.7	1.75	22.00	18.68	1.95	2.19	2.51	10:03
10/6/22	Ran out of time for sample.															
9/28/22	19.8	20.1	12.56	26.93	7.86	7.29	7.60	7.80	14.9	1.5	N/A	N/A	N/A	N/A	2.55	9:50
9/21/22	23.50	23.30	24.51	27.62	6.14	6.10	7.64	7.79	20.4	1.25	23.95	31.78	2.17	2.55	3.48	11:19
9/14/22	23.12	23.47	23.33	26.68	5.82	4.55	7.58	7.44	19.6	1.1	15.33	14.65	3.14	3.58	2.03	9:25
9/8/22	23.43	23.22	26.82	28.08	5.55	3.35	7.69	7.48	22.8	1.25	10.21	13.34	2.11	1.77	4.18	10:34
8/31/22	24.91	24.80	27.11	27.48	5.39	4.03	7.69	7.55	24.8	1.1	42.96	32.85	1.86	3.48	2.04	10:20
8/24/22	24.41	24.21	25.93	27.61	6.43	4.80	7.73	7.56	27.1	1.0	42.62	28.21	1.53	2.50	3.76	11:17
8/17/22	23.18	23.10	26.69	27.34	5.15	3.22	7.55	7.44	22.3	1.3	29.29	27.75	1.84	1.57	1.98	9:38
8/10/22	24.73	24.46	25.18	27.15	5.35	3.65	7.48	7.32	28.0	1.0	31.46	23.19	2.62	3.14	4.10	10:38
8/3/22	23.84	23.16	25.25	26.92	6.35	4.10	7.64	7.44	24.8	1.25	22.41	13.01	1.62	6.22	1.81	9:40
7/27/22	23.04	22.86	20.28	26.39	6.40	5.12	7.51	7.49	24.4	1.5	30.80	24.59	2.46	2.51	3.29	9:48
7/21/22	23.91	23.83	24.16	26.17	6.13	5.44	7.63	7.66	30.0	1.0	35.21	12.70	2.95	3.60	2.81	9:44
7/13/22	22.01	21.53	24.79	26.16	7.23	6.65	7.75	7.72	27.6	1.2	57.57	64.19	2.92	3.22	4.00	10:09
7/6/22	21.53	20.25	25.77	26.39	6.27	4.85	7.66	7.51	26.6	0.9	78.05	21.44	4.20	11.32	2.15	9:38
6/29/22	20.32	19.96	24.87	25.66	7.66	7.15	7.76	7.72	24.6	1.0	46.81	34.35	3.58	4.99	2.93	9:48
6/22/22	19.19	18.38	24.26	25.81	8.19	6.51	7.78	7.64	18.3	1.1	44.07	35.20	3.34	10.56	2.65	10:43
6/15/22	19.22	17.77	18.73	25.98	8.97	8.24	7.87	7.80	22.7	1.25	31.02	45.97	4.50	7.32	2.94	9:53
6/8/22	19.45	18.38	21.97	24.98	7.83	6.42	7.90	7.81	24.4	1.25	29.23	20.53	3.16	4.65	2.86	9:46
6/1/22	18.06	17.54	24.80	25.14	8.55	7.32	7.77	7.65	17.6	1.2	55.87	23.33	2.92	11.36	2.52	9:45
5/25/22	16.07	15.73	24.72	24.93	8.43	7.63	7.86	7.78	17.8	1.5	8.21	9.12	1.93	3.87	3.11	11:18
5/18/22	16.31	15.27	21.74	24.22	9.55	8.18	7.99	7.89	17.2	1.25	22.47	10.33	2.99	11.83	2.22	10:13

2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp (°C)	Secchi (m)	Chl-a (ug/L)		Turbidity (NTU)		Depth(m) (Total)***	Time (AM)
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom			Surface	Bottom	Surface	Bottom		
CSHH #13–60' West of Mill Pond Weir																
10/27/22	16.03	16.11	23.45	27.02	8.41	8.17	7.58	7.78	15.9	N/A	24.70	24.70	1.96	1.61	2.01	10:01
10/19/22	14.83	17.35	9.05	23.86	7.00	4.66	7.19	7.38	10.8	1.5Bottom	2.77	6.66	1.89	3.65	1.58	11:35
10/12/22	17.04	17.15	25.33	27.25	8.09	7.68	7.89	7.89	18.4	1.3	30.27	22.92	2.70	2.77	1.54	10:25
10/6/22	Ran out of time for sample.															
9/28/22	16.9	20.0	5.18	26.23	7.80	1.78	7.57	7.32	16.2	1.25	N/A	N/A	N/A	N/A	1.75	10:15
9/21/22	23.53	23.41	26.41	27.64	5.48	5.09	7.49	7.74	22.1	1.25	17.75	28.48	3.69	3.49	3.86	11:41
9/14/22	21.65	23.44	19.76	27.49	5.05	2.77	7.45	7.23	20.4	1.25	16.52	6.99	3.24	2.53	2.83	9:43
9/8/22	23.85	23.70	27.51	28.18	4.64	1.97	7.55	7.38	22.9	N/A	7.06	9.91	1.36	2.50	4.82	11:02
8/31/22	23.93	24.66	21.25	27.54	3.39	2.44	7.42	7.34	26.4	1.1	32.17	25.83	3.60	3.38	3.19	10:53
8/24/22	23.49	23.96	22.62	27.65	5.07	2.26	7.47	7.33	27.8	1.25	35.85	20.54	3.24	2.78	4.48	11:33
8/17/22	22.69	23.02	25.67	27.45	2.16	1.31	7.33	7.27	21.8	1.5	24.01	18.58	2.05	2.43	2.73	9:59
8/10/22	24.71	24.48	25.18	27.01	3.75	2.69	7.31	7.25	29.4	1.0	20.44	18.53	4.18	2.80	4.36	11:00
8/3/22	22.81	22.79	26.46	26.92	3.89	1.69	7.43	7.28	25.9	1.2	11.96	7.02	4.64	6.16	1.64	9:59
7/27/22	22.90	23.08	24.73	26.05	2.28	1.70	7.21	7.16	25.2	1.2	38.88	22.06	2.36	1.96	2.55	10:09
7/21/22	22.88	23.20	23.32	25.57	3.82	2.57	7.41	7.31	30.0	1.1	18.76	12.46	5.80	6.36	1.56	10:06
7/13/22	22.02	21.84	24.92	25.63	6.76	3.91	7.66	7.43	28.9	0.75	77.59	8.56	4.47	4.08	2.87	10:33
7/6/22	20.81	20.73	23.16	25.99	5.80	4.03	7.56	7.42	27.4	N/A	29.27	12.43	5.79	6.35	1.49	9:58
6/29/22	19.83	19.90	23.21	25.29	6.10	4.97	7.56	7.44	25.1	1.2	37.04	22.93	11.43	6.24	2.06	10:14
6/22/22	18.87	18.75	25.92	25.53	6.77	5.71	7.67	7.59	18.5	1.0	44.83	51.29	4.83	5.10	1.41	11:08
6/15/22	19.14	18.45	24.60	25.60	10.40	9.64	8.07	7.85	25.1	1.25	72.80	68.09	4.13	4.50	2.02	10:13
6/8/22	19.72	18.97	23.17	24.68	10.67	8.32	8.13	7.79	25.3	1.1	9.80	31.85	6.24	8.70	1.66	10:11
6/1/22	18.32	17.92	24.25	24.84	8.23	7.46	7.70	7.60	19.8	0.75	118.62	24.78	5.24	5.03	1.90	10:06
5/25/22	17.28	16.09	23.37	24.76	7.72	6.22	7.72	7.58	20.4	1.3	12.60	11.19	2.78	4.50	1.87	11:35
5/18/22	16.20	15.58	21.28	23.81	9.86	7.60	8.07	7.76	17.7	1.25	29.08	11.33	3.24	5.49	1.45	10:40

2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #14–NW Corner of Former Power Plant, Approximately 50 yds from Powerhouse Drain																
10/19/22	14.97	16.04	23.66	24.31	8.08	7.88	7.81	7.81	9.1	2.0Bottom	15.72	22.19	1.45	1.47	2.02	9:00
9/21/22	22.93	22.94	27.20	27.20	7.42	7.38	7.85	7.86	19.9	1.1	52.24	54.78	1.86	2.14	2.36	8:31
9/8/22	23.04	23.25	27.51	27.52	3.59	3.21	7.40	7.37	19.9	1.25	25.40	21.81	1.98	2.02	4.19	8:01
8/24/22	23.58	23.50	27.34	27.31	3.98	3.53	7.41	7.37	24.0	1.3	26.62	26.92	1.79	1.91	2.01	8:22
8/10/22	23.99	23.98	26.81	26.86	2.98	2.14	7.22	7.17	25.6	1.25	28.52	29.45	2.90	3.18	2.07	8:19
6/22/22	18.36	18.33	25.23	25.45	7.37	7.24	7.68	7.70	18.0	0.85	91.74	81.16	5.20	5.34	2.21	8:38
5/25/22	16.21	15.32	24.17	24.62	7.57	7.38	7.68	7.71	16.3	1.25	15.95	31.99	3.20	4.20	2.58	9:12
CSHH #15–50 yds from Scudder's Pond Outfall, North of Tappen Pool																
10/19/22	15.08	15.30	24.53	24.64	9.31	9.53	8.05	8.05	9.4	2.2Bottom	16.11	24.84	1.19	1.08	2.03	9:40
9/21/22	22.78	23.02	26.95	27.42	8.44	7.89	8.02	7.92	21.4	1.0	48.96	62.02	1.89	2.38	3.05	9:37
9/8/22	Ran out of time for survey.															
8/24/22	24.32	24.10	27.35	27.54	6.34	5.05	7.63	7.53	25.2	1.2	32.29	31.05	2.04	1.83	2.86	9:40
8/10/22	24.50	24.46	26.19	26.95	4.82	3.89	7.35	7.30	25.8	1.3	22.07	30.56	2.40	2.63	2.79	9:15
6/22/22	18.04	16.95	25.82	26.28	7.59	6.10	7.74	7.58	18.1	1.0	53.68	48.22	3.61	4.99	2.78	9:08
5/25/22	Ran out of time for survey.															

2022 CSHH Field-Monitoring Data

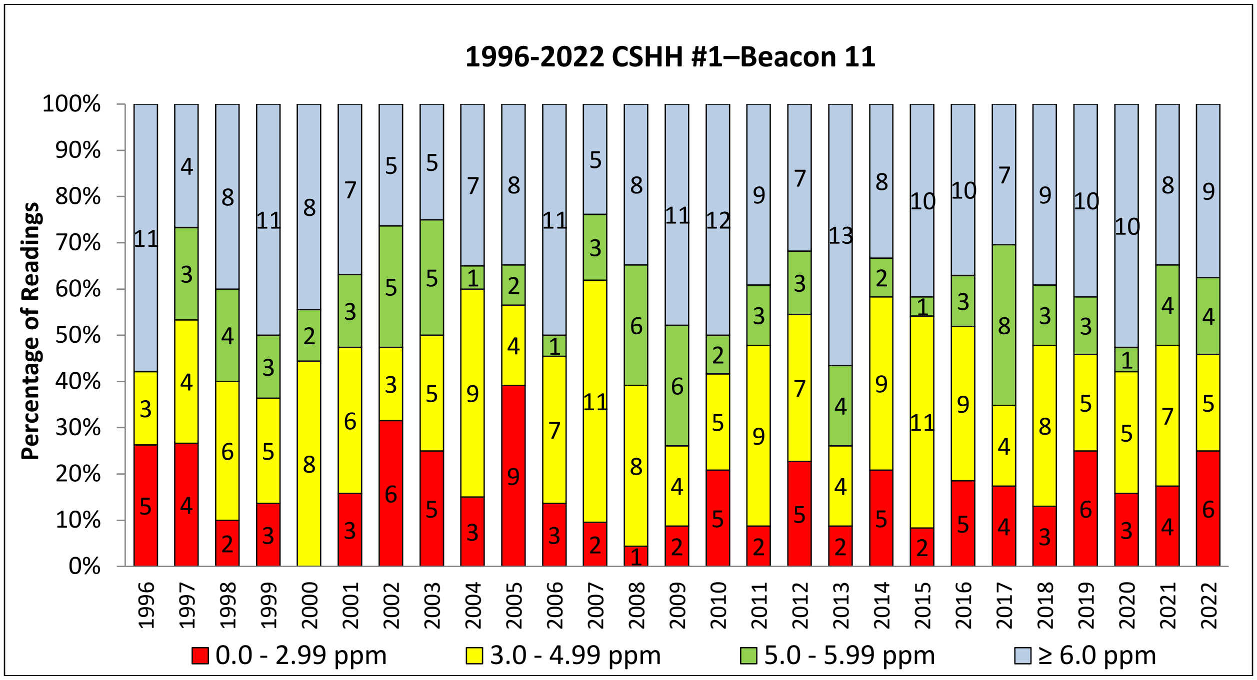
Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #4–Bar Beach Spit																
10/19/22	16.18	16.19	24.56	24.55	7.96	7.87	7.86	7.85	9.3	1.75Bottom	13.10	21.17	1.28	1.27	1.94	9:09
9/21/22	23.06	23.15	27.24	27.26	7.61	7.08	7.93	7.84	19.6	1.0	61.87	68.16	2.01	2.39	2.75	8:27
9/8/22	23.06	23.88	27.41	27.47	3.77	3.30	7.42	7.38	20.3	1.25	26.00	27.02	2.09	3.15	1.54	8:12
8/24/22	23.44	23.35	27.62	27.77	4.23	2.47	7.42	7.32	24.5	1.6	19.69	17.12	1.70	1.66	2.42	8:11
8/10/22	24.10	24.07	26.62	26.73	4.18	2.78	7.29	7.22	25.6	1.3	43.86	40.09	3.49	2.86	1.93	8:10
6/22/22	17.87	16.94	25.78	26.19	7.12	6.01	7.69	7.60	17.6	1.0	66.36	39.54	5.71	5.81	2.50	8:44
5/25/22	15.97	15.17	24.46	24.76	8.31	7.82	7.76	7.75	16.0	1.25	31.98	31.39	4.25	3.08	2.15	9:22
CSHH #5–Mott's Cove																
10/19/22	15.98	16.09	24.18	24.38	8.02	7.90	7.81	7.83	8.4	1.77Bottom	24.38	26.21	1.68	2.46	1.76	8:46
9/21/22	22.96	23.07	26.74	27.08	6.71	6.62	7.72	7.78	20.4	1.0	50.49	55.23	2.63	2.93	2.09	8:53
9/8/22	22.96	23.13	27.01	27.41	3.47	2.97	7.38	7.34	20.5	1.25	22.92	21.06	2.32	2.29	2.19	8:28
8/24/22	23.33	23.39	26.97	27.33	4.24	2.88	7.44	7.33	24.6	1.3	27.73	22.18	2.80	1.74	1.72	8:35
8/10/22	24.19	24.22	26.11	26.26	3.95	2.95	7.27	7.20	26.6	1.0	57.75	59.26	3.32	3.25	1.73	8:28
6/22/22	18.15	17.41	25.08	25.75	7.04	6.62	7.64	7.59	17.8	N/A	77.94	25.74	5.22	6.28	1.99	8:21
5/25/22	15.26	14.52	24.24	24.65	7.20	6.83	7.62	7.62	16.4	1.25	8.11	14.26	4.05	4.39	2.07	9:00

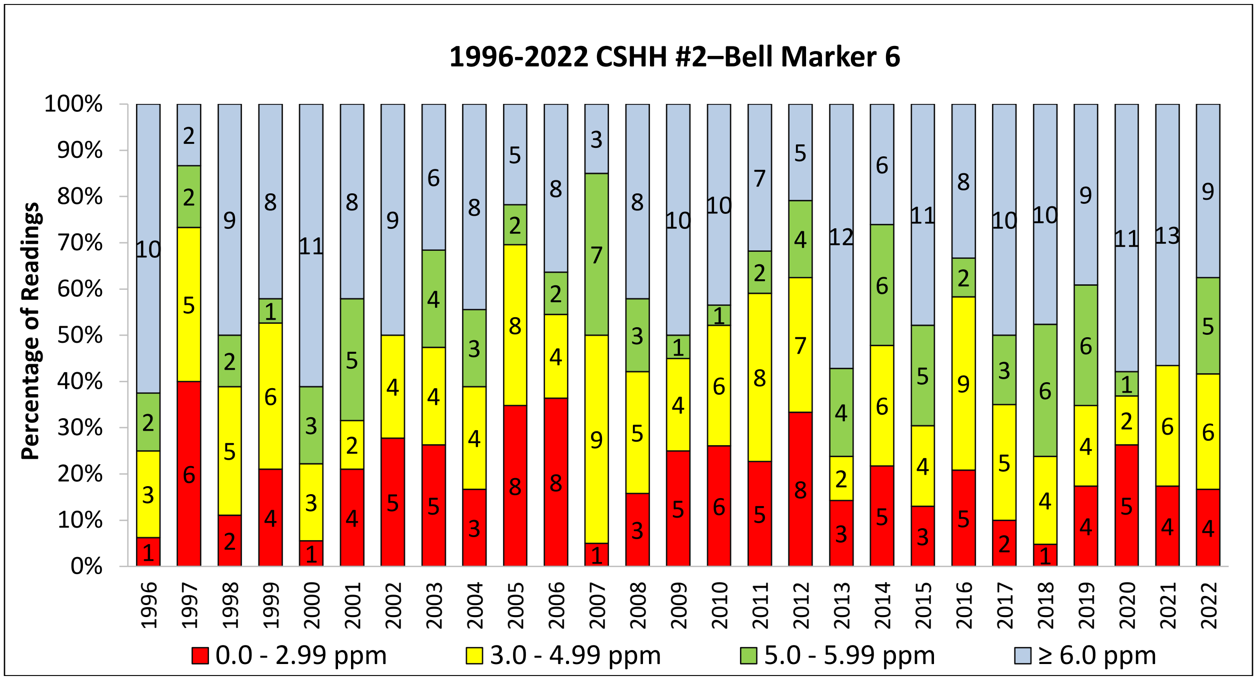
2022 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH		Air Temp	Secchi	Chl-a (ug/L)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #6–East of Former Incinerator Site																
10/19/22	15.30	15.94	23.81	24.23	7.26	7.21	7.68	7.76	7.3	1.25	25.63	32.71	3.46	3.75	2.16	8:28
9/21/22	22.97	23.10	26.60	26.93	6.71	6.43	7.72	7.71	20.7	1.0	43.18	45.29	4.19	7.03	2.27	9:06
9/8/22	23.02	23.08	26.53	27.25	2.81	2.93	7.34	7.34	21.2	1.25	24.42	24.41	3.43	4.28	2.90	8:44
8/24/22	23.74	23.74	26.62	27.23	5.02	3.03	7.45	7.33	24.6	1.25	36.78	28.85	2.26	2.76	2.07	8:52
8/10/22	24.39	24.39	26.24	26.30	4.15	2.86	7.32	7.21	24.9	1.2	42.71	36.57	2.85	2.72	2.09	8:38
6/22/22	18.82	18.02	24.98	25.76	7.34	6.95	7.65	7.65	17.9	0.75	67.94	53.42	7.65	8.45	2.35	8:09
5/25/22	17.12	15.13	24.08	24.65	6.81	6.38	7.59	7.60	17.4	0.75	27.68	13.27	8.62	10.77	2.46	8:45
CSHH #7–West of Bryant Landing (Formerly Site of Oil Dock)																
10/19/22	16.24	16.41	23.81	24.07	7.52	7.89	7.52	7.53	7.2	0.8	14.44	18.79	7.95	8.36	1.46	8:09
10/19/22	16.07	16.40	23.43	24.01	7.04	6.45	7.48	7.53	N/A	N/A	16.73	18.08	6.97	10.29	1.49	N/A
9/21/22	23.36	23.43	26.40	26.49	5.54	4.61	7.50	7.37	20.0	1.0	42.22	21.37	4.79	6.32	1.67	9:16
9/8/22	22.89	22.92	25.64	26.58	2.79	2.07	7.34	7.29	20.5	N/A	23.48	25.51	4.65	3.58	1.94	9:02
8/24/22	23.72	23.73	26.27	26.32	2.97	2.85	7.29	7.27	25.1	1.5	42.80	37.90	3.97	3.28	1.59	9:09
8/10/22	24.57	24.74	25.47	25.99	2.86	1.61	7.21	7.10	26.1	1.2	21.44	21.35	5.08	4.22	1.54	8:51
6/22/22	19.52	19.46	24.92	25.12	7.16	6.77	6.94	7.33	18.1	0.6	38.65	46.26	7.62	11.26	1.65	7:49
6/22/22	19.48	19.45	25.02	25.14	6.74	6.65	7.49	7.56	N/A	N/A	47.95	49.08	11.47	9.53	1.71	N/A
5/25/22	16.97	17.10	23.74	23.90	6.99	5.76	7.56	7.48	17.0	0.75	10.21	8.31	10.46	16.54	1.67	8:32

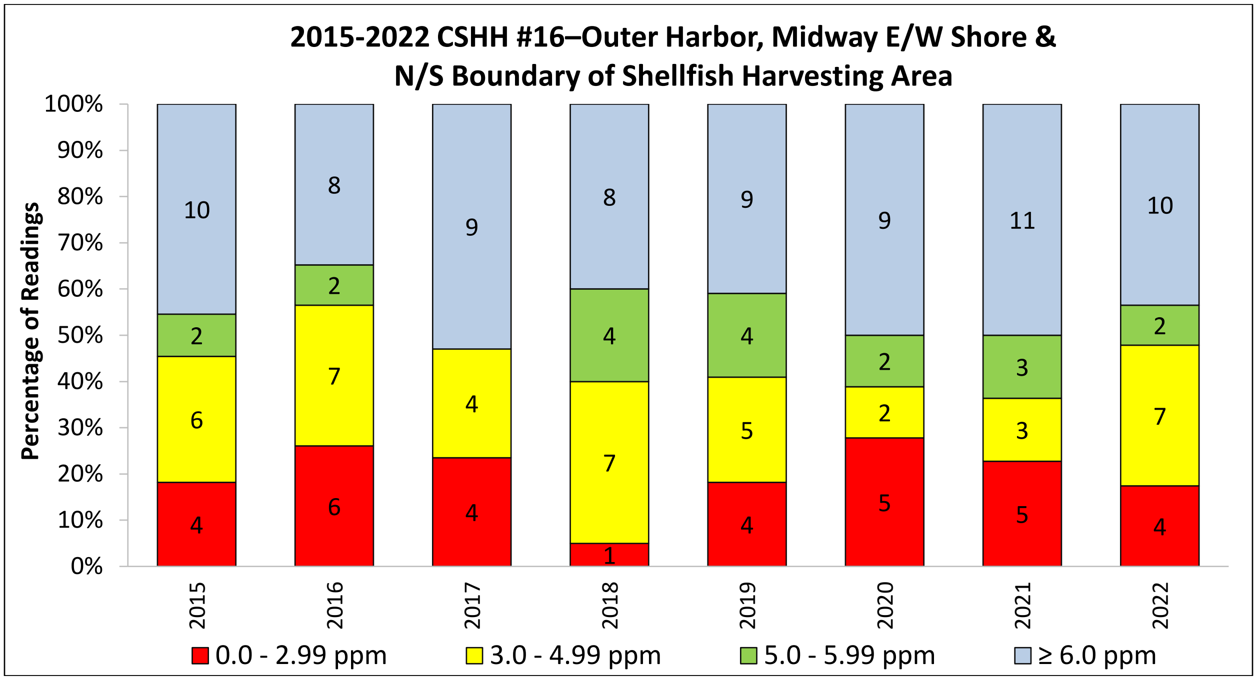
Long-Term Dissolved Oxygen Graphs

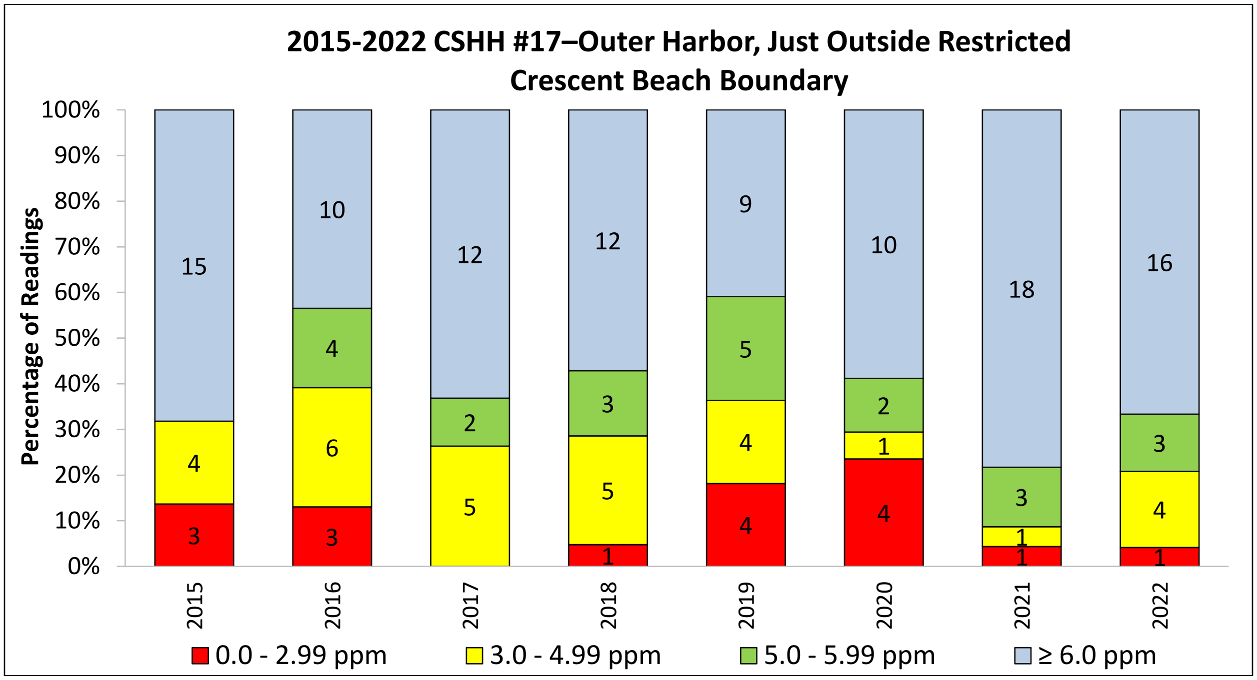
Each graph displays results from one of CSHH's monitoring sites. Each vertical bar represents the bottom readings taken during the indicated year and is divided into four categories. Red bars are representative of hypoxic conditions (DO below 3 ppm), yellow bars of DO between 3 and 5 ppm, green bars of 5 to 6 ppm, and blue of greater than 6 ppm. The number of readings falling into each category is indicated within the bars, and the percentage of readings is on the y-axis.



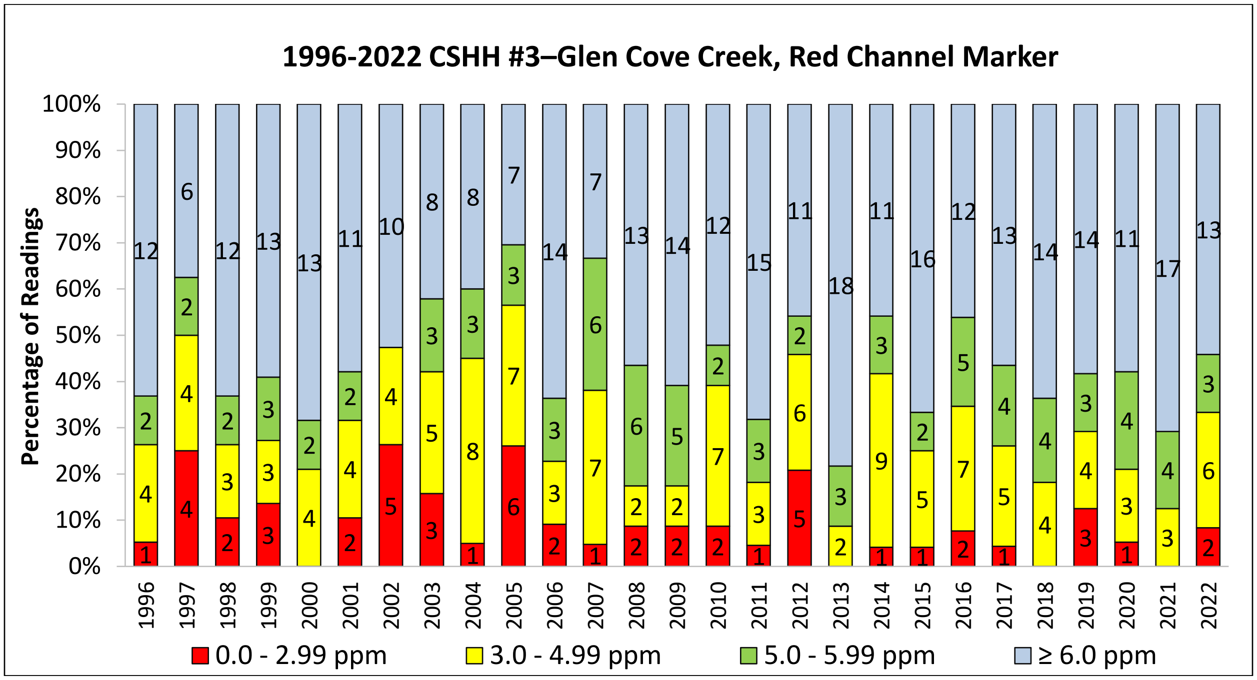


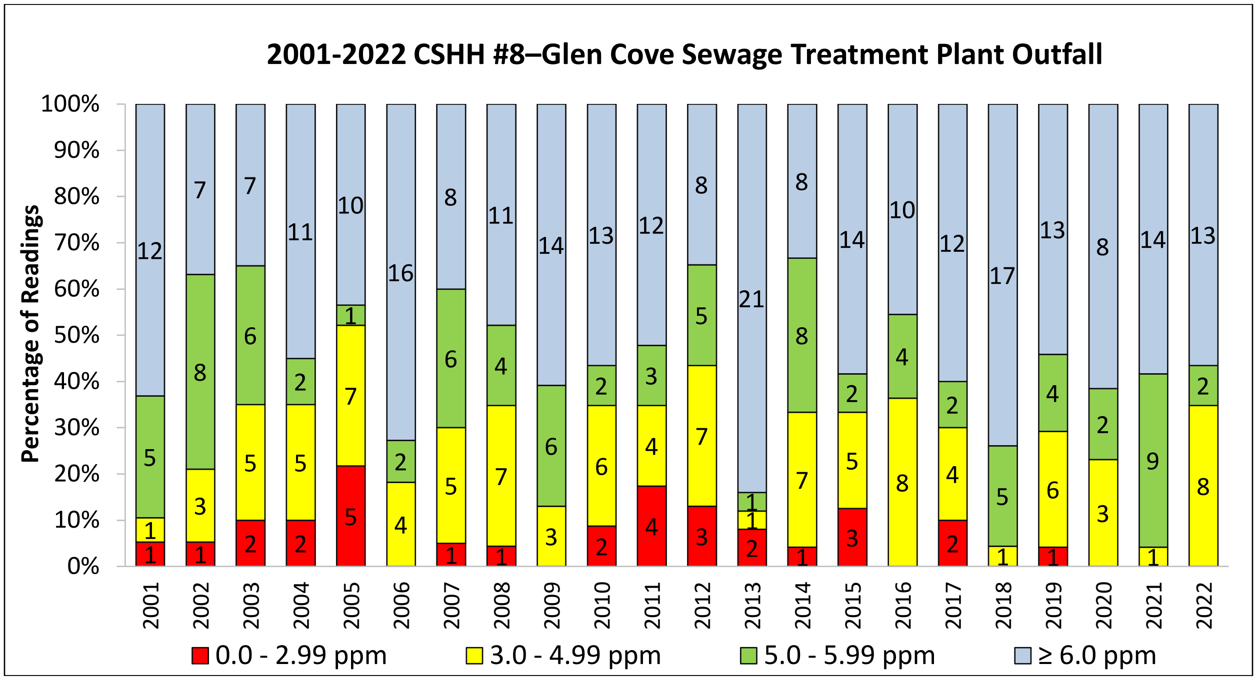
Long-Term Dissolved Oxygen Graphs



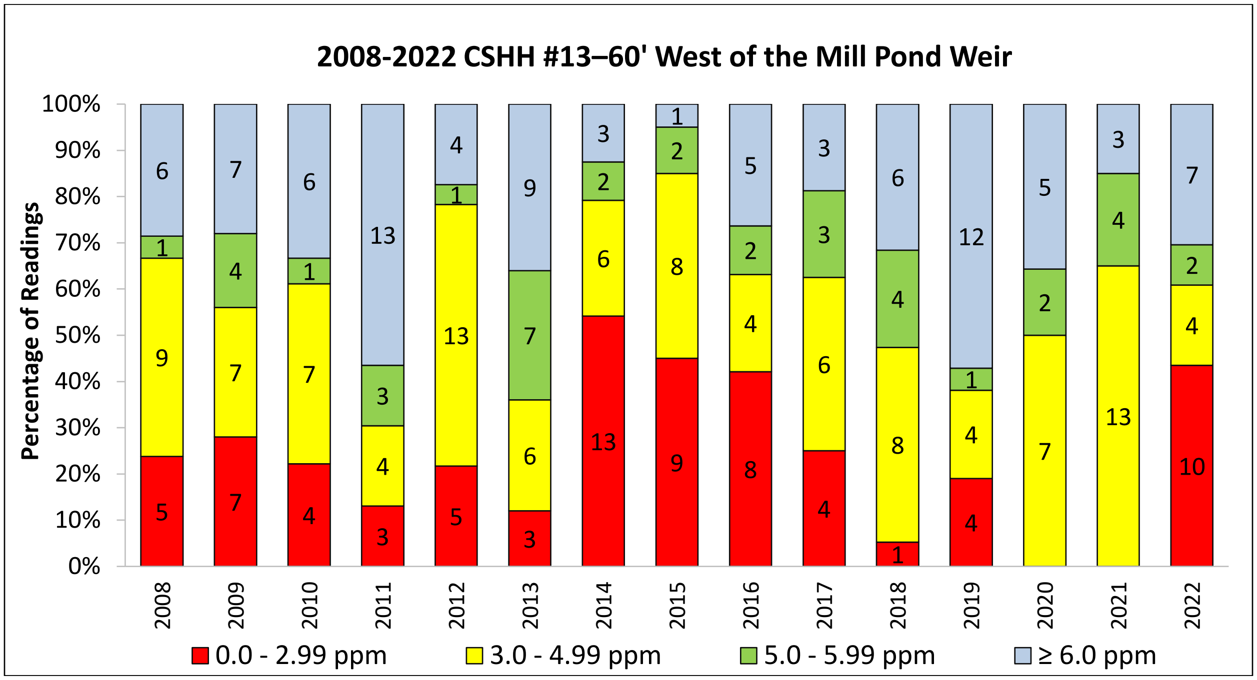


Long-Term Dissolved Oxygen Graphs





Long-Term Dissolved Oxygen Graphs



Appendix B

2022 In-Harbor Bacteria Data

CSHH #1–Beacon 11

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	33.00	0.00	0.10	0.00
5/25/22	5.00	12.85	0.10	0.10
6/1/22	29.00	16.85	4.00	0.34
6/8/22	12.00	15.48	0.10	0.25
6/15/22	73.00	21.11	3.00	0.41
6/22/22	15.00	18.03	1.00	0.65
6/29/22	80.00	31.39	2.00	1.19
7/6/22	32.00	32.02	0.10	0.57
7/13/22	127.00	51.32	27.00	1.75
7/21/22	14.00	36.89	1.00	1.40
7/27/22	31.00	42.65	14.00	2.38
8/3/22	30.00	35.05	19.00	3.73
8/10/22	520.00	61.22	***300.00***	18.48
8/17/22	20.00	42.30	21.00	17.57
8/24/22	13.00	41.68	13.00	29.35
8/31/22	47.00	45.29	51.00	***38.01***
9/8/22	136.00	61.28	25.00	***40.16***
9/14/22	220.00	51.59	***110.00***	32.86
9/21/22	8.00	42.96	1.00	17.87
9/28/22	58.00	57.93	***130.00***	28.32
10/6/22	109.00	68.55	50.00	28.21
10/12/22	14.00	43.50	70.00	34.66
10/19/22	4.00	19.52	2.00	15.55
10/27/22	109.00	32.91	70.00	***36.38***

Note that CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log Avg (log average) refers to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS beach-closure standards, 1,000 CFU/100 ml (200 Log Avg) for the formerly used fecal coliform standard and 104 CFU/100 ml (35 Log Avg) for the currently used enterococci standard.

2022 In-Harbor Bacteria Data

CSHH #2–Bell Marker 6

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	1.00	0.00	0.10	0.00
5/25/22	0.10	0.32	0.10	0.10
6/1/22	1.00	0.46	0.10	0.10
6/8/22	1.00	0.56	0.10	0.10
6/15/22	6.00	0.90	0.10	0.10
6/22/22	3.00	1.12	0.10	0.10
6/29/22	50.00	3.90	0.10	0.10
7/6/22	10.00	6.18	0.10	0.10
7/13/22	10.00	9.79	0.10	0.10
7/21/22	2.00	7.86	0.10	0.10
7/27/22	5.00	8.71	0.10	0.10
8/3/22	1.00	3.98	0.10	0.10
8/10/22	5.00	3.47	2.00	0.18
8/17/22	3.00	2.72	0.10	0.18
8/24/22	2.00	2.72	0.10	0.18
8/31/22	9.00	3.06	0.10	0.18
9/8/22	3.00	3.82	0.10	0.18
9/14/22	27.00	5.35	6.00	0.23
9/21/22	0.10	2.71	0.10	0.23
9/28/22	5.00	3.25	0.10	0.23
10/6/22	6.00	3.00	3.00	0.45
10/12/22	2.00	2.77	0.10	0.45
10/19/22	4.00	1.89	0.10	0.20
10/27/22	4.00	3.95	3.00	0.39

2022 In-Harbor Bacteria Data

CSHH #3–Glen Cove Creek, Red Channel Marker

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	14.00	0.00	0.10	0.00
5/25/22	0.10	1.18	0.10	0.10
6/1/22	220.00	6.75	5.00	0.37
6/8/22	51.00	11.20	1.00	0.47
6/15/22	9.00	10.72	0.10	0.35
6/22/22	182.00	17.90	2.00	0.63
6/29/22	24.00	53.57	0.10	0.63
7/6/22	31.00	36.20	0.10	0.29
7/13/22	15.00	28.34	6.00	0.41
7/21/22	21.00	33.57	2.00	0.75
7/27/22	10.00	18.79	0.10	0.41
8/3/22	13.00	16.62	0.10	0.41
8/10/22	1000.00	33.30	41.00	1.38
8/17/22	5.00	26.73	1.00	0.96
8/24/22	20.00	26.47	0.10	0.53
8/31/22	2.00	19.19	0.10	0.53
9/8/22	33.00	23.12	1.00	0.84
9/14/22	520.00	20.28	***140.00***	1.07
9/21/22	5.00	20.28	0.10	0.67
9/28/22	11.00	18.00	1.00	1.07
10/6/22	38.00	32.43	33.00	3.41
10/12/22	4.00	21.26	2.00	3.92
10/19/22	5.00	8.40	1.00	1.46
10/27/22	14.00	10.32	4.00	3.05

2022 In-Harbor Bacteria Data

CSHH #4–Bar Beach Spit

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/25/22	10	0	0.1	0
6/22/22	28.00	16.73	2.00	0.45
8/10/22	570.00	0.00	***460.00***	0.00
8/24/22	16.00	95.50	5.00	***47.96***
9/8/22	118.00	102.48	35.00	***43.18***
9/21/22	13.00	29.06	30.00	17.38
10/19/22	6.00	8.83	5.00	12.25

CSHH #5–Mott's Cove

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/25/22	17.00	0.00	0.10	0.00
6/22/22	31.00	22.96	0.10	0.10
8/10/22	430.00	0.00	***260.00***	0.00
8/24/22	44.00	137.55	40.00	***101.98***
9/8/22	210.00	158.38	50.00	***80.41***
9/21/22	57.00	80.76	***620.00***	***107.43***
10/19/22	6.00	18.49	***110.00***	***261.15***

2022 In-Harbor Bacteria Data

CSHH #6–East of Former Incinerator Site

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/25/22	10.00	0.00	0.10	0.00
6/22/22	23.00	15.17	0.10	0.10
8/10/22	800.00	0.00	***370.00***	0.00
8/24/22	26.00	144.22	28.00	***101.78***
9/8/22	330.00	190.05	***210.00***	***129.58***
9/21/22	43.00	71.72	55.00	***68.64***
10/19/22	30.00	35.92	44.00	***49.19***

CSHH #7–West of Bryant Landing (Formerly Site of Oil Dock)

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/25/22	20.00	0.00	0.10	0.00
6/22/22	37.00	27.20	0.10	0.10
8/10/22	520.00	0.00	***350.00***	0.00
8/24/22	100.00	***228.04***	60.00	***144.91***
9/8/22	700.00	***331.41***	***200.00***	***161.34***
9/21/22	118.00	***202.14***	***140.00***	***118.88***
10/19/22	18.00	46.09	33.00	***67.97***

2022 In-Harbor Bacteria Data

CSHH #8–Glen Cove Sewage Treatment Plant Outfall

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	29.00	0.00	0.10	0.00
5/25/22	9.00	16.16	0.10	0.10
6/1/22	59.00	24.88	6.00	0.39
6/8/22	29.00	25.85	1.00	0.49
6/15/22	32.00	26.98	3.00	0.71
6/22/22	36.00	28.17	0.10	0.71
6/29/22	110.00	46.47	2.00	1.29
7/6/22	127.00	54.18	0.10	0.57
7/13/22	73.00	65.16	50.00	1.25
7/21/22	136.00	87.03	***110.00***	2.56
7/27/22	64.00	97.64	23.00	7.60
8/3/22	48.00	82.72	19.00	11.92
8/10/22	700.00	116.38	***190.00***	***53.94***
8/17/22	30.00	97.42	22.00	***45.77***
8/24/22	30.00	72.00	8.00	27.10
8/31/22	590.00	112.28	25.00	27.55
9/8/22	35.00	105.40	48.00	33.17
9/14/22	35.00	57.90	60.00	26.34
9/21/22	23.00	54.90	27.00	27.44
9/28/22	82.00	67.13	32.00	***36.21***
10/6/22	55.00	41.76	43.00	***40.35***
10/12/22	14.00	34.77	14.00	31.54
10/19/22	127.00	45.00	23.00	26.04
10/27/22	48.00	52.13	29.00	26.41

2022 In-Harbor Bacteria Data

CSHH #9–First Pipe West of Sewage Treatment Plant Outfall

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	100.00	0.00	0.10	0.00
5/25/22	24.00	48.99	0.10	0.10
6/1/22	370.00	96.12	15.00	0.53
6/8/22	***6001.00***	***270.18***	***1100.00***	3.58
6/15/22	52.00	194.32	0.10	1.75
6/22/22	***1500.00***	***334.00***	31.00	5.52
6/29/22	120.00	***460.83***	0.10	5.52
7/6/22	220.00	***415.32***	16.00	5.59
7/13/22	270.00	***223.36***	56.00	3.08
7/21/22	***1600.00***	***443.24***	***3000.00***	24.22
7/27/22	44.00	***218.83***	17.00	21.48
8/3/22	47.00	181.42	28.00	***66.28***
8/10/22	***1200.00***	***254.71***	***340.00***	***122.15***
8/17/22	22.00	154.26	24.00	***103.11***
8/24/22	82.00	85.15	12.00	34.17
8/31/22	200.00	115.27	***490.00***	***66.93***
9/8/22	50.00	116.70	13.00	***57.41***
9/14/22	***2900.00***	139.23	***4100.00***	***94.46***
9/21/22	45.00	160.65	29.00	***98.11***
9/28/22	118.00	172.78	90.00	***146.80***
10/6/22	118.00	155.48	100.00	***106.83***
10/12/22	26.00	136.42	14.00	***108.42***
10/19/22	270.00	84.85	***210.00***	***59.84***
10/27/22	182.00	112.21	90.00	***75.05***

2022 In-Harbor Bacteria Data

CSHH #10–Pipe at Corner of Seawall, West of STP Outfall

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	88.00	0.00	1.00	0.00
5/25/22	14.00	35.10	0.10	0.32
6/1/22	380.00	77.65	6.00	0.84
6/8/22	530.00	125.51	16.00	1.76
6/15/22	53.00	105.63	1.00	1.57
6/22/22	***5100.00***	***237.91***	28.00	3.06
6/29/22	170.00	***391.99***	0.10	3.06
7/6/22	590.00	***428.04***	43.00	4.54
7/13/22	250.00	***368.31***	60.00	5.91
7/21/22	350.00	***537.25***	***360.00***	19.19
7/27/22	64.00	***223.82***	41.00	20.71
8/3/22	41.00	168.41	44.00	***69.96***
8/10/22	***1100.00***	190.75	***230.00***	***97.83***
8/17/22	31.00	125.65	40.00	***90.21***
8/24/22	109.00	99.50	13.00	***46.43***
8/31/22	***1200.00***	178.83	26.00	***42.39***
9/8/22	41.00	178.83	23.00	***37.23***
9/14/22	155.00	120.84	100.00	31.52
9/21/22	38.00	125.86	9.00	23.39
9/28/22	310.00	155.13	70.00	32.75
10/6/22	200.00	108.41	***320.00***	***54.11***
10/12/22	23.00	96.57	10.00	***45.80***
10/19/22	73.00	83.07	23.00	34.14
10/27/22	173.00	112.49	***120.00***	***57.31***

2022 In-Harbor Bacteria Data

CSHH #11–50 yds East of STP Outfall

	Fecal Coliform		**Enterococci**	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	128.00	0.00	0.10	0.00
5/25/22	15.00	43.82	0.10	0.10
6/1/22	630.00	106.55	34.00	0.70
6/8/22	***2000.00***	***221.78***	22.00	1.65
6/15/22	800.00	***286.65***	0.10	0.94
6/22/22	***5100.00***	***599.00***	28.00	2.91
6/29/22	1.00	***348.50***	1.00	4.62
7/6/22	700.00	***355.92***	10.00	3.61
7/13/22	655.00	***284.71***	***220.00***	5.73
7/21/22	310.00	***235.53***	***180.00***	25.64
7/27/22	64.00	98.12	19.00	23.73
8/3/22	155.00	***269.06***	60.0	***53.82***
8/10/22	***1300.00***	***304.52***	***340.00***	***108.95***
8/17/22	48.00	180.56	36.00	***75.86***
8/24/22	100.00	143.99	26.00	***51.51***
8/31/22	***2800.00***	***306.57***	43.00	***60.66***
9/8/22	173.00	***313.38***	39.00	***55.65***
9/14/22	***2700.00***	***362.71***	***3300.00***	***87.67***
9/21/22	200.00	***482.52***	19.00	***77.15***
9/28/22	230.00	***569.99***	70.00	***94.05***
10/6/22	430.00	***391.86***	***410.00***	***147.65***
10/12/22	26.00	***268.23***	14.00	***120.30***
10/19/22	191.00	157.92	22.00	***44.16***
10/27/22	390.00	180.49	***140.00***	***65.84***

2022 In-Harbor Bacteria Data

CSHH #12–East of STP Outfall, by Bend in Seawall

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	172.00	0.00	1.00	0.00
5/25/22	30.00	71.83	0.10	0.32
6/1/22	***1300.00***	188.60	70.00	1.91
6/8/22	***1500.00***	***316.72***	6.00	2.55
6/15/22	100.00	***251.50***	0.10	1.33
6/22/22	***1300.00***	***376.89***	5.00	1.84
6/29/22	350.00	***616.04***	4.00	3.84
7/6/22	240.00	***439.40***	1.00	1.64
7/13/22	100.00	***255.65***	43.00	2.44
7/21/22	310.00	***320.57***	***210.00***	11.25
7/27/22	200.00	***220.46***	80.00	19.60
8/3/22	136.00	182.49	55.00	33.10
8/10/22	***1600.00***	***266.69***	***410.00***	***110.25***
8/17/22	36.00	***217.41***	30.00	***102.59***
8/24/22	260.00	***209.89***	25.00	***67.03***
8/31/22	***1800.00***	***325.72***	50.00	***61.01***
9/8/22	73.00	***287.61***	30.00	***54.05***
9/14/22	***3000.00***	***326.14***	***4500.00***	***87.27***
9/21/22	210.00	***464.07***	9.00	***68.60***
9/28/22	330.00	***486.73***	80.00	***86.56***
10/6/22	330.00	***346.69***	***480.00***	***136.08***
10/12/22	45.00	***314.71***	15.00	***118.46***
10/19/22	109.00	162.17	14.00	***37.34***
10/27/22	290.00	172.99	***160.00***	***66.39***

2022 In-Harbor Bacteria Data

CSHH #13–60' West of Mill Pond Weir

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	151.00	0.00	7.00	0.00
5/25/22	80.00	109.91	2.00	3.74
6/1/22	900.00	***221.53***	70.00	9.93
6/8/22	***1200.00***	***337.97***	53.00	15.10
6/15/22	164.00	***292.46***	12.00	14.42
6/22/22	800.00	***408.22***	16.00	17.01
6/29/22	880.00	***659.43***	25.00	28.19
7/6/22	390.00	***557.87***	1.00	12.05
7/13/22	173.00	***378.71***	***120.00***	14.19
7/21/22	800.00	***519.94***	***1500.00***	***37.28***
7/27/22	240.00	***408.68***	***210.00***	***62.39***
8/3/22	250.00	***317.74***	***130.00***	***86.75***
8/10/22	***1100.00***	***390.96***	***510.00***	***301.86***
8/17/22	40.00	***291.70***	47.00	***250.26***
8/24/22	136.00	***204.66***	51.00	***127.26***
8/31/22	155.00	187.52	53.00	***96.63***
9/8/22	191.00	177.69	55.00	***81.35***
9/14/22	***2800.00***	***214.20***	***4900.00***	***127.91***
9/21/22	50.00	***223.98***	14.00	***100.39***
9/28/22	490.00	***289.43***	***450.00***	***155.18***
10/6/22	200.00	***304.56***	***310.00***	***220.93***
10/12/22	60.00	***241.60***	50.00	***216.76***
10/19/22	290.00	153.51	70.00	***92.67***
10/27/22	300.00	***219.67***	***330.00***	***174.35***

2022 In-Harbor Bacteria Data

CSHH #14–NW Corner of Former Power Plant, Approximately 50 yds from Powerhouse Drain

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/25/22	10.00	0.00	0.10	0.00
6/22/22	32.00	17.89	3.00	0.55
8/10/22	330.00	0.00	***320.00***	0.00
8/24/22	18.00	77.07	46.00	***121.33***
9/8/22	118.00	88.83	51.00	***90.89***
9/21/22	21.00	35.46	36.00	***43.87***
10/19/22	24.00	22.45	24.00	29.39

CSHH #15–50 yds from Scudder's Pond Outfall, North of Tappen Beach Pool

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
6/22/22	14.00	0.00	0.10	0.00
8/10/22	440.00	0.00	90.00	0.00
8/24/22	9.00	62.93	1.00	9.49
9/21/22	20.00	13.42	7.00	2.65
10/19/22	41.00	28.64	57.00	19.97

2022 In-Harbor Bacteria Data

CSHH #16–Outer Harbor, Midway Between E/W Shore and N/S Boundary of Shellfish Harvesting Area

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	0.10	0.00	0.10	0.00
5/25/22	0.10	0.10	0.10	0.10
6/1/22	5.00	0.37	0.10	0.10
6/8/22	0.10	0.27	0.10	0.10
6/15/22	1.00	0.35	0.10	0.10
6/22/22	1.00	0.55	0.10	0.10
6/29/22	11.00	1.41	0.10	0.10
7/6/22	1.00	1.02	0.10	0.10
7/13/22	2.00	1.86	0.10	0.10
7/21/22	1.00	1.86	0.10	0.10
7/27/22	1.00	1.86	0.10	0.10
8/3/22	0.10	0.72	0.10	0.10
8/10/22	0.10	0.46	0.10	0.10
8/17/22	0.10	0.25	0.10	0.10
8/24/22	0.10	0.16	0.10	0.10
8/31/22	0.10	0.10	0.10	0.10
9/8/22	2.00	0.18	0.10	0.10
9/14/22	17.00	0.51	1.00	0.16
9/21/22	5.00	1.11	0.10	0.16
9/28/22	0.10	1.11	0.10	0.16
10/12/22	4.00	2.41	0.10	0.18
10/19/22	1.00	1.19	0.10	0.10
10/27/22	5.00	1.19	8.00	0.30

2022 In-Harbor Bacteria Data

CSHH #17–Outer Harbor, Outside Restricted Crescent Beach Boundary

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	2.00	0.00	0.10	0.00
5/25/22	0.10	0.45	0.10	0.10
6/1/22	18.00	1.53	0.10	0.10
6/8/22	1.00	1.38	0.10	0.10
6/15/22	7.00	1.91	1.00	0.16
6/22/22	0.10	1.05	0.10	0.16
6/29/22	1.00	1.66	1.00	0.25
7/6/22	0.10	0.59	0.10	0.25
7/13/22	3.00	0.73	0.10	0.25
7/21/22	1.00	0.50	0.10	0.16
7/27/22	0.10	0.50	0.10	0.16
8/3/22	7.00	0.73	1.00	0.16
8/10/22	2.00	1.33	1.00	0.25
8/17/22	1.00	1.07	2.00	0.46
8/24/22	0.10	0.67	0.10	0.46
8/31/22	5.00	1.48	0.10	0.46
9/8/22	10.00	1.58	0.10	0.29
9/14/22	5.00	1.90	0.10	0.18
9/21/22	1.00	1.90	0.10	0.10
9/28/22	0.10	1.90	0.10	0.10
10/6/22	1.00	1.38	2.00	0.18
10/12/22	1.00	0.87	0.10	0.18
10/19/22	3.00	0.79	2.00	0.33
10/27/22	5.00	1.08	5.00	0.72

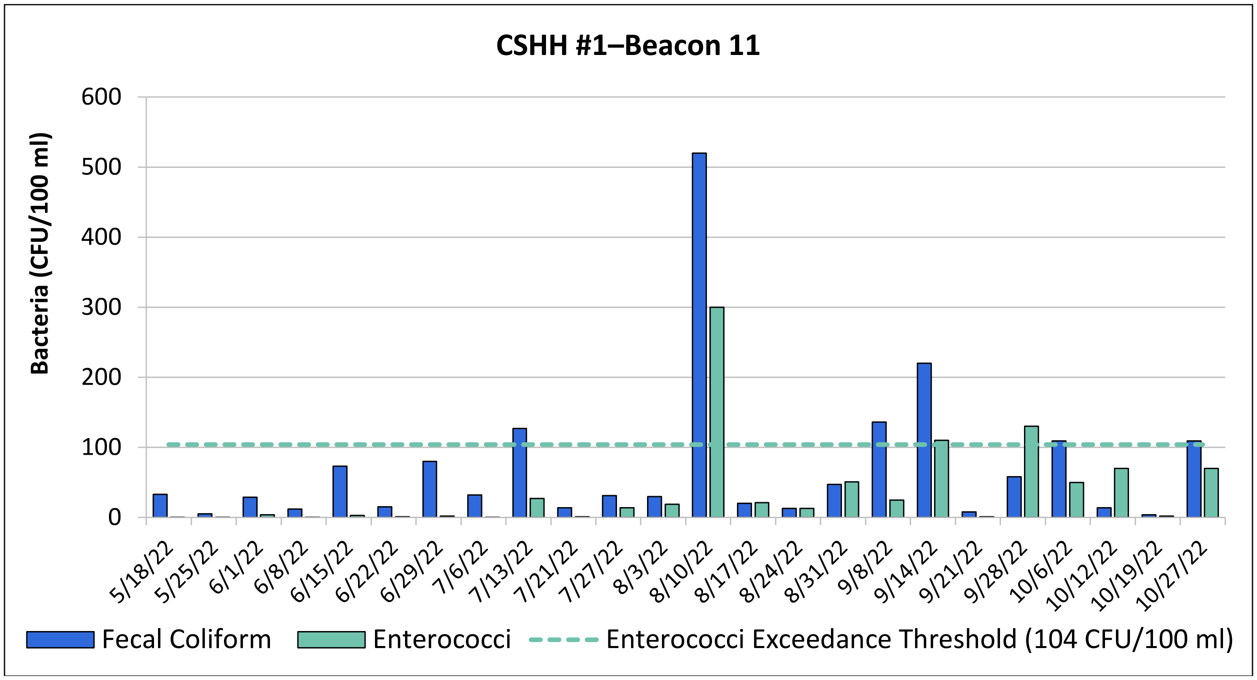
2022 In-Harbor Bacteria Data

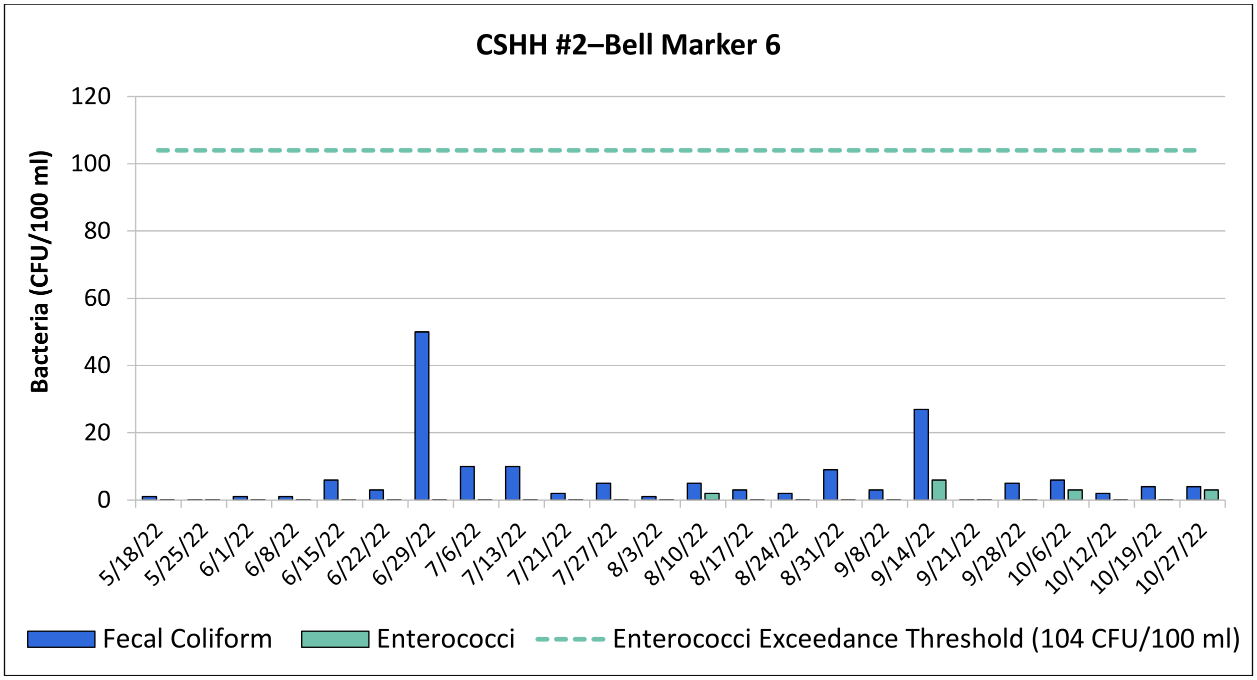
CSHH #17A–Within Restricted Shellfishing Area

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	13.00	0.00	0.10	0.00
6/1/22	1.00	3.61	2.00	0.45
6/8/22	5.00	4.02	0.10	0.27
6/15/22	7.00	4.62	0.10	0.21
6/29/22	4.00	3.44	0.10	0.21
7/6/22	0.10	1.93	0.10	0.10
7/13/22	9.00	2.24	3.00	0.23
7/21/22	60.00	3.83	6.00	0.65
7/27/22	9.00	4.55	0.10	0.45
8/3/22	9.00	5.35	3.00	0.88
8/17/22	10.00	14.85	1.00	1.16
9/14/22	64.00	25.30	37.00	6.08
9/28/22	25.00	40.00	25.00	30.41
10/6/22	39.00	39.66	23.00	27.71
10/12/22	9.00	27.38	0.10	6.79

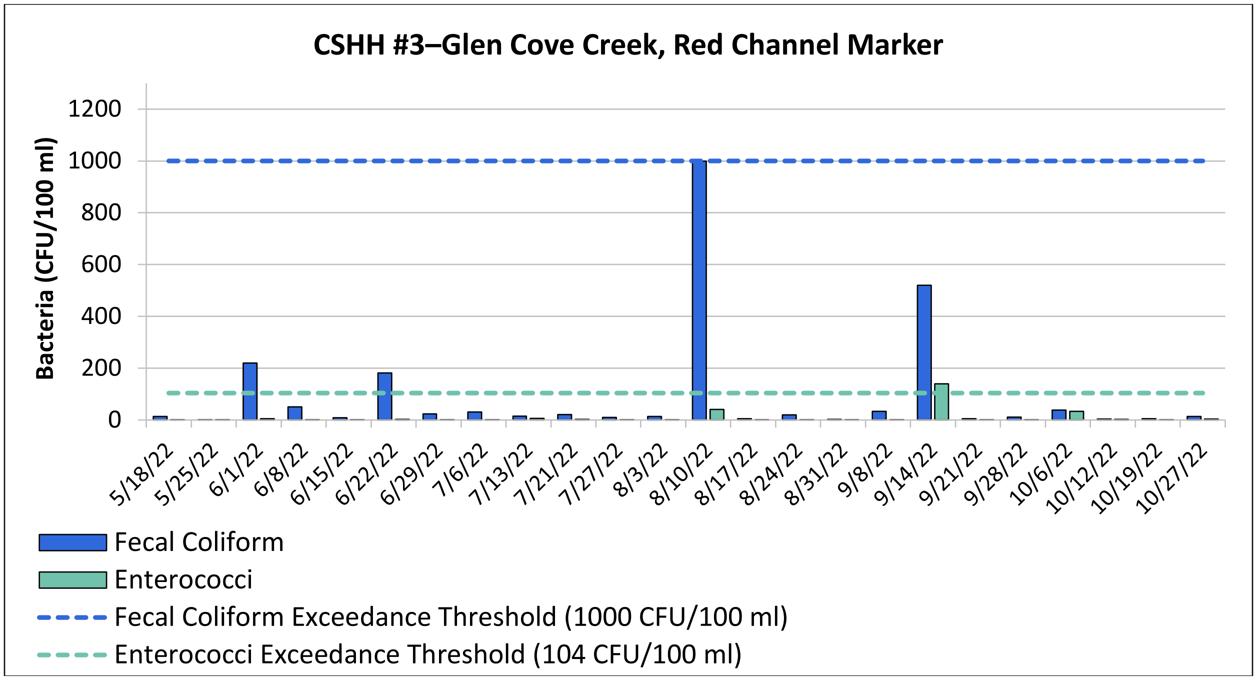
2022 In-Harbor Bacteria Graphs

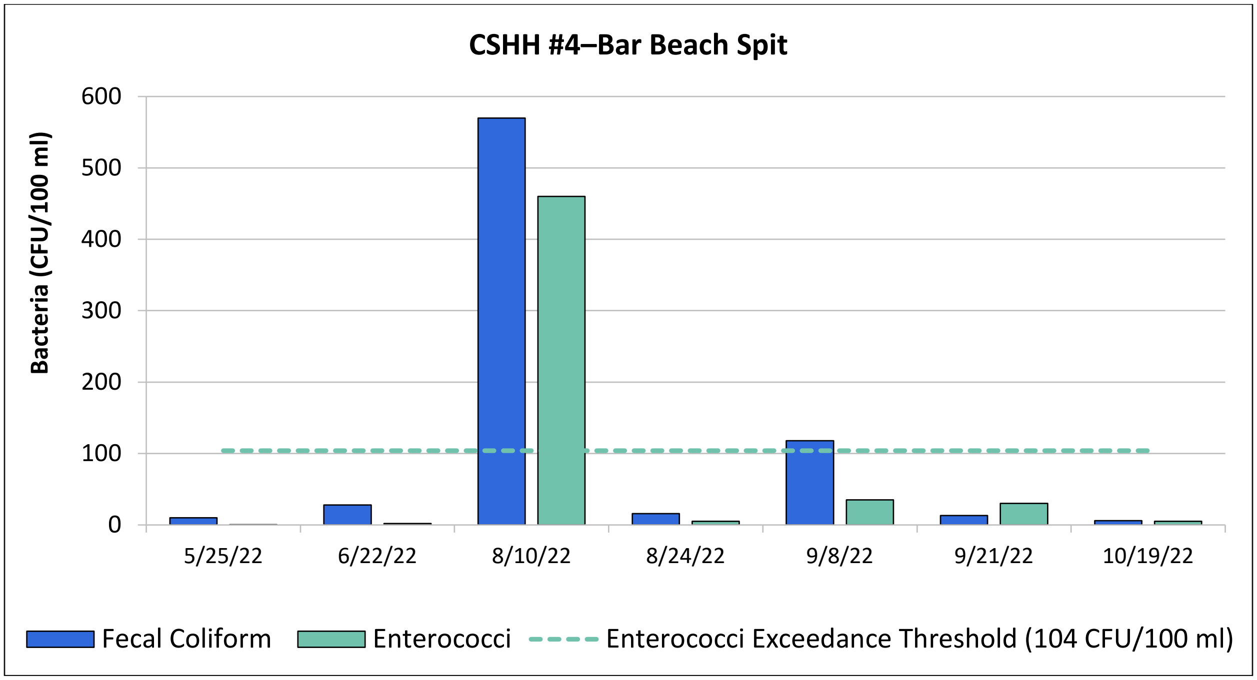
The following graphs display fecal coliform and enterococci data received from the Nassau County Department of Health. Lab results for fecal coliform greater than 6000 CFU/100 ml are represented at an absolute value of 6001 CFU/100 ml. Dashed lines show NYS beach-closure standards, 1,000 CFU/100 ml for the formerly used fecal coliform standard and 104 CFU/100 ml for the currently used enterococci standard. Beach-closure standards are used only as a frame-of-reference for in-harbor sample results. Note that the y-axes vary in order to accommodate a wide range of values.



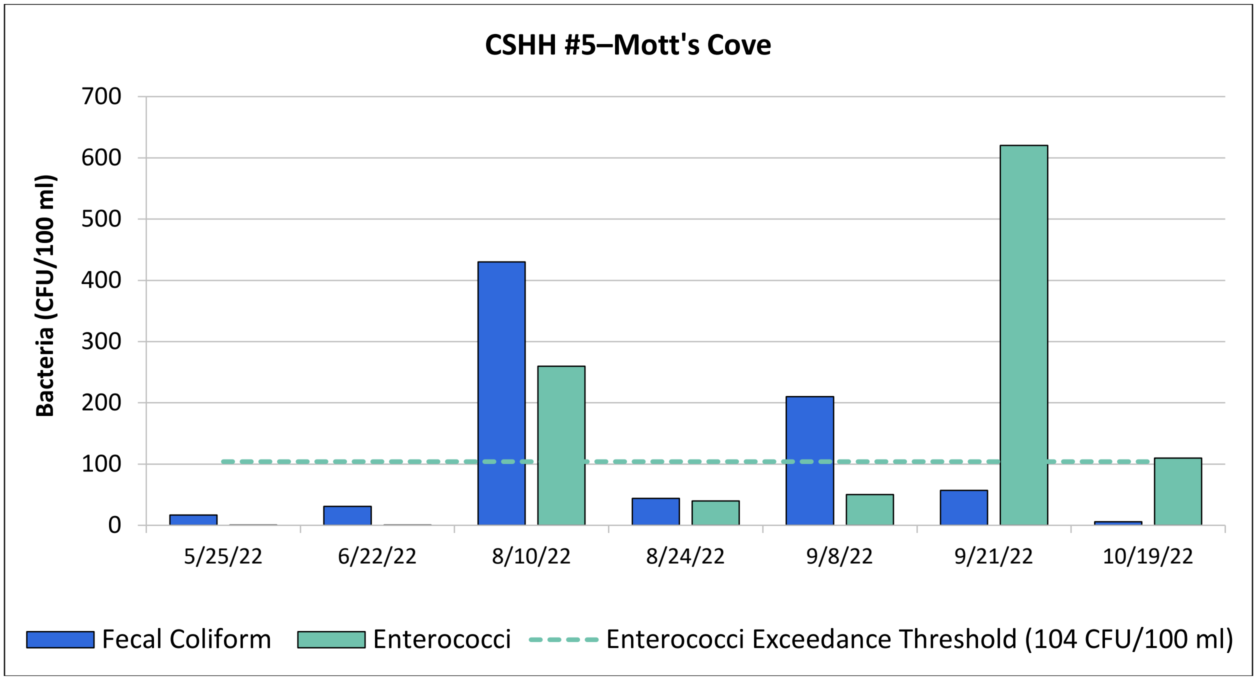


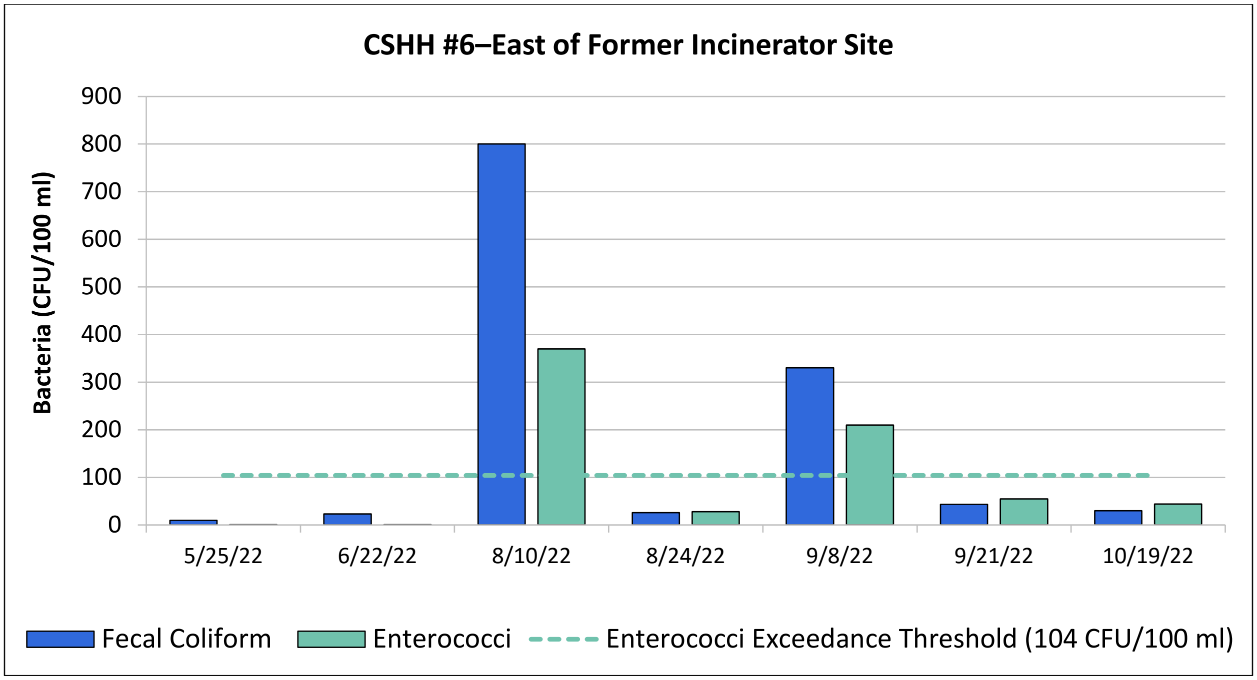
2022 In-Harbor Bacteria Graphs



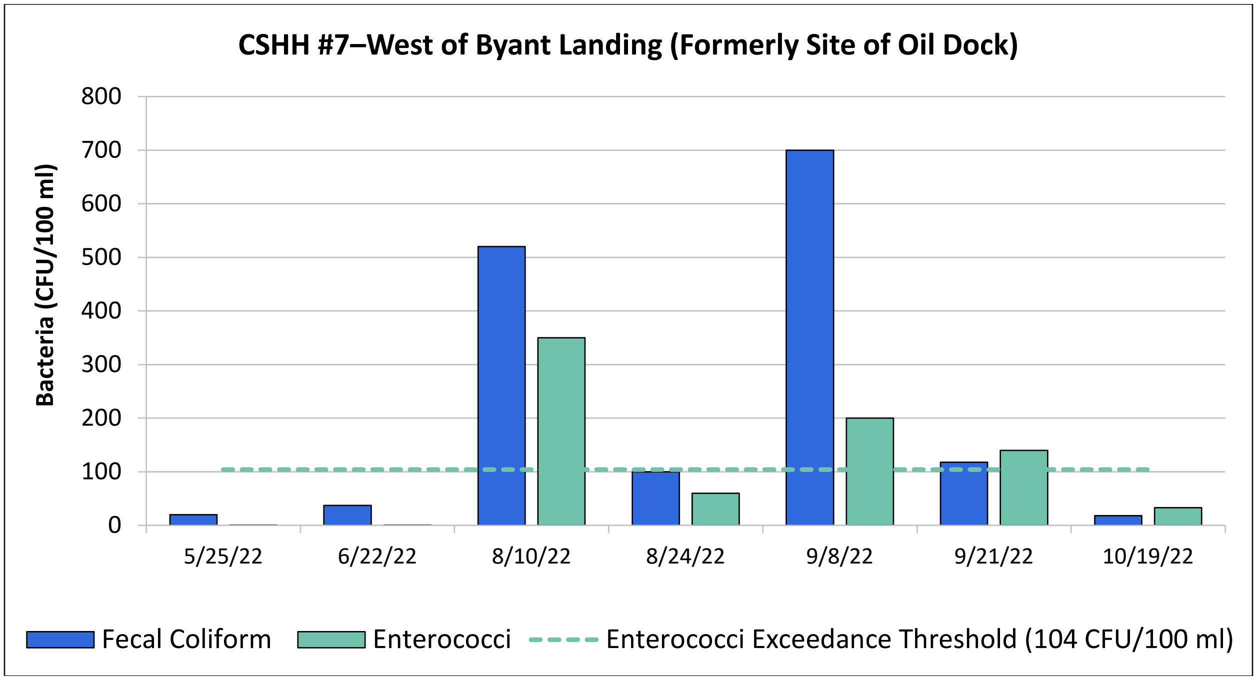


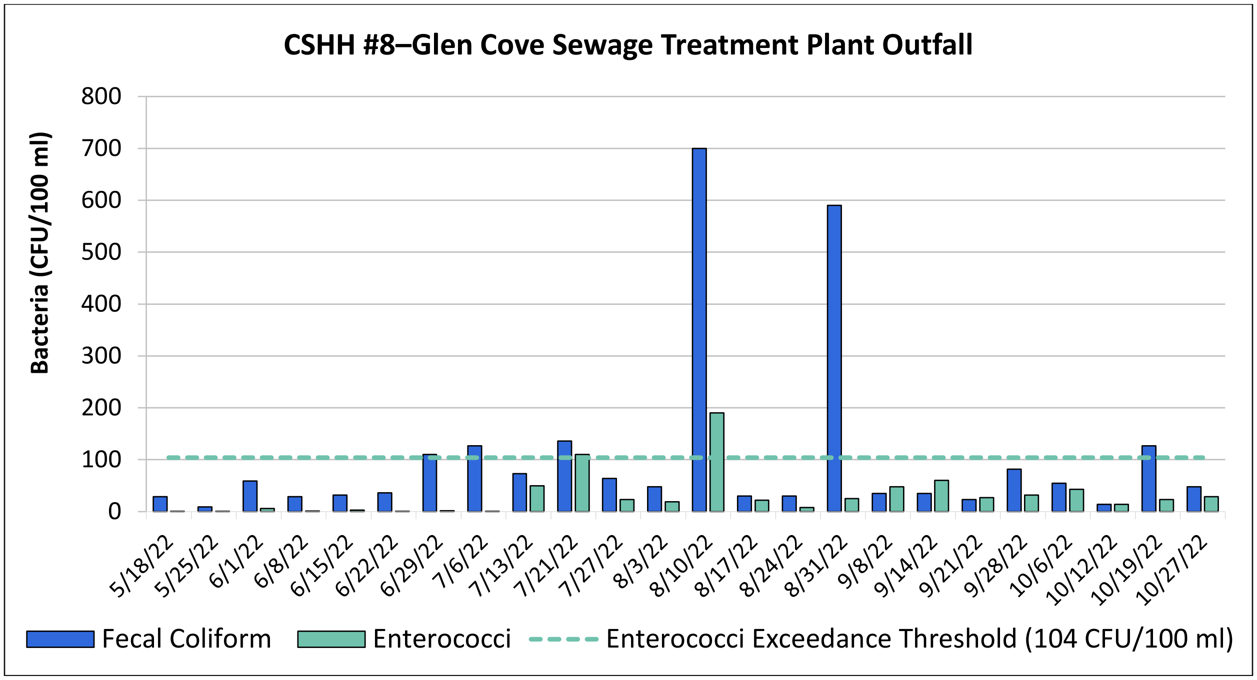
2022 In-Harbor Bacteria Graphs



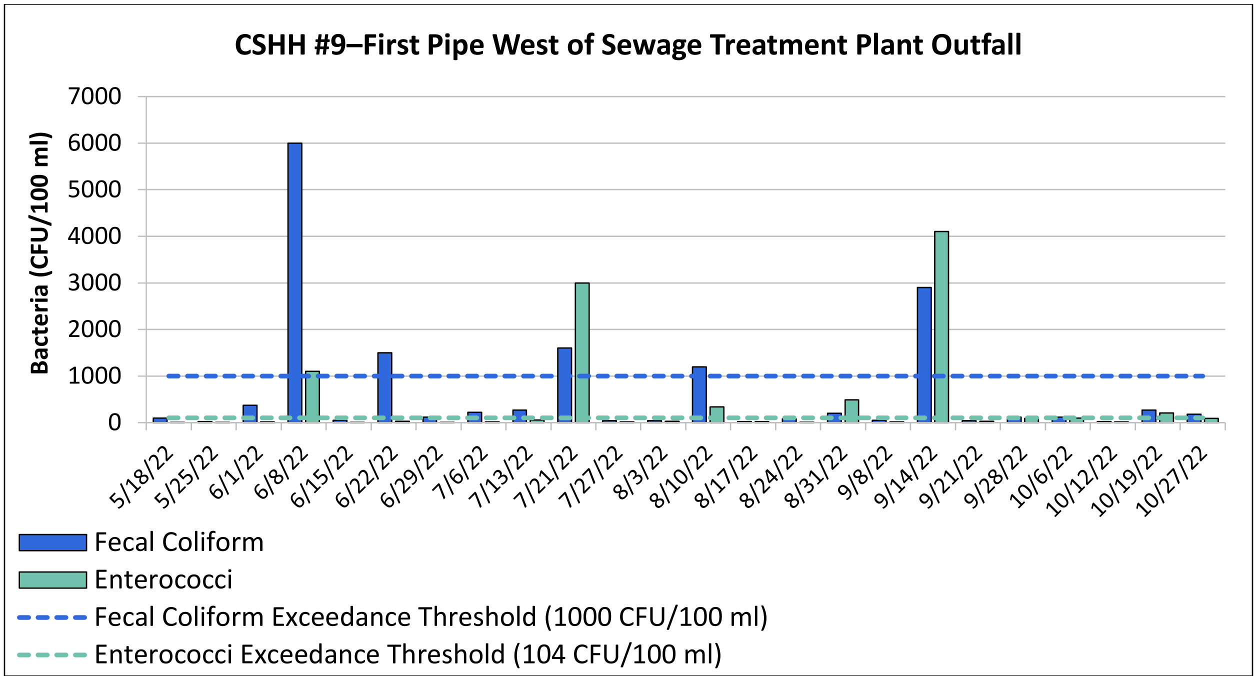


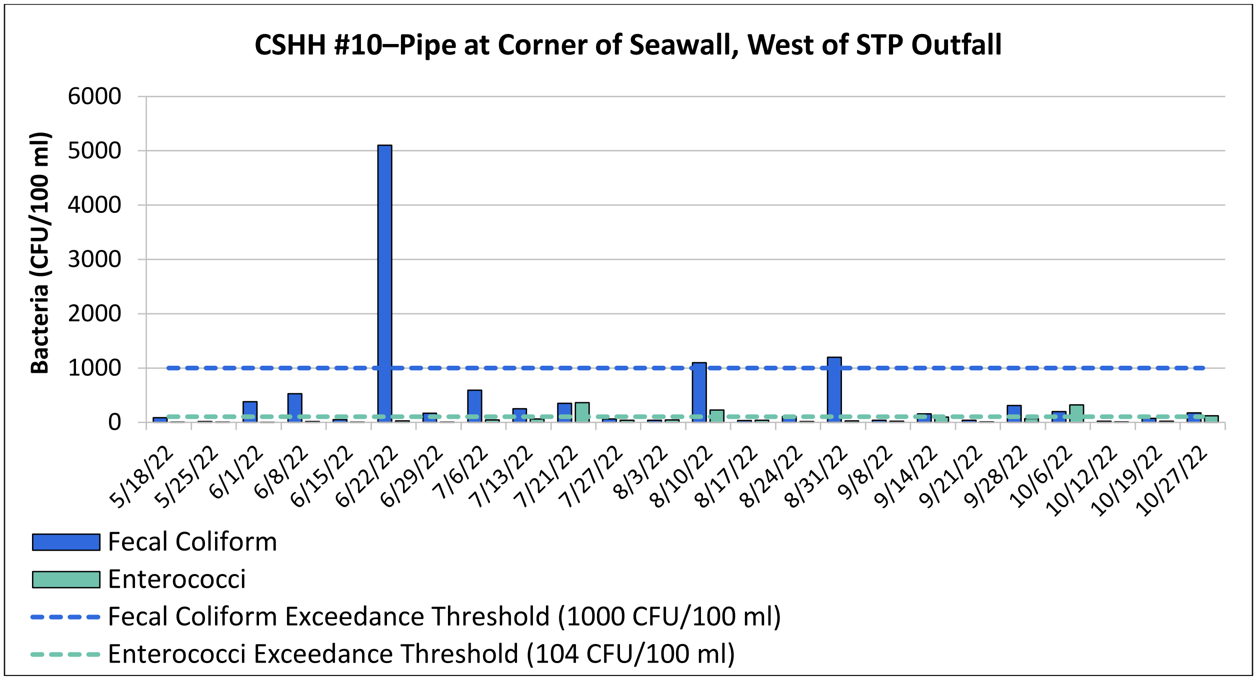
2022 In-Harbor Bacteria Graphs



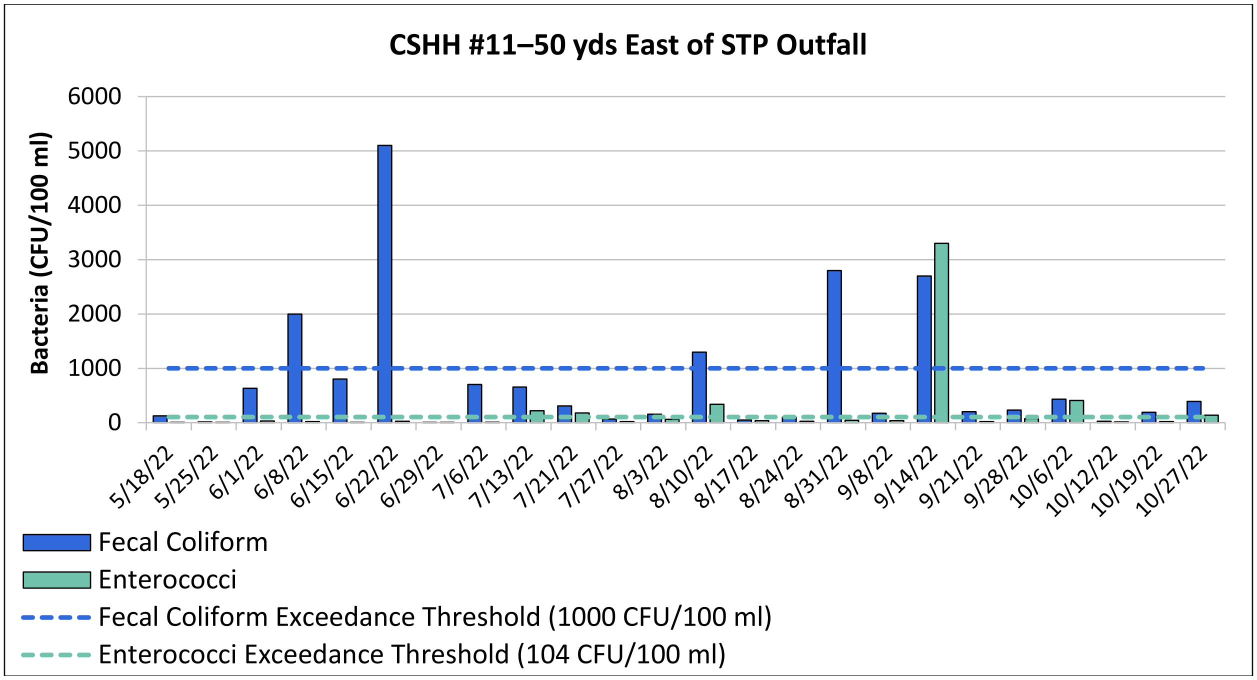


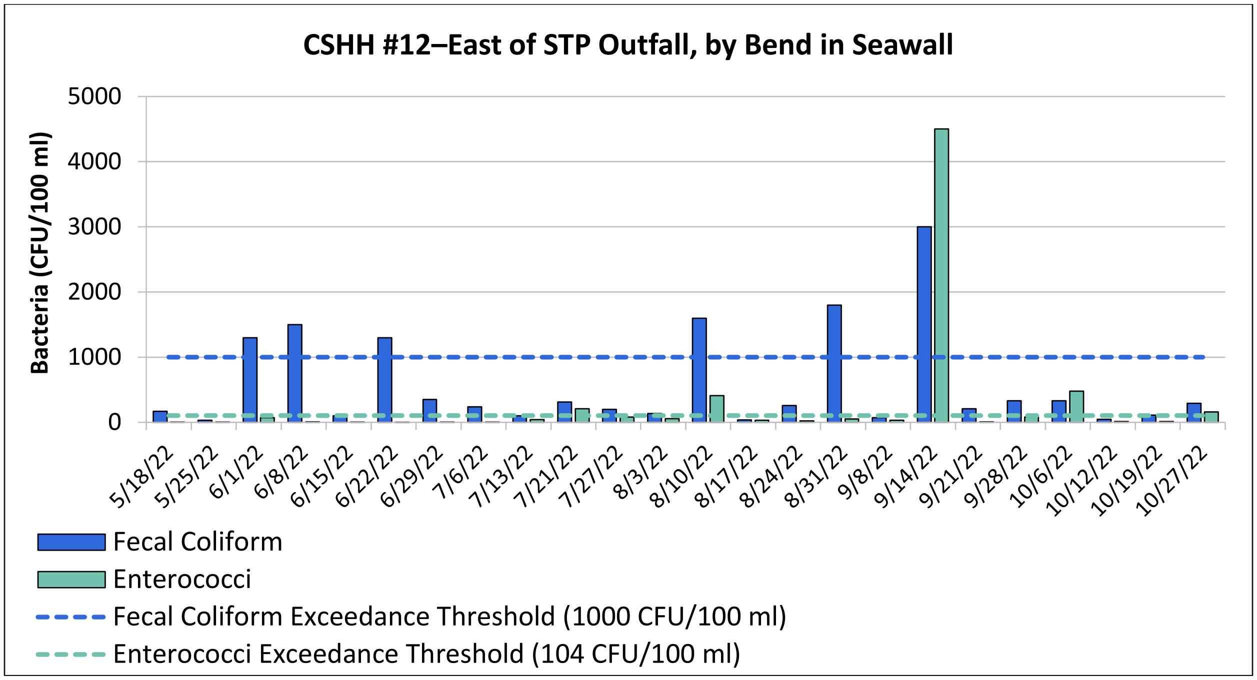
2022 In-Harbor Bacteria Graphs



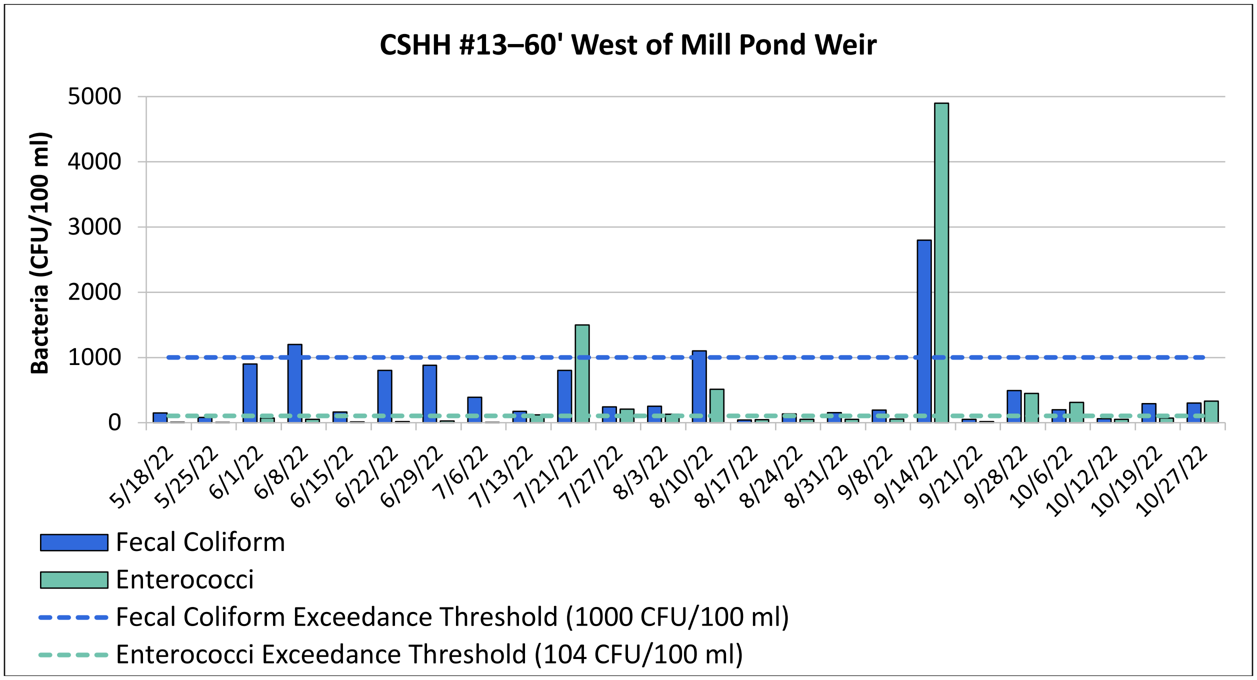


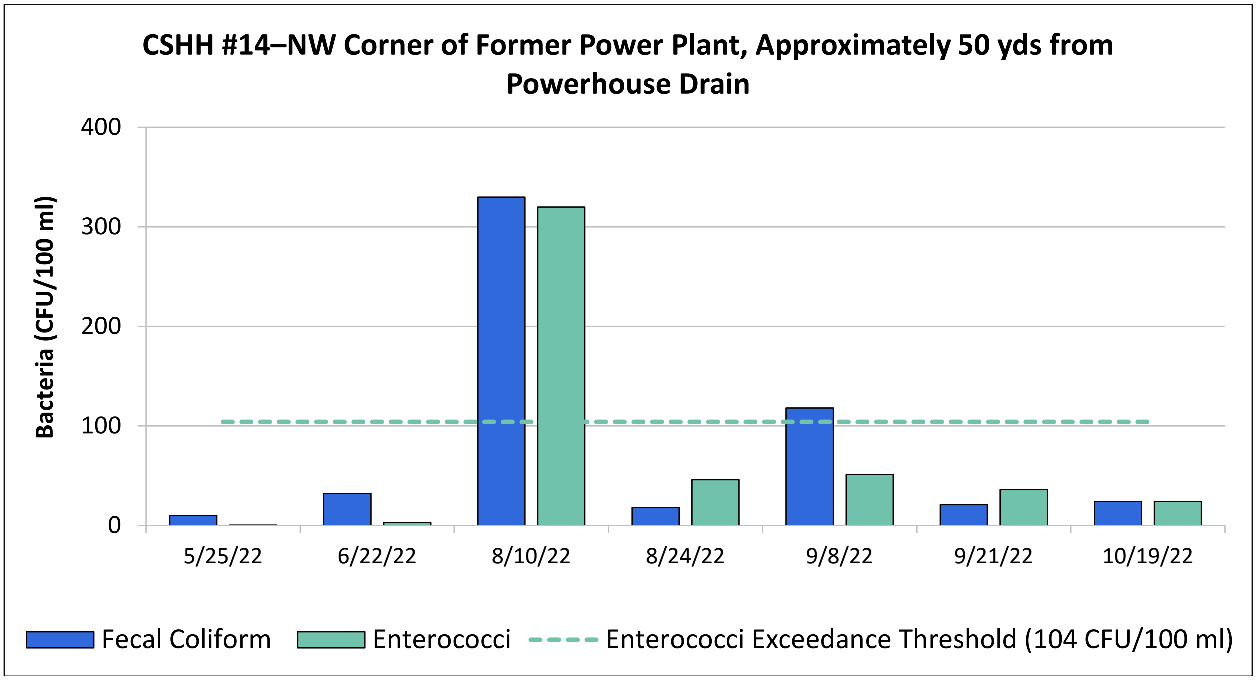
2022 In-Harbor Bacteria Graphs





2022 In-Harbor Bacteria Graphs





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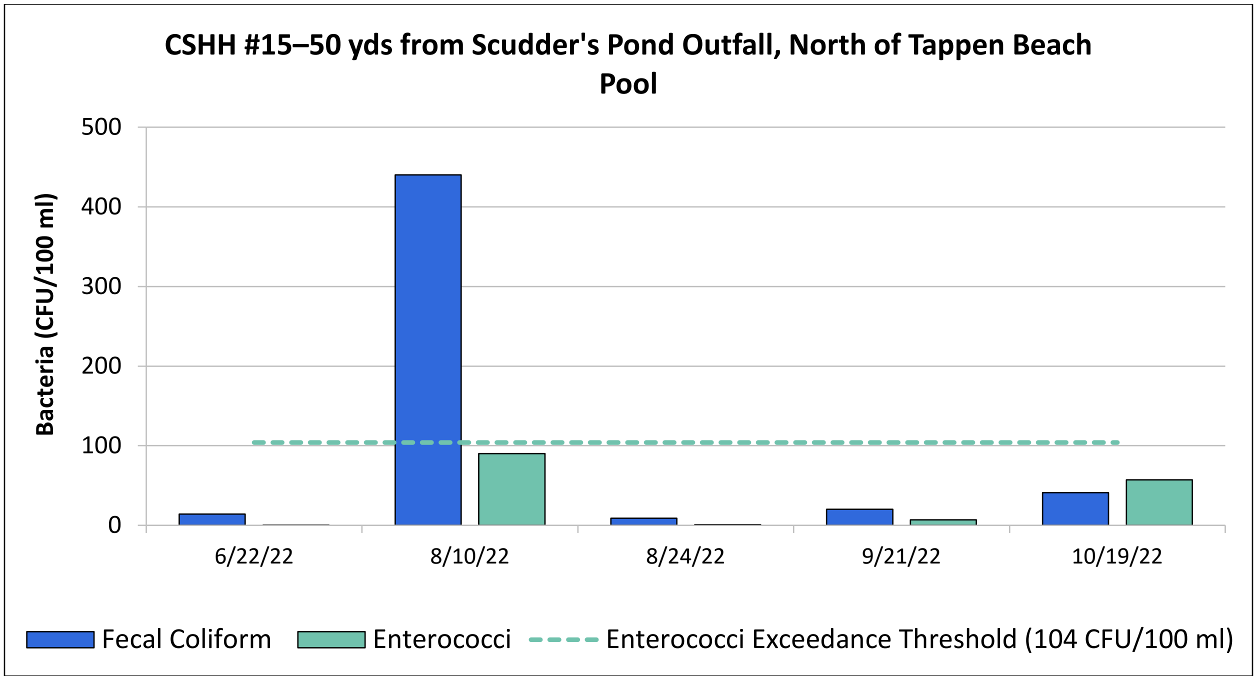
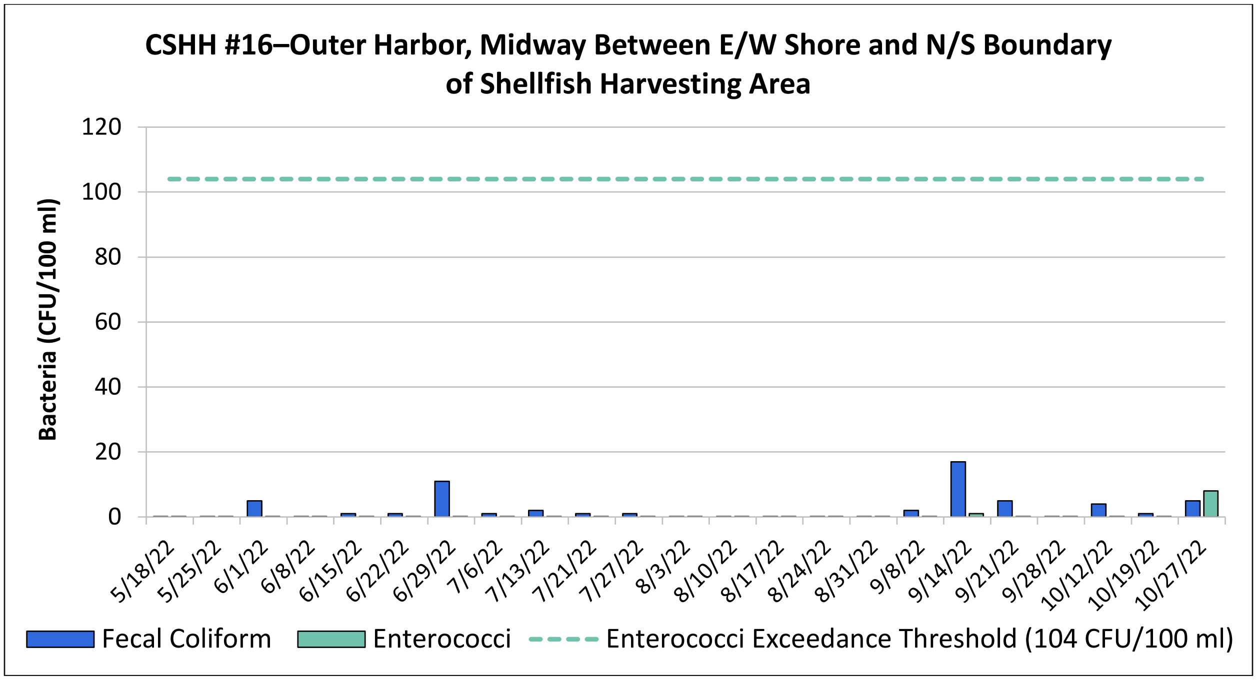
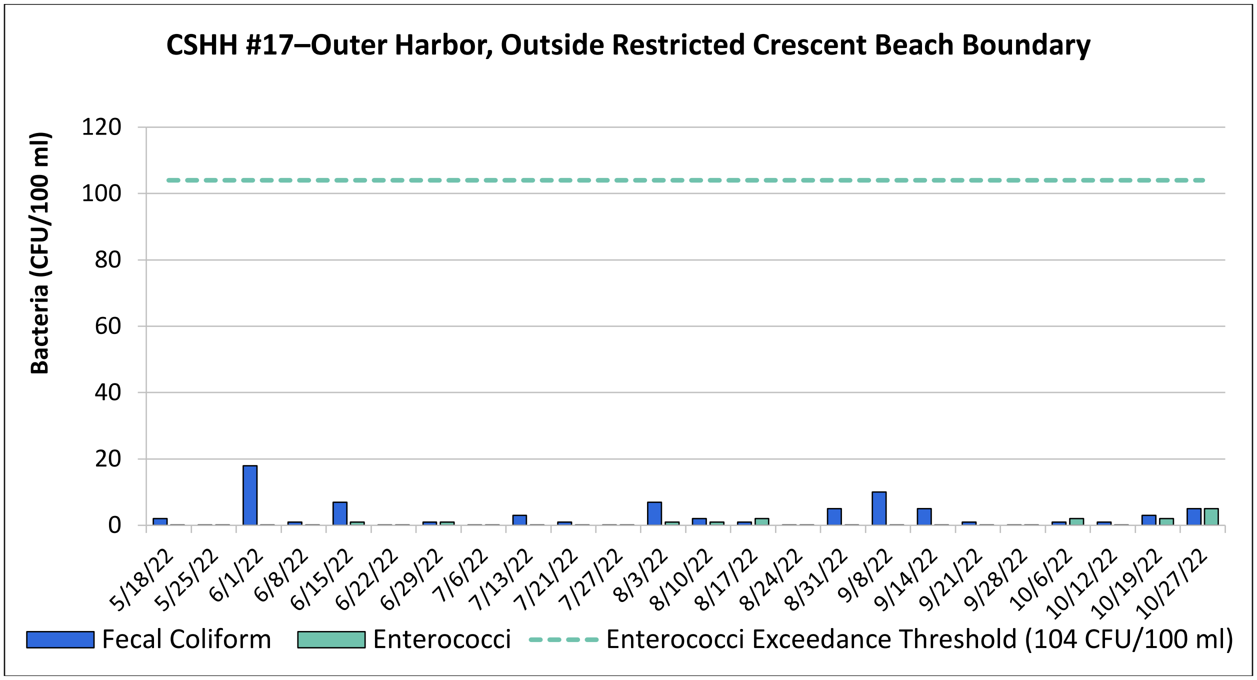
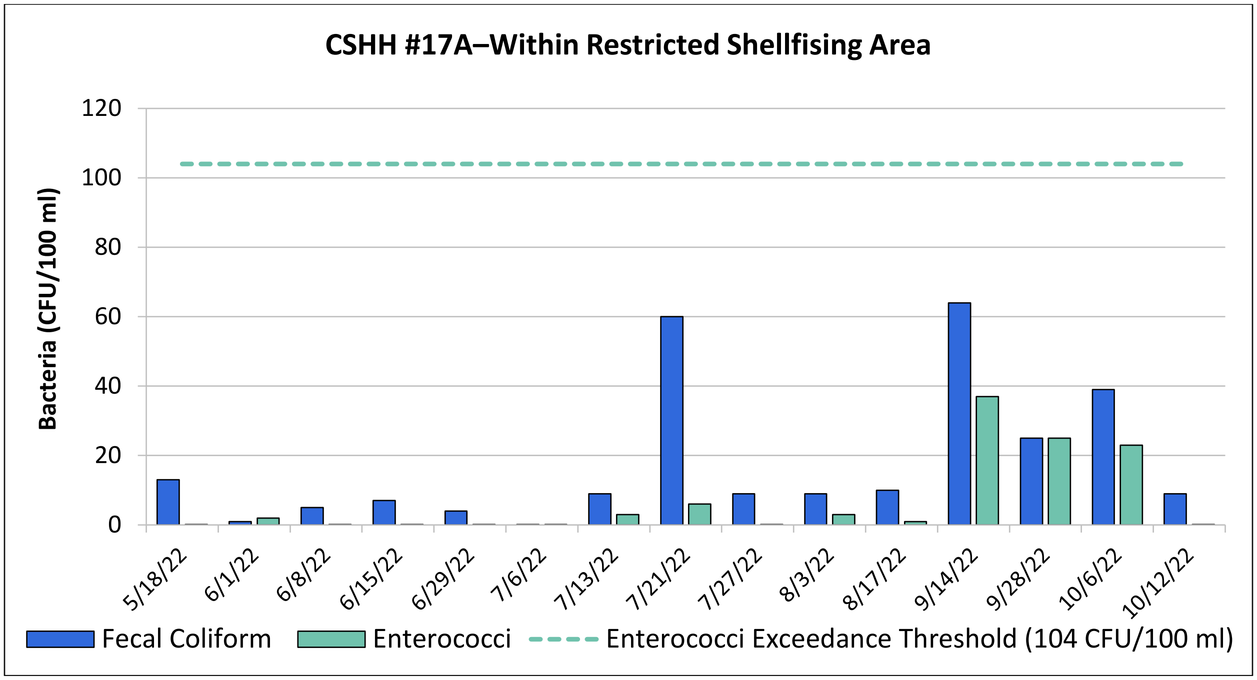




2022 In-Harbor Bacteria Graphs





2022 Powerhouse Drain and Scudder's Pond Outfalls
Regular Season Monitoring Bacteria Data

CSHH #14A–Powerhouse Drain Outfall

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	180.00	0.00	19.00	0.00
5/25/22	24.00	65.73	4.00	8.72
6/1/22	1000.00	162.87	15.00	10.45
6/8/22	200.00	171.45	16.00	11.62
6/15/22	800.00	***233.30***	22.00	13.20
6/22/22	37.00	170.02	7.00	10.81
6/29/22	980.00	***357.03***	48.00	17.77
7/6/22	73.00	***211.53***	10.00	16.39
7/13/22	400.00	***242.99***	***310.00***	29.65
7/21/22	73.00	150.53	***110.00***	**40.91**
7/27/22	580.00	***261.02***	***460.00***	**94.48**
8/3/22	1000.00	***262.08***	***390.00***	**143.65**
8/10/22	700.00	***411.89***	***390.00***	**298.90**
8/17/22	210.00	***362.09***	90.00	**233.40**
8/24/22	440.00	***518.61***	***380.00***	**299.08**
8/31/22	31.00	***288.69***	***110.00***	**224.65**
9/8/22	***1500.00***	***313.07***	***1400.00***	**290.08**
9/14/22	***2400.00***	***400.56***	***3700.00***	**454.94**
9/21/22	46.00	***295.65***	70.00	**432.63**
9/28/22	240.00	***261.89***	***440.00***	**445.51**
10/12/22	210.00	***273.12***	70.00	**298.86**
10/19/22	53.00	105.28	16.00	**76.64**
10/27/22	410.00	181.92	***110.00***	**85.81**

Tan highlights indicate a direct sample from flow at CSHH #14A and #15A.

Note that CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log Avg (log average) refers to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS beach-closure standards, 1,000 CFU/100 ml (200 Log Avg) for the formerly used fecal coliform standard and 104 CFU/100 ml (35 Log Avg) for the currently used enterococci standard.

2022 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Data

CSHH #15A–Outfall North of Tappen Beach Pool

	Fecal Coliform		**Enterococci**	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	92.00	0.00	7.00	0.00
5/25/22	65.00	77.33	25.00	13.23
6/1/22	240.00	112.80	4.00	8.88
6/8/22	57.00	95.10	2.00	6.12
6/15/22	100.00	96.06	0.10	2.69
6/22/22	57.00	87.29	2.00	2.09
6/29/22	680.00	139.60	9.00	1.70
7/6/22	145.00	126.22	1.00	1.29
7/13/22	182.00	159.21	***190.00***	3.21
7/21/22	340.00	***203.36***	***250.00***	15.36
7/27/22	220.00	***266.42***	70.00	31.28
8/3/22	39.00	150.41	50.00	***44.07***
8/10/22	***5100.00***	***306.56***	***2100.00***	***203.51***
8/17/22	28.00	***210.83***	44.00	***151.89***
8/24/22	91.00	161.98	55.00	***112.21***
8/31/22	145.00	149.02	***1100.00***	***194.66***
9/8/22	590.00	***256.57***	***110.00***	***227.91***
9/14/22	***2000.00***	***212.76***	***1900.00***	***223.39***
9/21/22	300.00	***341.89***	***170.00***	***292.73***
9/28/22	220.00	***407.90***	70.00	***307.20***
10/12/22	127.00	***359.83***	70.00	***199.46***
10/19/22	490.00	***253.15***	70.00	***87.38***
10/27/22	182.00	***223.42***	45.00	***62.68***

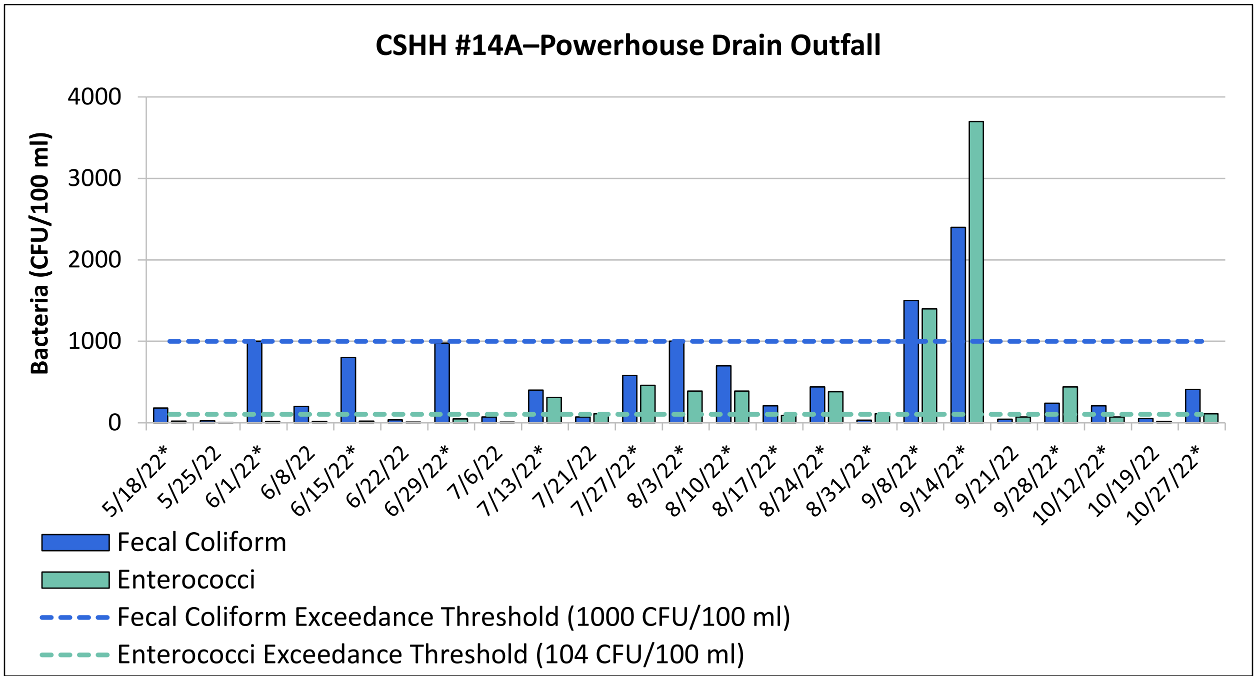
2022 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Data

CSHH #15B–Scudder's Pond Weir on East Side of Shore Road

	Fecal Coliform		Enterococci	
Date	**CFU/100 ml**	**Log Avg**	**CFU/100 ml**	**Log Avg**
5/18/22	104.00	0.00	0.10	0.00
6/15/22	164.00	130.60	2.00	0.45
7/21/22	***1200.00***	0.00	***1300.00***	0.00
8/17/22	118.00	***376.30***	***440.00***	***756.31***
9/14/22	***1300.00***	***391.66***	***700.00***	***554.98***
9/21/22	210.00	***522.49***	***190.00***	***364.69***
10/19/22	360.00	***274.95***	70.00	***115.33***

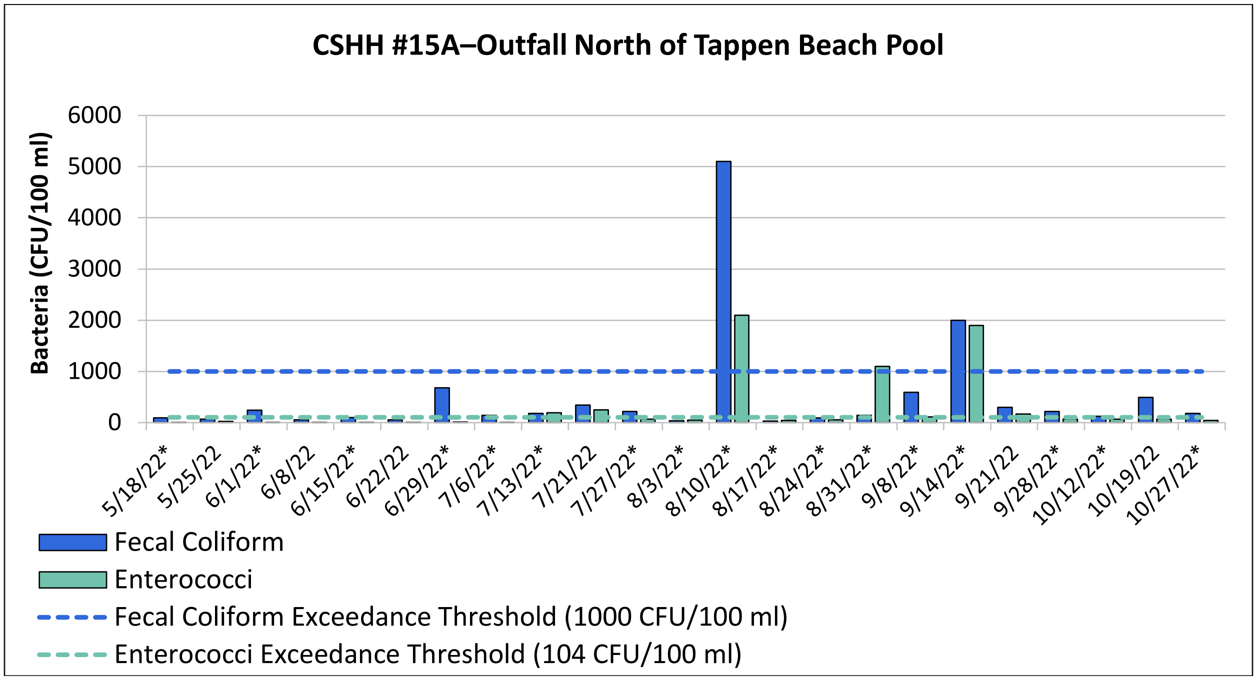
2022 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Graphs

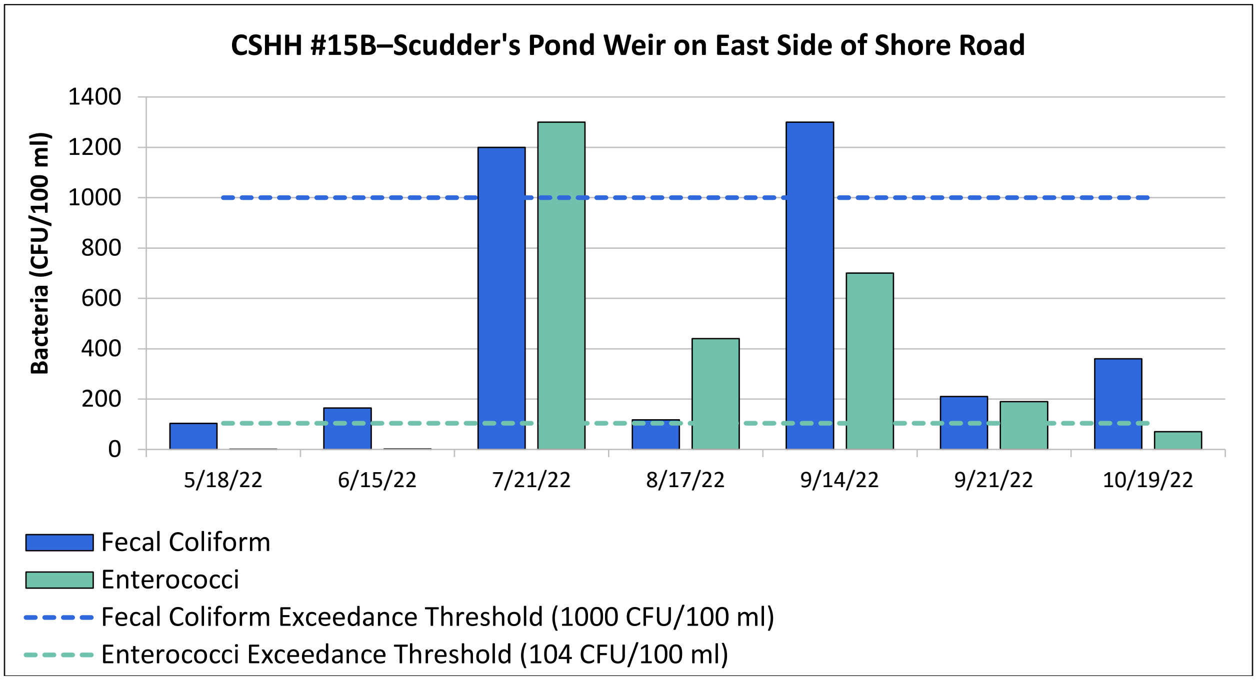
The following graphs display fecal coliform and enterococci data received from the Nassau County Department of Health. Lab results for fecal coliform greater than 6000 CFU/100 ml are represented at an absolute value of 6001 CFU/100 ml. Dashed lines show NYS beach-closure standards, 1,000 CFU/100 ml for the formerly used fecal coliform standard and 104 CFU/100 ml for the currently used enterococci standard. Beach-closure standards are used only as a frame-of-reference for in-harbor sample results. Note that the y-axes vary in order to accommodate a wide range of values.



*Direct sample from flow

2022 Powerhouse Drain and Scudder's Pond Outfalls Regular Season Monitoring Bacteria Graphs





2022-23 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Data

CSHH #14A–at Powerhouse Drain Outfall

	Fecal Coliform	**Enterococci**
Date	**CFU/100 ml**	**CFU/100 ml**
11/9/22	42.00	44.00
11/22/22	32.00	22.00
12/8/22	240.00	***110.00***
12/21/22	12.00	25.00
1/4/23	410.00	***140.00***
1/17/23	700.00	2.00
2/7/23	460.00	0.10
2/22/23	400.00	***1300.00***
3/8/23	82.00	***170.00***
3/21/23	230.00	***110.00***
4/5/23	30.00	1.00
4/19/23	230.00	24.00

Tan highlights indicate a direct sample from flow at CSHH #14A and #15A.

Note that CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Under NYS beach-closure standards: the exceedance thresholds are 1,000 CFU/100 ml for the formerly used fecal coliform standard and 104 CFU/100 ml for the currently used enterococci standard.

2022-23 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Data

CSHH #15A–at Outfall North of Tappen Beach Pool

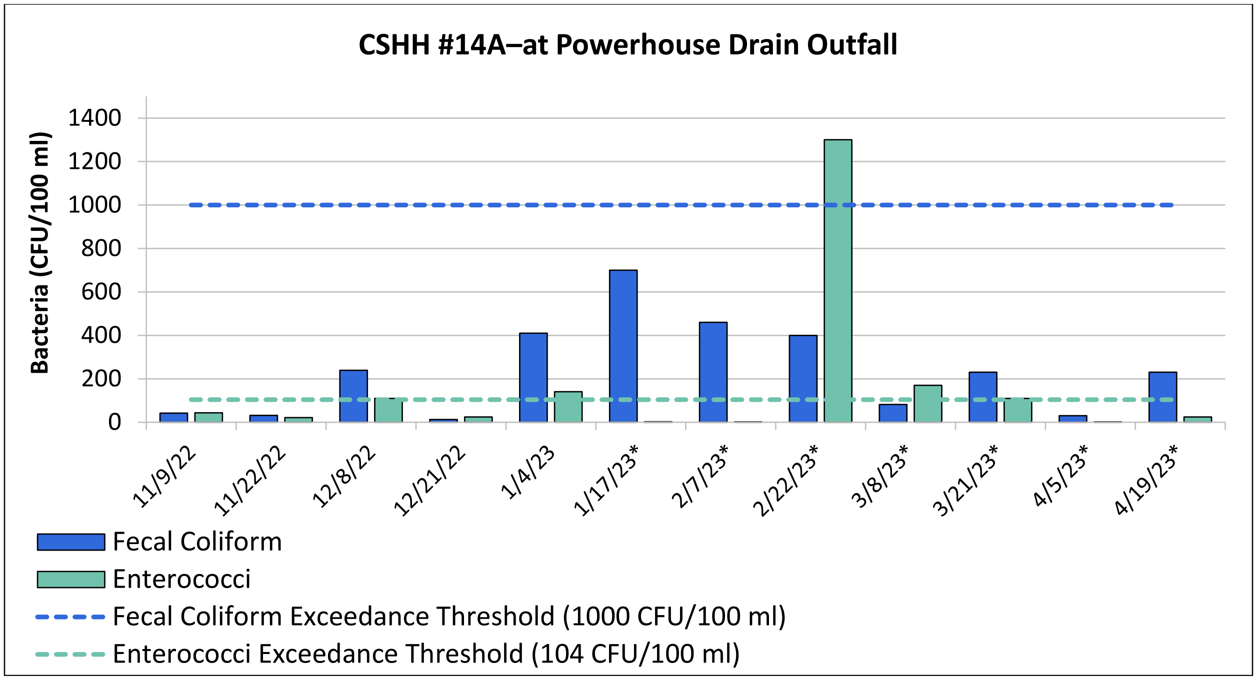
	Fecal Coliform	Enterococci
Date	**CFU/100 ml**	**CFU/100 ml**
11/9/22	390.00	25.00
12/8/22	530.00	***120.00***
1/4/23	270.00	24.00
2/7/23	1.00	0.10
3/8/23	73.00	2.00
4/5/23	25.00	1.00

CSHH #15B–Scudder's Pond Weir on East Side of Shore Road

	Fecal Coliform	Enterococci
Date	**CFU/100 ml**	**CFU/100 ml**
11/9/22	570.00	10.00
12/8/22	590.00	***160.00***
1/4/23	250.00	10.00
3/8/23	52.00	0.10
4/5/23	20.00	2.00

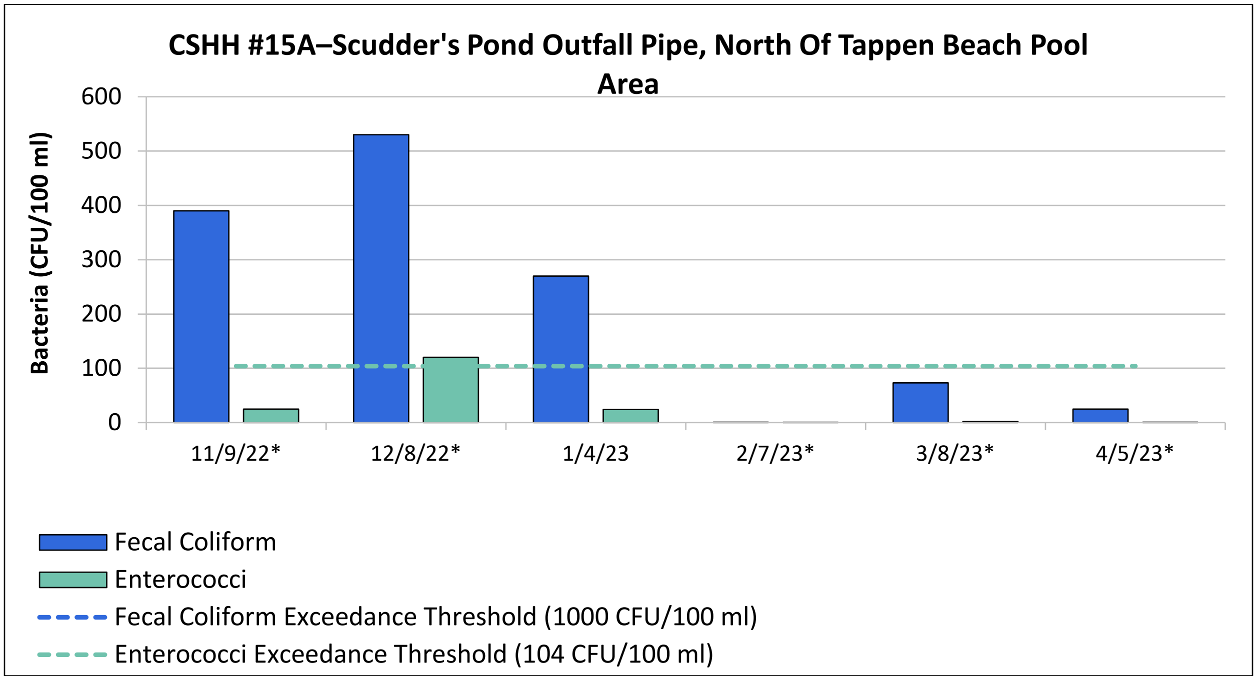
2022-23 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Graphs

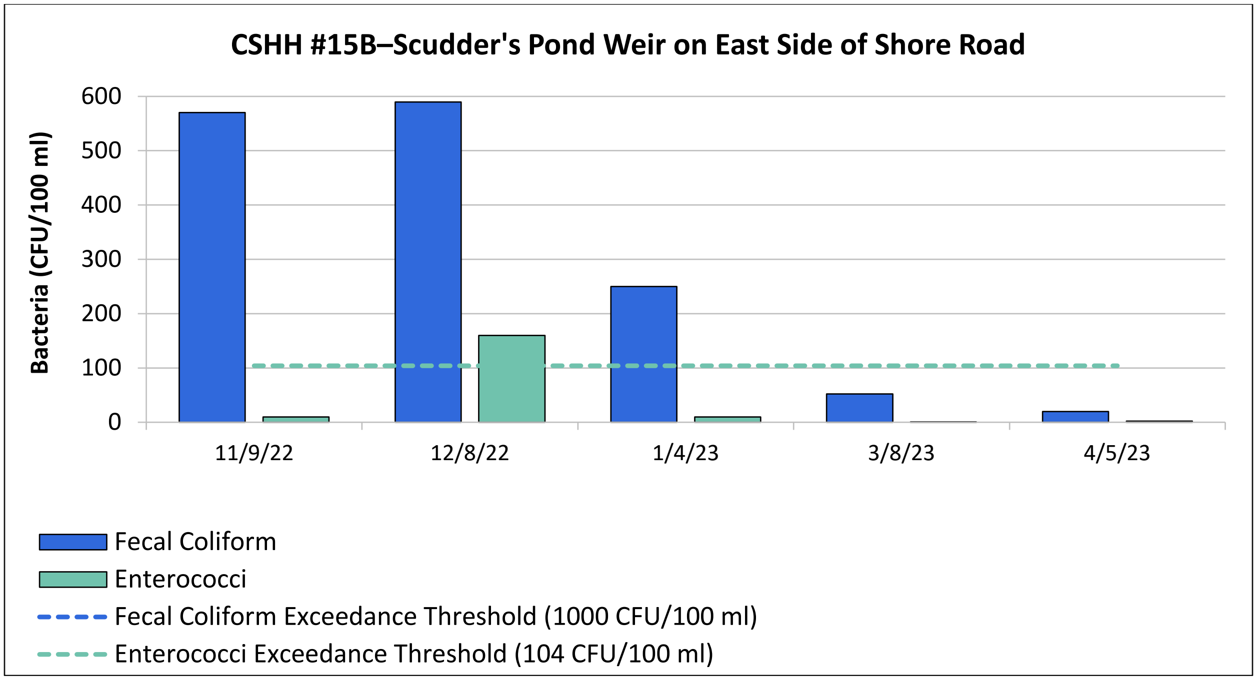
The following graphs display fecal coliform and enterococci data received from the Nassau County Department of Health. Lab results for fecal coliform greater than 6000 CFU/100 ml are represented at an absolute value of 6001 CFU/100 ml. Dashed lines show NYS beach-closure standards, 1,000 CFU/100 ml for the formerly used fecal coliform standard and 104 CFU/100 ml for the currently used enterococci standard. Beach-closure standards are used only as a frame-of-reference for in-harbor sample results. Note that the y-axes vary in order to accommodate a wide range of values.



*Direct sample from flow

2022-23 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Graphs





2022 Sea Cliff Precipitation Data

JAN	mm	in	MARCH	mm	in	MAY	mm	in	JULY	mm	in	SEPT	mm	in	NOV	mm	in
1	7.62	0.30	3	1.78	0.07	2	6.35	0.25	2	0.51	0.02	5T	0.00	0.00	1	4.83	0.19
2	14.22	0.56	6	2.03	0.08	4	2.03	0.08	5	2.54	0.10	6A	32.26	1.27	7	1.02	0.04
5	6.60	0.26	7	2.03	0.08	6	21.59	0.85	8	3.81	0.15	7	0.76	0.03	11	23.37	0.92
7**	21.59	0.85	9*	16.76	0.66	7	27.69	1.09	16	6.86	0.27	11	2.54	0.10	15-16	18.80	0.74
9	4.32	0.17	12*	13.97	0.55	10	1.02	0.04	17	0.51	0.02	12	14.22	0.56	25	1.02	0.04
11**	0.25	0.01	13**	0.51	0.02	14	2.54	0.10	18B†	39.12	1.54	13	60.96	2.40	27	14.22	0.56
16-17*	44.20	1.74	17	4.32	0.17	15	0.51	0.02	21B	32.26	1.27	19	1.27	0.05	30	20.07	0.79
20*	6.86	0.27	19	3.81	0.15	16	7.62	0.30	23T	0.00	0.00	22	19.05	0.75			
23-24**	1.02	0.04	23	2.03	0.08	19	19.56	0.77	25B	8.38	0.33	25	20.07	0.79			
28-29**	20.32	0.80	24	22.35	0.88	20	12.70	0.50	28A	2.54	0.10						
			25	3.81	0.15	22	4.32	0.17									
			26*	6.35	0.25	27	0.51	0.02									
			27T**	0.00	0.00	28	10.16	0.40									
			31	0.51	0.02												
TOTAL	**127.00**	**5.00**	**TOTAL**	**80.3**	**3.16**	**TOTAL**	**116.59**	**4.59**	**TOTAL**	**96.52**	**3.80**	**TOTAL**	**151.13**	**5.95**	**TOTAL**	**83.31**	**3.28**
FEB	**mm**	**in**	**APRIL**	**mm**	**in**	**JUNE**	**mm**	**in**	**AUG**	**mm**	**in**	**OCT**	**mm**	**in**	**DEC**	**mm**	**in**
3-4	30.23	1.19	1	9.40	0.37	1†	20.07	0.79	1	8.89	0.35	1	19.05	0.75	3	13.21	0.52
7	1.52	0.06	3	3.81	0.15	2†	19.05	0.75	7	6.60	0.26	2	2.03	0.08	6	13.46	0.53
13**	8.89	0.35	6	10.67	0.42	8A	3.56	0.14	9†	17.27	0.68	3	38.10	1.50	7	12.70	0.50
18	17.78	0.70	7	10.92	0.43	9A†	13.46	0.53	10	0.25	0.01	4	9.40	0.37	11*	5.08	0.20
19T	0.00	0.00	8	8.38	0.33	11T	0.00	0.00	11	2.29	0.09	5	6.10	0.24	15	12.70	0.50
22	11.43	0.45	9*	1.27	0.05	12	3.30	0.13	17	0.25	0.01	7	1.52	0.06	16	21.08	0.83
25*	20.57	0.81	12	1.78	0.07	13	2.03	0.08	18	1.52	0.06	13	24.13	0.95	17	0.51	0.02
			14	5.08	0.20	14T	0.00	0.00	22	6.60	0.26	14	17.27	0.68	22	6.35	0.25
			16	3.81	0.15	16	6.10	0.24	23	0.51	0.02	17	4.83	0.19	23	12.70	0.50
			19	43.18	1.70	21	2.54	0.10	26	5.33	0.21	23	1.78	0.07	31	8.13	0.32
			26	1.27	0.05	22	2.29	0.09	31A	1.27	0.05	24	13.46	0.53			
						23	1.02	0.04				25	2.54	0.10			
						27†	23.37	0.92				26	0.76	0.03			
												31	1.02	0.04			
TOTAL	**90.42**	**3.56**	**TOTAL**	**99.57**	**3.92**	**TOTAL**	**96.77**	**3.81**	**TOTAL**	**50.80**	**2.00**	**TOTAL**	**141.99**	**5.59**	**TOTAL**	**105.92**	**4.17**

Note: Precipitation recorded from midnight to midnight; snow recorded in inches, converted to approximate liquid equivalent (see below).

"A" designates that about 12.5 mm of rain fell between midnight and 8 AM; "B" designates that the first 12.5 mm of rain fell by 4 PM; "C" designates that the first 12.5 mm of rain fell later in the evening, by midnight (meaningful during beach season). T=trace amount of rain.

†Advisory/closure: Hempstead Harbor beaches were closed following half an inch or more of rain on 7 dates. North Hempstead Beach Park (S) was closed on dates 6/2, 6/3, 6/9, 6/27, 7/19, 7/27, 8/10. Morgan Beach, Sea Cliff Beach, and Tappen Beach were closed for 4 dates (above), 6/27 – 8/10.

Village Club at Sands Point and North Hempstead Beach Park (N) were not operational during this season. Crescent Beach remained closed all season.

††Elevated bacteria beach closures: Morgan Beach was also closed for two days due to elevated bacteria levels on 7/14 and 7/15. Sea Cliff Beach had a precautionary closure for two dates (8/14 and 8/15) following a sewage leak in Glen Cove.

*Sleet/rain mix or wet snow converted to approximate liquid equivalent in mm (5 in of wet snow approximately equal to 1 in liquid precipitate).

**Snow--powdery--converted to approximate liquid equivalent in mm (10 in of snow equal to approximately 1 in liquid precipitate).

2023 Partial Sea Cliff Precipitation Data

CSHH 2023 (JANUARY-APRIL) PRECIPITATION DATA FOR SEA CLIFF											
JAN	mm	in	FEB	mm	in	MARCH	mm	in	APRIL	mm	in
1T	0.00	0.00	1**	1.02	0.04	2	0.51	0.02	1	11.18	0.44
3	10.41	0.41	7	1.27	0.05	3	2.54	0.10	5	0.76	0.03
4	0.76	0.03	8	0.51	0.02	4	30.99	1.22	6T	0.00	0.00
5	4.32	0.17	9T	0.00	0.00	7**	0.76	0.03	15	0.51	0.02
6	1.27	0.05	13	1.52	0.06	10-11	19.05	0.75	22-23	50.29	1.98
9	0.51	0.02	16	1.52	0.06	12-13	30.73	1.21	29*	63.75	2.51
12	10.92	0.43	17	7.37	0.29	13**	1.78	0.07	30	33.27	1.31
13	2.79	0.11	21	8.64	0.34	18	0.76	0.03			
14T**	0.00	0.00	22*	2.54	0.10	23	3.30	0.13			
17T	0.00	0.00	23	1.78	0.07	25	6.35	0.25			
19	21.84	0.86	24	0.51	0.02	27	4.57	0.18			
22-23	25.40	1.00	25T**	0.00	0.00	28	0.76	0.03			
25*	44.96	1.77	27**	10.16	0.40						
31*	2.79	0.11	28*	3.81	0.15						
TOTAL	**125.98**	**4.96**	**TOTAL**	**40.64**	**1.60**	**TOTAL**	**102.1**	**4.02**	**TOTAL**	**159.77**	**6.29**

Note: Precipitation recorded from midnight to midnight; snow recorded in inches, converted to approximate liquid equivalent (see below).
T=trace amount.
*Sleet/rain mix or wet snow converted to approximate liquid equivalent in mm (5 in of wet snow approximately equal to 1 in liquid precipitate).
**Snow--powdery--converted to approximate liquid equivalent in mm (10 in of snow equal to approximately 1 in liquid precipitate).

1997-2022 Monthly Rainfall Totals (mm)

	June	July	August	September	October	Total
2022	96.77	96.52	50.80	151.13	141.99	537.21
2021	48.26	314.71	181.10	235.97	138.18	918.21
2020	46.48	141.99	116.33	114.05	175.77	594.62
2019	92.20	212.09	130.05	9.14	156.97	600.45
2018	75.95	103.89	147.32	158.75	112.27	598.18
2017	124.7	118.4	131.6	64.8	145.5	585.0
2016	36.6	134.1	141.9	75.9	147.1	535.6
2015	130.3	75.7	76.2	75.2	156.5	513.9
2014	81	78.5	93.5	59.5	112	424.5
2013	235	69	59	75.5	8.5	447
2012	175.5	140.5	140.5	117.5	92.5	666.5
2011	127.5	48.5	381.5	163	122	842.5
2010	50.5	103.5	61.5	97	146	458.5
2009	294	150.5	83	69	175	771.5
2008	79.5	91	205.5	177.5	118	671.5
2007	159.5	198.5	132.5	36.5	136	663
2006	262	148	89	105	166.5	770.5
2005	45	81	41	28.5	460.5	656
2004	95	214	91	310.5	40	750.5
2003	291.5	87	88	194.5	134	795
2002	180.5	22.5	175.5	116.5 (9/15-30)	180	675+
2001	167	70.5	165	94	19.5	516
2000	146	159	158	125	6	594
1999	31	21	135	323	92	602
1998	191	59	145	90	97	582
1997	47	232	141	84	27 (10/1-15)	531+

Appendix C

2022 Beach-Monitoring Bacteria Data

Village Club of Sands Point*

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
4/11/22	0.10	0.00
4/13/22	0.10	0.10
4/20/22	***260.00***	1.38
4/25/22	23.00	2.78
4/27/22	2.00	2.60
5/2/22	0.10	1.51
5/4/22	0.10	1.03
5/11/22	0.10	0.77
5/18/22	0.10	1.03
5/25/22	10.00	0.64
6/1/22	3.00	0.38
6/6/22	0.10	0.50
6/8/22	1.00	0.56
6/13/22	6.00	1.10
6/15/22	59.00	1.95
6/20/22	0.10	1.95
6/22/22	0.10	1.34
6/27/22	0.10	0.76
6/29/22	0.10	0.60
7/6/22	0.10	0.41
7/11/22	***116.00***	0.89
7/13/22	43.00	1.38
7/18/22	13.00	0.95
7/20/22	17.00	1.31
7/25/22	45.00	3.86
7/27/22	***110.00***	5.60
8/1/22	4.00	14.70
8/3/22	6.00	13.31
8/8/22	5.00	20.55
8/10/22	***270.00***	26.59
8/15/22	***330.00***	28.31
8/17/22	0.10	16.10
8/22/22	2.00	13.00
8/24/22	1.00	10.06
8/31/22	***150.00***	8.81

*Village Club at Sands Point is considered a "nonoperational" beach and is therefore not subject to preemptive or other closures. It is a historical testing site for the Nassau County Department of Health for which data continues to be collected.

Note for bacteria data for beaches: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log Avg (log average for enterococci) refers to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log Avg.

2022 Beach-Monitoring Bacteria Data

North Hempstead Beach Park (N) (formerly Hempstead Harbor Beach)

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
4/11/22	11.00	0.00
4/13/22	0.10	1.05
4/18/22	0.10	0.48
4/20/22	0.10	0.32
4/25/22	0.10	0.26
4/27/22	0.10	0.22
5/02/22	2.00	0.30
5/04/22	0.10	0.26
5/11/22	0.10	0.24
5/16/22	0.10	0.15
5/18/22	10.00	0.23
5/25/22	4.00	0.41
6/01/22	24.00	1.10
6/06/22	0.10	0.99
6/08/22	2.00	1.10
6/13/22	4.00	1.86
6/15/22	3.00	1.97
6/20/22	0.10	1.57
6/22/22	0.10	1.11
6/27/22	0.10	0.70
6/29/22	1.00	0.73
7/06/22	3.00	0.58
7/11/22	2.00	0.72
7/13/22	90.00	1.23
7/18/22	34.00	1.44
7/20/22	1.00	1.38
7/25/22	1.00	2.56
7/27/22	4.00	2.69
8/01/22	4.00	4.83
8/03/22	1.00	4.05

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
8/08/22	6.00	4.38
8/10/22	***400.00***	6.87
8/15/22	11.00	6.24
8/17/22	7.00	6.31
8/22/22	17.00	7.17
8/24/22	20.00	7.95
8/31/22	23.00	12.15

2022 Beach-Monitoring Bacteria Data

North Hempstead Harbor Beach Park (S) (formerly Bar Beach)

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
4/11/22	15.00	0.00
4/13/22	1.00	3.87
4/18/22	0.10	1.14
4/20/22	0.10	0.62
4/25/22	0.10	0.43
4/27/22	2.00	0.56
5/2/22	1.00	0.61
5/4/22	0.10	0.48
5/11/22	0.10	0.41
5/16/22	0.10	0.19
5/18/22	5.00	0.28
5/25/22	0.10	0.32
6/1/22	12.00	0.48
6/6/22	2.00	0.70
6/8/22	0.10	0.53
6/13/22	0.10	0.53
6/15/22	2.00	0.63
6/20/22	1.00	0.65
6/22/22	0.10	0.51
6/27/22	0.10	0.51
6/29/22	0.10	0.43
7/6/22	0.10	0.25
7/11/22	0.10	0.19
7/13/22	80.00	0.38
7/18/22	23.00	0.61
7/20/22	8.00	0.81
7/25/22	10.00	1.40
7/27/22	58.00	2.12
8/1/22	13.00	5.70
8/3/22	4.00	5.48
8/8/22	10.00	9.14
8/10/22	**1400.00**	15.11
8/15/22	5.00	19.40
8/17/22	40.00	20.85
8/22/22	21.00	22.96
8/24/22	1.00	16.78
8/29/22	72.00	18.21
8/31/22	29.00	19.08

2022 Beach-Monitoring Bacteria Data

Tappen Beach

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
4/11/22	22.00	0.00
4/13/22	***280.00***	***78.49***
4/18/22	0.10	8.51
4/20/22	33.00	11.94
4/25/22	4.00	9.59
4/27/22	3.00	7.90
5/02/22	26.00	9.37
5/04/22	0.10	5.31
5/11/22	1.00	4.41
5/16/22	26.00	2.68
5/18/22	4.00	2.80
5/25/22	0.10	2.06
6/01/22	5.00	2.02
6/06/22	***370.00***	5.18
6/08/22	0.10	2.95
6/13/22	25.00	4.67
6/15/22	52.00	6.31
6/20/22	8.00	5.69
6/22/22	1.00	4.58
6/27/22	8.00	7.91
6/29/22	0.10	4.87
7/06/22	1.00	4.07
7/11/22	***124.00***	5.65
7/13/22	50.00	7.19
7/18/22	10.00	5.01
7/20/22	9.00	5.35
7/25/22	12.00	6.94
7/27/22	***110.00***	9.43
7/29/22	4.00	8.73
8/01/22	13.00	14.99

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
8/03/22	1.00	11.44
8/08/22	21.00	15.51
8/10/22	***320.00***	20.42
8/15/22	12.00	14.78
8/17/22	4.00	13.13
8/22/22	12.00	13.88
8/24/22	3.00	12.08
8/31/22	14.00	10.87

2022 Beach-Monitoring Bacteria Data

Sea Cliff Beach

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
4/11/22	0.10	0.00
4/13/22	0.10	0.10
4/18/22	0.10	0.10
4/20/22	27.00	0.41
4/25/22	0.10	0.31
4/27/22	0.10	0.25
5/02/22	1.00	0.31
5/04/22	0.10	0.27
5/11/22	0.10	0.24
5/16/22	50.00	0.58
5/18/22	0.10	0.48
5/25/22	1.00	0.39
6/01/22	0.10	0.47
6/06/22	1.00	0.61
6/08/22	0.10	0.47
6/13/22	0.10	0.47
6/15/22	1.00	0.52
6/20/22	0.10	0.27
6/22/22	1.00	0.32
6/27/22	2.00	0.34
6/29/22	2.00	0.42
7/06/22	1.00	0.54
7/11/22	5.00	0.82
7/13/22	12.00	1.10
7/18/22	13.00	2.05
7/20/22	4.00	2.21
7/25/22	3.00	3.73
7/27/22	***170.00***	5.70
7/29/22	3.00	5.96
8/01/22	0.10	4.28
8/03/22	1.00	3.70
8/08/22	17.00	4.91
8/10/22	***110.00***	6.51
8/15/22	2.00	5.59
8/17/22	2.00	5.09
8/22/22	3.00	4.50
8/24/22	3.00	4.34
8/29/22	14.00	3.57
8/31/22	2.00	3.37
9/07/22	55.00	7.77
9/14/22	33.00	6.06
9/21/22	1.00	6.44

2022 Beach-Monitoring Bacteria Data

Morgan Memorial Beach

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
4/12/22	0.10	0.00
4/19/22	44.00	2.10
4/26/22	1.00	1.64
5/3/22	1.00	1.45
5/10/22	0.10	0.85
5/17/22	5.00	1.86
5/24/22	0.10	0.55
5/25/22	0.10	0.41
5/31/22	0.10	0.28
6/1/22	15.00	0.50
6/6/22	0.10	0.36
6/7/22	0.10	0.31
6/8/22	2.00	0.38
6/13/22	4.00	0.57
6/14/22	3.00	0.67
6/15/22	6.00	0.82
6/21/22	0.10	0.57
6/22/22	0.10	0.49
6/27/22	3.00	0.78
6/28/22	3.00	0.87
6/29/22	0.10	0.74
7/5/22	0.10	0.57
7/6/22	1.00	0.60
7/11/22	28.00	1.06
7/12/22	***440.00***	1.75
7/13/22	***110.00***	2.40
7/15/22	56.00	2.94
7/18/22	8.00	3.01
7/19/22	27.00	3.56
7/20/22	6.00	3.70

Enterococci		
Date	**CFU/100 ml**	**Log Avg**
7/25/22	***200.00***	8.75
7/26/22	8.00	8.70
7/27/22	36.00	9.56
8/1/22	13.00	16.62
8/2/22	0.10	11.53
8/3/22	0.10	8.40
8/8/22	4.00	12.73
8/9/22	6.00	12.11
8/10/22	***160.00***	14.23
8/16/22	1.00	6.50
8/17/22	1.00	5.69
8/22/22	1.00	4.18
8/23/22	10.00	4.47
8/24/22	8.00	4.66
8/29/22	10.00	2.93
8/30/22	0.10	2.26
8/31/22	1.00	2.13

2022 Beach-Monitoring Bacteria Data

Crescent Beach

Enterococci			
Date	**CFU/100 ml**	**Log Avg**	**Location**
4/12/22	0.10	0.00	CENTER
4/19/22	***130.00***	3.61	CENTER
4/19/22	***360.00***	16.73	LEFT
4/19/22	***140.00***	28.45	RIGHT
4/26/22	0.10	9.19	CENTER
4/26/22	0.10	4.33	LEFT
4/26/22	1.00	3.51	RIGHT
5/3/22	0.10	2.25	CENTER
5/3/22	0.10	1.59	LEFT
5/3/22	1.00	1.52	RIGHT
5/10/22	0.10	1.19	CENTER
5/10/22	0.10	0.97	LEFT
5/10/22	0.10	0.81	RIGHT
5/17/22	0.10	0.81	CENTER
5/17/22	0.10	0.70	LEFT
5/17/22	0.10	0.61	RIGHT
5/23/22	0.10	0.14	CENTER
5/24/22	0.10	0.14	CENTER
5/24/22	0.10	0.14	LEFT
5/24/22	0.10	0.13	RIGHT
5/25/22	1.00	0.15	CENTER
5/25/22	0.10	0.15	LEFT
5/25/22	4.00	0.17	RIGHT
5/31/22	1.00	0.19	CENTER
5/31/22	1.00	0.20	LEFT
5/31/22	1.00	0.22	RIGHT
6/1/22	22.00	0.28	CENTER
6/1/22	12.00	0.33	LEFT
6/1/22	8.00	0.39	RIGHT
6/6/22	4.00	0.47	CENTER
6/6/22	0.10	0.44	LEFT
6/6/22	12.00	0.51	RIGHT
6/7/22	0.10	0.48	CENTER
6/7/22	0.10	0.45	LEFT
6/7/22	0.10	0.42	RIGHT
6/8/22	1.00	0.44	CENTER
6/8/22	0.10	0.41	LEFT
6/8/22	0.10	0.39	RIGHT
6/13/22	4.00	0.50	CENTER
6/13/22	10.00	0.56	LEFT
6/13/22	***300.00***	0.70	RIGHT
6/14/22	2.00	0.73	CENTER
6/14/22	4.00	0.77	LEFT
6/14/22	***130.00***	0.91	RIGHT
6/15/22	2.00	0.93	CENTER
6/15/22	0.10	0.87	LEFT
6/15/22	3.00	0.90	RIGHT
6/21/22	0.10	1.04	CENTER
6/21/22	0.10	0.96	LEFT
6/21/22	0.10	0.90	RIGHT
6/22/22	0.10	0.85	CENTER
6/22/22	0.10	0.80	LEFT
6/22/22	1.00	0.80	RIGHT
6/27/22	1.00	1.07	CENTER
6/27/22	1.00	1.07	LEFT
6/27/22	0.10	0.99	RIGHT
6/28/22	1.00	0.99	CENTER
6/28/22	5.00	1.04	LEFT
6/28/22	18.00	1.12	RIGHT
6/29/22	0.10	1.05	CENTER
6/29/22	0.10	0.99	LEFT
6/29/22	1.00	0.99	RIGHT
7/5/22	0.10	0.74	CENTER
7/5/22	0.10	0.70	LEFT
7/5/22	0.10	0.66	RIGHT
7/6/22	0.10	0.63	CENTER
7/6/22	0.10	0.60	LEFT
7/6/22	0.10	0.57	RIGHT
7/11/22	3.00	0.71	CENTER
7/11/22	2.00	0.73	LEFT
7/11/22	6.00	0.78	RIGHT
7/12/22	27.00	0.86	CENTER

2022 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

Enterococci			
Date	**CFU/100 ml**	**Log Avg**	**Location**
7/12/22	7.00	0.92	LEFT
7/12/22	13.00	0.99	RIGHT
7/13/22	60.00	1.10	CENTER
7/13/22	4.00	1.14	LEFT
7/13/22	70.00	1.27	RIGHT
7/18/22	***2600.00***	1.04	CENTER
7/18/22	***3700.00***	1.34	LEFT
7/18/22	***200.00***	1.56	RIGHT
7/19/22	***6001.00***	1.99	CENTER
7/19/22	***120.00***	2.24	LEFT
7/19/22	***3100.00***	2.74	RIGHT
7/20/22	60.00	2.98	CENTER
7/20/22	27.00	3.16	LEFT
7/20/22	***160.00***	3.49	RIGHT
7/25/22	***200.00***	6.88	CENTER
7/25/22	25.00	7.14	LEFT
7/25/22	20.00	7.34	RIGHT
7/26/22	9.00	7.38	CENTER
7/26/22	4.00	7.27	LEFT
7/26/22	31.00	7.54	RIGHT
7/27/22	1.00	7.17	CENTER
7/27/22	1.00	6.83	LEFT
7/27/22	5.00	6.78	RIGHT
8/1/22	36.00	12.69	CENTER
8/1/22	***160.00***	13.65	LEFT
8/1/22	***100.00***	14.42	RIGHT
8/2/22	6.00	14.08	CENTER
8/2/22	1.00	13.14	LEFT
8/2/22	5.00	12.82	RIGHT
8/3/22	7.00	12.62	CENTER
8/3/22	0.10	11.22	LEFT
8/3/22	1.00	10.59	RIGHT
8/8/22	4.00	21.97	CENTER
8/8/22	1.00	20.26	LEFT
8/8/22	1.00	18.75	RIGHT
8/9/22	34.00	19.03	CENTER

Enterococci			
Date	**CFU/100 ml**	**Log Avg**	**Location**
8/9/22	2.00	18.02	LEFT
8/9/22	52.00	18.48	RIGHT
8/10/22	24.00	18.59	CENTER
8/10/22	10.00	18.33	LEFT
8/10/22	31.00	18.54	RIGHT
8/15/22	4.00	20.46	CENTER
8/15/22	0.10	17.78	LEFT
8/15/22	6.00	17.29	RIGHT
8/17/22	3.00	16.55	CENTER
8/17/22	2.00	15.72	LEFT
8/17/22	2.00	14.97	RIGHT
8/22/22	10.00	5.94	CENTER
8/22/22	13.00	6.08	LEFT
8/22/22	22.00	6.30	RIGHT
8/23/22	7.00	6.31	CENTER
8/23/22	2.00	6.13	LEFT
8/23/22	13.00	6.25	RIGHT
8/24/22	1.00	5.97	CENTER
8/24/22	7.00	5.99	LEFT
8/24/22	2.00	5.83	RIGHT
8/29/22	0.10	4.57	CENTER
8/29/22	2.00	4.46	LEFT
8/29/22	3.00	4.41	RIGHT
8/30/22	25.00	4.62	CENTER
8/30/22	7.00	4.67	LEFT
8/30/22	3.00	4.62	RIGHT

2022 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

Enterococci			
Date	**CFU/100 ml**	**Log Avg**	**Location**
8/31/22	24.00	4.82	CENTER
8/31/22	18.00	4.97	LEFT
8/31/22	17.00	5.12	RIGHT
9/7/22	90.00	5.31	CENTER
9/7/22	29.00	5.58	LEFT
9/7/22	***1700.00***	6.54	RIGHT
9/14/22	80.00	6.76	CENTER
9/14/22	***130.00***	7.48	LEFT
9/14/22	38.00	7.90	RIGHT
9/21/22	0.10	9.52	CENTER
9/21/22	1.00	8.73	LEFT
9/21/22	4.00	8.48	RIGHT

Comparison of Averaged Indicator Bacteria Data for Beaches

The tables in this section display the average values for indicator bacteria for Hempstead Harbor Beaches from 2001-2021. The current year is displayed below, and the previous years follow.

2022

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	57.04	1.92	3.05	57.02	4.58	15.03	156.01
May	Enterococci	2.08	2.72	1.07	9.53	8.72	1.07	161.06
June	Enterococci	7.72	3.82	1.94	52.13	0.82	3.04	56.12
July	Enterococci	49.16	19.29	25.60	40.00	26.38	76.68	382.29
August	Enterococci	85.34	54.33	159.50	44.44	15.41	15.38	365.69
September	Enterococci	—	—	—	—	29.67	—	427.78
Season Averages	Enterococci	42.21	18.55	47.80	41.80	12.89	26.03	260.25

2021

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	14.42	24.02	9.02	19.33	1.88	0.40	10.69
May	Enterococci	5.71	4.75	13.13	9.14	7.16	14.93	96.31
June	Enterococci	20.22	4.33	3.57	46.01	9.34	36.36	85.53
July	Enterococci	152.38	67.89	77.78	72.56	117.56	77.29	279.42
August	Enterococci	165.78	69.67	46.44	163.40	107.50	56.73	178.76
September	Enterococci	—	—	—	—	7.70	1.00**	52.83
Season Averages	Enterococci	79.08	35.59	31.93	68.28	51.31	44.25	143.08

**Only one data point collected.

Comparison of Averaged Indicator Bacteria Data for Beaches

2020

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	—	—	—	—	—	—	—
May	Enterococci	0.10**	17.03	10.40	2.03	0.10	1.05	1.70
June	Enterococci	14.79	4.38	4.79	8.79	13.02	9.59	69.27
July	Enterococci	106.46	13.24	6.90	15.56	10.68	28.94	16.64
August	Enterococci	21.22	31.01	84.63	6.02	3.01	17.32	172.07
September	Enterococci	12.00**	19.00**	21.00	26.00**	96.28	1.55	10.35
Season Averages	Enterococci	48.38	15.89	27.19	9.85	18.41	16.15	71.87

**Only one data point collected.

2019

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	30.47	29.34	45.49	30.17	1.50	0.33	0.73
May	Enterococci	7.55	6.66	2.18	8.03	2.18	2.14	9.26
June	Enterococci	101.14	12.38	10.39	27.01	20.76	112.10	491.37
July	Enterococci	174.20	75.40	46.10	43.30	41.00	108.65	69.14
August	Enterococci	53.89	122.25	44.67	13.25	26.68	45.81	55.97
September	Enterococci	—	—	—	—	—	—	6.90
Season Averages	Enterococci	83.10	50.97	30.52	25.13	20.58	66.14	131.46

Comparison of Averaged Indicator Bacteria Data for Beaches

2018

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	3.64	27.47	4.20	39.76	27.64	1.37	0.73
May	Enterococci	8.31	8.93	1.94	2.68	5.04	1.58	8.36
June	Enterococci	4.93	12.64	25.29	19.16	10.51	25.90	45.84
July	Enterococci	51.91	51.63	7.76	12.65	14.03	37.43	426.19
August	Enterococci	42.17	124.67	14.36	11.79	19.89	13.75	97.82
September	Enterococci	—	—	—	—	—	—	55.09
Season Averages	Enterococci	22.20	45.07	10.71	17.21	15.42	16.00	105.67

2017

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	3.38	11.57	10.17	10.05	1.90	1.40	32.03
May	Enterococci	14.46	14.68	37.80	13.24	20.26	7.96	29.94
June	Enterococci	17.01	56.89	10.51	35.02	19.53	42.08	40.48
July	Enterococci	95.13	71.90	44.78	105.84	14.89	18.52	259.23
August	Enterococci	11.33	12.02	15.10	18.27	52.28	178.44	164.89
September	Enterococci	—	—	—	59.75	—	—	65.33
Season Averages	Enterococci	30.36	34.44	24.73	44.25	24.63	60.41	111.43

Comparison of Averaged Indicator Bacteria Data for Beaches

2016

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	0.58	0.25	0.57	0.88	0.57	63.67	0.92
May	Enterococci	24.17	7.05	10.16	4.89	2.30	10.43	76.97
June	Enterococci	4.58	5.58	2.91	6.57	622.72**	16.37	614.04
July	Enterococci	12.71	9.30	6.86	3.44	6.31	7.28	79.28
August	Enterococci	113.31	34.42	36.48	32.22	29.46	69.47	50.57
September	Enterococci	—	—	—	—	—	—	10.70
Season Averages	Enterococci	36.82	12.94	13.66	11.25	157.55	32.54	172.69

**June monthly average is highly influenced by a single reading that may be an anomaly. Excluding this reading the average for June is 25.13 CFU/100ml and the season average is 15.03 CFU/100ml.

2015

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	0.26	1.28	1.66	24.46	10.62	1.26	2.79
May	Enterococci	27.44	8.00	19.03	23.87	22.47	24.29	12.76
June	Enterococci	680.51	257.39	60.24	68.33	26.67	80.87	86.57
July	Enterococci	20.90	17.69	34.81	18.01	15.34	21.37	28.41
August	Enterococci	12.13	7.46	7.92	4.76	26.44	36.17	15.92
September	Enterococci	4.00**	11.00**	8.00**	0.10**	4.00**	1.00**	6.47
Season Averages	Enterococci	152.28	60.48	27.10	28.33	20.76	38.05	32.65

**Only one data point collected in September.

Comparison of Averaged Indicator Bacteria Data for Beaches

2014

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	20.83	16.05	7.20	8.85	7.55	14.84	224.55
May	Enterococci	223.16	39.91	34.31	37.41	10.33	14.57	9.43
June	Enterococci	103.79	221.71	91.92	74.00	395.65	78.67	470.85
July	Enterococci	8.02	13.68	17.22	24.44	31.44	865.13	78.19
August	Enterococci	139.26	83.51	74.58	96.75	125.79	41.32	461.83
September	Enterococci	—	—	—	—	—	—	15.02
Season Averages	Enterococci	97.63	84.60	50.49	50.89	140.11	263.23	238.04

2013

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	2.55	1.30	22.80	8.03	6.80	2.05	2.13
May	Enterococci	20.03	10.57	38.76	23.90	20.38	25.51	17.39
June	Enterococci	36.38	6.65	73.12	79.33	20.88	40.62	53.47
July	Enterococci	63.00	21.75	5.11	10.42	5.00	51.35	87.59
August	Enterococci	4.13	7.13	16.13	19.01	15.75	18.08	23.53
September	Enterococci	—	—	—	—	—	—	129.63
Season Averages	Enterococci	29.85	11.00	31.78	30.61	14.03	32.67	55.43

Comparison of Averaged Indicator Bacteria Data for Beaches

2012

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	2.73	9.48	3.63	9.90	12.17	16.33	142.11
May	Enterococci	568.26	21.00	11.13	16.78	12.14	5.37	391.34
June	Enterococci	148.00	72.14	98.01	60.26	76.88	37.58	122.06
July	Enterococci	81.38	26.01	8.89	8.64	6.40	12.85	271.13
August	Enterococci	737.67	199.56	53.22	24.67	50.79	32.01	134.05
Season Averages	Enterococci	334.27	73.59	36.22	24.42	32.64	21.65	223.67

2011

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	6.50	20.75	92.50	31.60	14.20	2.67	12.89
May	Enterococci	410.40	40.88	89.63	325.63	48.51	49.50	458.09
June	Enterococci	22.60	24.11	72.30	10.46	29.11	103.07	209.16
July	Enterococci	74.50	113.90	63.30	13.44	19.59	54.24	50.28
August	Enterococci	21.22	49.23	28.41	7.52	19.81	63.44	199.22
Season Averages	Enterococci	122.96	52.14	64.93	77.60	27.14	65.64	223.31

Comparison of Averaged Indicator Bacteria Data for Beaches

2010

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	6.82	9.42	12.44	22.60	2.24	0.10	24.22
May	Enterococci	17.88	14.50	8.14	30.89	23.65	42.01	338.19
June	Enterococci	94.37	12.48	17.02	14.01	56.85	87.34	78.69
July	Enterococci	65.00	19.22	14.11	88.23	54.55	76.10	286.52
August	Enterococci	104.34	89.23	77.12	44.13	159.64	86.84	113.02
September	Enterococci	—	7.00**	13.00**	1.00**	11.00**	0.10**	369.83
Season Averages	Enterococci	65.22	29.61	26.22	40.19	67.48	68.40	208.47

** Only one data point collected in September.

2009

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach	Morgan Memorial Beach	Crescent Beach
April	Enterococci	2.20	1.52	1.53	2.52	9.70	3.73	4.03
May	Enterococci	6.78	5.16	4.14	4.03	5.78	3.74	20.29
June	Enterococci	104.24	47.22	290.88	247.31	21.46	23.86	634.65
July	Enterococci	31.03	102.89	206.46	23.24	26.62	46.34	231.47
August	Enterococci	84.00	86.24	16.82	7.37	70.36	79.14	282.44
September	Enterococci	4.00**	120**	90.00**	0.10**	11.00**	3.00**	19.86
Season Averages*	Enterococci	48.69	54.70	109.23	65.02	29.97	40.35	290.61

*Average of monthly averages

**Only one data point collected in September.

Comparison of Averaged Indicator Bacteria Data for Beaches

2008[1]

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach
April	Enterococci	0.42	3.53	14.70	3.52	1.72
May	Enterococci	26.04	5.15	33.75	18.65	68.13
June	Enterococci	8.42	77.31	23.81	29.80	54.40
July	Enterococci	85.59	13.41	23.61	47.60	97.41
August	Enterococci	161.00	11.88	427.56	28.51	65.88
Season Averages*	Enterococci	56.29	22.26	104.69	25.62	57.51

*Average of monthly averages

[1] First year in which enterococci was the only indicator bacteria monitored.

2007

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach
April	Enterococci	7.62	8.82	15.02	35.8	73.42
	Fecal Coliform	**8.82**	**14.22**	**12.42**	**89**	**5.64**
May	Enterococci	16.22	35.91	26.36	43.92	9.49
	Fecal Coliform	**29.36**	**157**	**84.68**	**49.89**	**17.8**
June	Enterococci	38.39	45.11	46.44	14.89	10.57
	Fecal Coliform	**27.38**	**438.56**	**219**	**130.67**	**73.33**
July	Enterococci	143.89	51.33	36.4	16.4	10.52
	Fecal Coliform	**890.25**	**877**	**581**	**519.6**	**193.70**
August	Enterococci	297	188.44	68.56	17.78	72.78
	Fecal Coliform	**166.11**	**1173**	**272.8**	**248.44**	**358.33**
Season Averages*	Enterococci	100.62	65.92	38.56	25.76	35.35
	Fecal Coliform	**224.38**	**531.96**	**233.9**	**207.52**	**129.76**

*Average of monthly averages

Comparison of Averaged Indicator Bacteria Data for Beaches

2006

	Units in CFU/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach
April	Enterococci	0.1	0.1	0.1	2	0.1
	Fecal Coliform	**7**	**0.6**	**1**	**5**	**0.6**
May	Enterococci	7	16	35	333	73
	Fecal Coliform	**16**	**9**	**100**	**20**	**14**
June	Enterococci	6	27	30	33	12
	Fecal Coliform	**9**	**98**	**107**	**73**	**68**
July	Enterococci	68	46	40	35	47
	Fecal Coliform	**259**	**567**	**154**	**150**	**277**
August	Enterococci	120	46	76	11	65
	Fecal Coliform	**106**	**97**	**100**	**94**	**51**
Season Averages*	Enterococci	40	27	36	83	39
	Fecal Coliform	**79**	**151**	**92**	**69**	**82**

*Average of monthly averages

2005

	Units in MPN/100 mlS	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach
April	Enterococci	1	5	33	12	1
	Fecal Coliform	**12**	**60**	**289**	**19**	**43**
May	Enterococci	8	29	33	19	13
	Fecal Coliform	**15**	**89**	**120.23**	**21**	**18**
June	Enterococci	9	20	9	5	3
	Fecal Coliform	**77**	**330**	**118**	**87**	**86**
July	Enterococci	17	26	6	15	39
	Fecal Coliform	**176**	**561**	**159**	**472**	**596**
August	Enterococci	186	50	79	20	18
	Fecal Coliform	**265**	**166**	**256**	**346**	**239**
Season Averages*	Enterococci	44.2	26	32	14.2	14.8
	Fecal Coliform	**109**	**241**	**188**	**189**	**196**

*Average of monthly averages

Comparison of Averaged Indicator Bacteria Data for Beaches

2004

	Units in MPN/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**
April	Total Coliform	57	76	36	265	161
	Fecal Coliform	**4**	**71**	**29**	**66**	**25**
May	Total Coliform	140	1137	1910	851	22029
	Fecal Coliform	**46**	**141**	**822**	**210**	**3859**
June	Total Coliform	168	1179	560	701	864
	Fecal Coliform	**44**	**615**	**167**	**557**	**298**
July	Total Coliform	146	2353	571	790	624
	Fecal Coliform	**43**	**460**	**341**	**301**	**222**
August	Total Coliform	634	993	445	414	727
	Fecal Coliform	**375**	**905**	**383**	**313**	**442**
September	Total Coliform	*700*	*22*	*17*	*80*	*230*
	Fecal Coliform	***500***	***17***	***11***	***80***	***130***
Season Averages*	Total Coliform	268	1582	701	682	3574
	Fecal Coliform	**126**	**505**	**359**	**337**	**761**

*Average of monthly averages

2003

	Units in MPN/100 ml	**Village Club of Sands Point**	**North Hempstead Beach Park (N) (former Hempstead Harbor Beach)**	**North Hempstead Beach Park (S) (former Bar Beach)**	**Tappen Beach**	**Sea Cliff Beach**
April	Total Coliform	13	140	159	155	19
	Fecal Coliform	**8**	**44**	**152**	**19**	**5**
May	Total Coliform	161	122	130	154	1277
	Fecal Coliform	**62**	**35**	**47**	**88**	**143**
June	Total Coliform	197	1747	478	724	915
	Fecal Coliform	**80**	**136**	**64**	**255**	**111**
July	Total Coliform	239	781	1237	517	1810
	Fecal Coliform	**65**	**539**	**874**	**203**	**304**
August	Total Coliform	347	678	804	2117	22364
	Fecal Coliform	**81**	**344**	**334**	**1904**	**3114**
September	Total Coliform	*6567*	*3500*	*1033*	*910*	*1820*
	Fecal Coliform	***977***	***1090***	***177***	***274***	***110***
Season Averages*	Total Coliform	632	949	816	1097	8735
	Fecal Coliform	**126**	**370**	**421**	**809**	**1222**

*Average of monthly averages

Comparison of Averaged Indicator Bacteria Data for Beaches

2002

	Units in MPN/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach
April	Total Coliform	160	326	157	728	163
	Fecal Coliform	**44**	**39**	**11**	**658**	**53**
May	Total Coliform	130	145	127	282	194
	Fecal Coliform	**76**	**124**	**78**	**169**	**46**
June	Total Coliform	560	674	431	1604	750
	Fecal Coliform	**123**	**559**	**168**	**1016**	**154**
July	Total Coliform	613	1921	964	2770	4779
	Fecal Coliform	**246**	**810**	**831**	**1367**	**210**
August	Total Coliform	4773	3277	6202	1625	1832
	Fecal Coliform	**2593**	**2971**	**2130**	**1278**	**839**
Season Averages*	Total Coliform	1226	1969	3096	1463	1626
	Fecal Coliform	**605**	**1637**	**1133**	**1008**	**451**

*Average of monthly averages

2001

	Units in MPN/100 ml	Village Club of Sands Point	North Hempstead Beach Park (N) (former Hempstead Harbor Beach)	North Hempstead Beach Park (S) (former Bar Beach)	Tappen Beach	Sea Cliff Beach
April	Total Coliform	26	239	68	194	86
	Fecal Coliform	**9**	**85**	**36**	**103**	**43**
May	Total Coliform	559	486	364	944	1689
	Fecal Coliform	**21**	**83**	**106**	**555**	**274**
June	Total Coliform	2373	974	1091	1045	494
	Fecal Coliform	**157**	**488**	**451**	**365**	**60**
July	Total Coliform	242	6025	11526	1308	1501
	Fecal Coliform	**44**	**3458**	**11297**	**566**	**399**
August	Total Coliform	2183	3360	2594	12230	24148
	Fecal Coliform	**124**	**1000**	**1872**	**10285**	**1623**
September	Total Coliform	468	348	570	1500	1100
	Fecal Coliform	**53**	**110**	**116**	**1308**	**300**
Season Averages*	Total Coliform	**1143**	**2848**	**4187**	**4513**	**9080**
	Fecal Coliform	**75**	**1325**	**3754**	**3559**	**717**

*Average of monthly averages

Appendix D

2022 Nitrogen Data

TKN (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/19/22	0.95	<0.50	<0.50	3.9	1.6	0.71	<0.50	1.2	1.1	1.1
10/6/22	0.65	0.60	—	—	0.90	<0.50	<0.50	—	—	—
9/21/22	1.1	1.1	0.94	0.99	1.4	0.85	<0.50	<0.50	2.0	<0.50
9/8/22	1.6	0.95	1.6	1.6	1.4	1.3	1.4	<0.50	2.3	1.2
8/24/22	<0.50	1.8	<0.50	2.6	1.0	0.52	1.6	2.2	3.1	<0.50
8/10/22	1.6	0.81	1.7	1.0	1.2	1.2	1.5	<0.50	1.8	0.97
7/27/22	<0.50	<0.50	—	—	<0.50	<0.50	<0.50	<0.50	2.3	<0.50
7/13/22	1.0	0.84	—	—	1.2	2.5	0.54	<0.50	2.1	<0.50
6/29/22	<0.50	<0.50	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
6/15/22	<0.50	<0.50	—	—	0.72	0.84	<0.50	1.0	0.66	<0.50
6/1/22	3.8	2.7	—	—	2.1	1.2	1.9	<0.50	2.5	<0.50
5/18/22	0.84	1.1	—	—	2.7	1.8	—	<0.50	2.1	0.52

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2022 Nitrogen Data

Total Organic N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/19/22	0.89	0.19	0.24	3.6	1.3	0.45	<0.10	1.0	1.0	1.1
10/6/22	0.40	0.49	—	—	0.77	<0.10	0.30	—	—	—
9/21/22	1.1	1.0	0.73	0.54	1.1	0.69	0.15	0.28	1.9	<0.10
9/8/22	1.4	0.84	1.3	1.2	1.3	1.1	1.2	<0.10	2.0	1.1
8/24/22	0.21	1.8	0.25	2.3	0.89	0.39	1.5	1.6	3.0	0.28
8/10/22	1.5	0.77	1.5	0.72	1.1	0.95	1.2	<0.10	1.5	0.97
7/27/22	0.20	0.19	—	—	<0.10	<0.10	<0.10	<0.10	2.1	<0.10
7/13/22	1.0	0.83	—	—	1.1	2.4	0.43	<0.10	2.1	0.28
6/29/22	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	0.35	<0.10
6/15/22	0.34	0.38	—	—	0.58	0.82	<0.10	<0.10	0.53	<0.10
6/1/22	3.6	2.7	—	—	1.8	1.1	1.8	<0.10	2.3	<0.10
5/18/22	0.74	1.0	—	—	2.3	1.7	—	<0.10	2.0	0.48

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2022 Nitrogen Data

Ammonia as N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/19/22	<0.10	<0.10	0.16	0.25	0.29	0.26	0.22	0.18	<0.10	<0.10
10/6/22	0.24	0.11	—	—	0.13	0.12	0.13	—	—	—
9/21/22	<0.10	<0.10	0.20	0.45	0.33	0.15	0.23	0.15	<0.10	<0.10
9/8/22	0.19	0.11	0.31	0.38	0.16	0.20	0.23	0.77	0.29	<0.10
8/24/22	<0.10	<0.10	<0.10	0.34	0.14	0.13	0.13	0.60	0.13	<0.10
8/10/22	<0.10	<0.10	0.22	0.31	0.12	0.25	0.27	0.66	0.27	<0.10
7/27/22	<0.10	<0.10	—	—	<0.10	0.10	0.17	0.83	0.25	<0.10
7/13/22	<0.10	<0.10	—	—	<0.10	<0.10	0.10	0.78	<0.10	<0.10
6/29/22	0.12	<0.10	—	—	0.19	0.13	0.16	0.74	<0.10	<0.10
6/15/22	<0.10	<0.10	—	—	0.15	<0.10	<0.10	0.97	0.13	<0.10
6/1/22	0.18	<0.10	—	—	0.26	0.11	<0.10	0.63	0.11	<0.10
5/18/22	0.10	<0.10	—	—	0.45	0.16	—	0.88	0.11	<0.10

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2022 Nitrogen Data

Nitrite as N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/19/22	<0.050	<0.050	<0.050	<0.050	0.073	<0.050	<0.050	<0.050	0.051	<0.050
10/6/22	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	—	—	—
9/21/22	<0.050	<0.050	<0.050	<0.050	0.068	<0.050	<0.050	<0.050	<0.050	<0.050
9/8/22	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.084	0.072	<0.050
8/24/22	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.071	0.070	<0.050
8/10/22	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.096	0.060	<0.050
7/27/22	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	0.072	<0.050	<0.050
7/13/22	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	0.096	<0.050	<0.050
6/29/22	<0.050	<0.050	—	—	0.054	<0.050	<0.050	0.066	<0.050	<0.050
6/15/22	<0.050	<0.050	—	—	0.054	<0.050	<0.050	0.086	<0.050	<0.050
6/1/22	<0.050	<0.050	—	—	0.073	<0.050	<0.050	0.097	<0.050	<0.050
5/18/22	<0.050	<0.050	—	—	0.093	<0.050	—	0.074	<0.050	<0.050

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2022 Nitrogen Data

Nitrate as N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/19/22	0.13	0.14	0.25	0.22	1.4	1.2	2.7	0.96	4.1	0.11
10/6/22	0.25	0.16	—	—	0.58	0.50	0.62	—	—	—
9/21/22	0.12	0.12	0.22	0.43	0.70	0.62	0.89	0.67	3.7	0.13
9/8/22	0.060	0.093	0.17	0.62	0.39	0.22	9.0	3.2	<0.050	0.057
8/24/22	<0.050	0.082	0.13	0.22	0.90	1.2	1.5	9.0	3.9	<0.050
8/10/22	0.083	<0.050	0.074	0.096	0.51	0.49	0.53	9.9	2.8	<0.050
7/27/22	<0.050	0.16	—	—	0.53	0.54	1.1	0.43	1.1	<0.050
7/13/22	0.054	0.091	—	—	0.77	0.24	0.34	9.7	2.9	<0.050
6/29/22	<0.050	<0.050	—	—	0.44	0.61	0.68	4.6	1.4	<0.050
6/15/22	<0.050	<0.050	—	—	0.73	0.35	0.21	8.0	3.2	<0.050
6/1/22	<0.050	<0.050	—	—	1.3	0.35	0.32	9.7	2.8	<0.050
5/18/22	0.097	<0.050	—	—	1.2	1.6	—	0.91	1.9	<0.050

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2022 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/19/22	0.17	0.18	0.45	0.51	1.8	1.5	3.0	1.2	4.1	0.15
10/6/22	0.53	0.31	—	—	0.75	0.66	0.79	—	—	—
9/21/22	0.14	0.14	0.45	0.91	1.10	0.80	1.1	0.86	3.7	0.17
9/8/22	0.28	0.24	0.51	1.03	0.59	0.45	9.2	4.0	0.38	0.09
8/24/22	0.067	0.09	0.14	0.58	1.08	1.3	1.6	9.7	4.1	0
8/10/22	0.083	0	0.29	0.41	0.65	0.76	0.80	10.7	3.2	0
7/27/22	0	0.16	—	—	0.56	0.66	1.3	1.3	1.4	0
7/13/22	0.054	0.091	—	—	0.79	0.24	0.44	10.6	2.9	0
6/29/22	0.12	0	—	—	0.69	0.77	0.86	5.4	1.5	0
6/15/22	0	0	—	—	0.93	0.37	0.23	9.1	3.3	0
6/1/22	0.18	0	—	—	1.6	0.47	0.34	10.4	2.9	0
5/18/22	0.20	0	—	—	1.8	1.9	—	1.9	2.1	0

Notes:

Total Inorganic Nitrogen = Ammonia + (Nitrate + Nitrite); lab methodology results in a combined nitrate/nitrite value, which is used here to calculate Total Inorganic Nitrogen.

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2022 Nitrogen Data

Total N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/19/22	1.1	0.42	0.69	4.2	3.1	2.0	2.8	2.2	5.2	1.3
10/6/22	0.94	0.80	—	—	1.5	0.70	1.1	—	—	—
9/21/22	1.3	1.2	1.2	1.5	2.2	1.5	1.3	1.1	5.7	0.17
9/8/22	1.7	1.1	1.8	2.2	1.9	1.5	10.4	3.4	2.4	1.3
8/24/22	0.35	1.9	0.48	2.8	2.0	1.8	3.1	11.3	7.1	0.30
8/10/22	1.7	0.84	1.8	1.1	1.7	1.7	2.0	10.2	4.6	0.97
7/27/22	0.24	0.35	—	—	0.56	0.56	1.1	0.50	3.4	<0.10
7/13/22	1.1	0.93	—	—	1.9	2.7	0.87	9.8	5.0	0.29
6/29/22	<0.10	<0.10	—	—	0.50	0.64	0.70	4.7	1.9	<0.10
6/15/22	0.37	0.40	—	—	1.5	1.2	0.24	9.1	3.9	<0.10
6/1/22	3.8	2.7	—	—	3.4	1.6	2.3	9.8	5.3	<0.10
5/18/22	0.94	1.1	—	—	4.0	3.5	—	0.98	4.1	0.52

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2021 Nitrogen Data

TKN (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	2.1	2.0	—	—	3.5	3.5	2.8	3.1	2.5	3.4	—
10/13/21	<0.50	<0.50	—	—	--	1.8	1.6	1.6	0.85	<0.50	<0.50
9/29/21	2.5	1.5	—	—	3.2	—	2.2	3.4	2.4	4.6	2.9
9/15/21	<0.50	<0.50	—	—	1.6	—	4.0	0.89	<0.50	<0.50	2.0
9/3/21	<0.50	<0.50	<0.50	<0.50	<0.50	—	2.8	<0.50	<0.50	<0.50	<0.50
8/18/21	<0.50	<0.50	<0.50	2.2	2.0	—	<0.50	1.4	<0.50	<0.50	<0.50
8/4/21	0.59	1.2	1.5	2.6	0.85	—	<0.50	1.3	1.0	2.1	<0.50
7/21/21	1.3	<0.50	<0.50	<0.50	<0.50	—	<0.50	<0.50	0.88	1.4	<0.50
7/7/21	2.0	2.8	1.7	1.7	3.7	—	—	—	4.7	3.3	1.3
6/23/21	3.1	2.0	4.1	3.1	3.9	—	—	—	3.2	5.8	<0.50
6/9/21	<0.50	0.69	—	—	5.2	—	1.1	<0.50	<0.50	1.6	<0.50
5/26/21	1.7	0.92	—	—	3.7	—	—	2.2	2.2	1.3	<0.50

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2021 Nitrogen Data

Total Organic N (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #8A	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/28/21	1.8	1.8	—	—	3.1	3.3	2.4	2.6	2.2	3.2	—
10/13/21	<0.10	<0.10	—	—	—	1.2	1.2	1.1	0.55	<0.10	<0.10
9/29/21	2.4	1.4	—	—	2.8	—	1.8	2.9	2.2	4.5	2.8
9/15/21	<0.10	<0.10	—	—	0.89	—	3.4	<0.10	<0.10	<0.10	2.0
9/3/21	<0.10	<0.10	<0.10	<0.10	<0.10	—	2.3	<0.10	<0.10	<0.10	<0.10
8/18/21	<0.10	<0.10	<0.10	1.9	1.1	—	<0.10	1.0	<0.10	<0.10	<0.10
8/4/21	0.44	1.1	1.1	2.3	0.29	—	<0.10	0.70	0.85	2.0	0.11
7/21/21	1.2	<0.10	<0.10	<0.10	<0.10	—	<0.10	<0.10	<0.10	1.3	0.23
7/7/21	1.9	2.8	1.6	1.5	2.2	—	—	—	3.7	3.2	1.3
6/23/21	3.0	2.0	4.0	3.0	1.7	—	—	—	2.3	5.6	<0.10
6/9/21	<0.10	0.64	—	—	1.3	—	0.70	<0.10	<0.10	1.5	0.39
5/26/21	1.6	0.87	—	—	0.94	—	—	2.0	1.3	1.2	<0.10

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2021 Nitrogen Data

Ammonia as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	0.34	0.19	—	—	0.34	0.25	0.37	0.46	0.36	0.22	—
10/13/21	0.25	<0.10	—	—	—	0.61	0.38	0.40	0.30	0.17	<0.10
9/29/21	0.12	0.13	—	—	0.37	—	0.38	0.46	0.18	0.15	<0.10
9/15/21	<0.10	0.13	—	—	0.68	—	0.62	1.0	0.23	0.16	<0.10
9/3/21	0.20	0.10	0.27	0.54	0.30	—	0.46	0.43	0.86	0.21	<0.10
8/18/21	0.13	0.11	0.22	0.28	0.92	—	0.41	0.37	0.19	0.11	<0.10
8/4/21	0.15	0.10	0.36	0.32	0.56	—	0.21	0.55	0.18	0.11	0.13
7/21/21	0.12	0.37	0.23	0.30	0.64	—	0.37	0.40	0.97	<0.10	<0.10
7/7/21	<0.10	<0.10	0.18	0.18	1.4	—	—	—	1.0	0.12	<0.10
6/23/21	<0.10	<0.10	<0.10	0.14	2.2	—	—	—	0.94	0.20	<0.10
6/9/21	0.24	<0.10	—	—	3.9	—	0.45	0.33	0.87	0.12	<0.10
5/26/21	0.10	<0.10	—	—	2.8	—	—	0.19	0.94	0.11	<0.10

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2021 Nitrogen Data

Nitrite as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	—
10/13/21	<0.050	<0.050	—	—	--	0.057	<0.050	<0.050	<0.050	<0.050	<0.050
9/29/21	<0.050	<0.050	—	—	<0.050	—	<0.050	<0.050	<0.050	<0.050	<0.050
9/15/21	<0.050	<0.050	—	—	0.088	—	<0.050	<0.050	<0.050	<0.050	<0.050
9/3/21	<0.050	<0.050	<0.050	<0.050	<0.050	—	<0.050	<0.050	<0.050	<0.050	<0.050
8/18/21	<0.050	<0.050	<0.050	<0.050	0.16	—	<0.050	<0.050	<0.050	<0.050	<0.050
8/4/21	<0.050	<0.050	<0.050	<0.050	0.13	—	<0.050	<0.050	<0.050	0.058	<0.050
7/21/21	<0.050	<0.050	<0.050	<0.050	0.091	—	<0.050	<0.050	0.11	<0.050	<0.050
7/7/21	<0.050	<0.050	<0.050	<0.050	0.073	—	—	—	0.073	0.052	<0.050
6/23/21	<0.050	<0.050	<0.050	<0.050	0.064	—	—	—	0.11	<0.050	<0.050
6/9/21	<0.050	<0.050	—	—	0.21	—	<0.050	<0.050	0.12	0.077	<0.050
5/26/21	<0.050	<0.050	—	—	0.40	—	—	<0.050	0.36	0.14	<0.050

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2021 Nitrogen Data

Nitrate as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	0.21	0.17	—	—	0.44	1.1	0.42	0.36	0.70	1.4	—
10/13/21	0.20	0.19	—	—	—	1.6	0.63	0.43	0.95	1.5	0.13
9/29/21	<0.050	0.064	—	—	0.97	—	0.19	0.15	0.43	4.7	<0.050
9/15/21	0.12	0.16	—	—	1.2	—	0.84	1.2	0.48	0.63	0.092
9/3/21	0.12	0.063	0.21	0.70	0.91	—	0.46	0.44	2.2	0.88	0.058
8/18/21	<0.050	<0.050	<0.050	<0.050	2.7	—	0.14	0.14	0.12	0.21	<0.050
8/4/21	<0.050	<0.050	0.092	0.17	1.1	—	0.33	0.56	0.68	3.7	<0.050
7/21/21	<0.050	<0.050	<0.050	0.11	0.69	—	0.40	0.34	4.6	1.9	<0.050
7/7/21	<0.050	<0.050	<0.050	0.086	1.1	—	—	—	7.9	2.5	<0.050
6/23/21	<0.050	<0.050	<0.050	<0.050	0.88	—	—	—	9.2	3.1	<0.050
6/9/21	0.11	<0.050	—	—	0.48	—	0.78	1.2	8.3	3.9	<0.050
5/26/21	0.055	<0.050	—	—	0.41	—	—	1.4	8.5	3.8	<0.050

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2021 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	0.58	0.39	—	—	0.81	1.35	0.81	0.84	1.08	1.62	—
10/13/21	0.47	0.22	—	—	—	—	1.05	0.9	1.28	1.67	0.15
9/29/21	0.182	0.216	—	—	1.37	—	0.59	0.63	0.63	4.95	0.1
9/15/21	0.15	0.31	—	—	1.98	—	1.51	2.2	0.74	0.82	0.12
9/3/21	0.33	0.178	0.49	1.27	1.23	—	0.94	0.9	3.06	1.12	0.078
8/18/21	0.13	0.11	0.22	0.28	3.72	—	0.58	0.53	0.33	0.34	0
8/4/21	0.15	0.1	0.452	0.49	1.86	—	0.57	1.15	0.88	3.81	0.13
7/21/21	0.12	0.37	0.288	0.42	1.42	—	0.81	0.78	5.67	2	0
7/7/21	0	0	0.18	0.266	2.6	—	—	—	9	2.72	0
6/23/21	0	0	0	0.14	3.14	—	—	—	10.24	3.3	0
6/9/21	0.38	0	—	—	4.58	—	1.3	1.53	9.27	4.12	0
5/26/21	0.155	0	—	—	3.61	—	—	1.59	9.84	4.01	0

Notes:

Total Inorganic Nitrogen = Ammonia + (Nitrate + Nitrite); lab methodology results in a combined nitrate/nitrite value, which is used here to calculate Total Inorganic Nitrogen.

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2021 Nitrogen Data

Total N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #8A**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/28/21	2.4	2.2	—	—	3.9	4.6	3.2	3.5	3.2	4.8	—
10/13/21	0.22	0.22	—	—	—	3.5	2.3	2.0	1.8	1.5	0.15
9/29/21	2.5	1.6	—	—	4.2	—	2.4	3.5	2.8	9.4	3.0
9/15/21	0.15	0.18	—	—	2.8	—	4.9	2.1	0.51	0.66	2.2
9/3/21	0.30	<0.10	0.39	0.89	0.93	—	3.3	0.63	2.7	1.1	0.24
8/18/21	<0.10	<0.10	<0.10	2.2	4.8	—	0.17	1.6	0.14	0.23	<0.10
8/4/21	0.62	1.2	1.6	2.8	2.1	—	0.36	1.9	1.7	5.9	0.24
7/21/21	1.4	<0.10	0.37	0.12	0.78	—	0.44	0.38	5.6	3.3	0.31
7/7/21	2.0	2.9	1.8	1.8	4.8	—	—	—	12.7	5.8	1.3
6/23/21	3.1	2.0	4.1	3.1	4.8	—	—	—	12.5	9.0	<0.10
6/9/21	0.14	0.72	—	—	5.9	—	2.0	1.2	8.6	5.5	0.46
5/26/21	1.8	0.92	—	—	4.5	—	—	3.6	11.1	5.2	<0.10

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2020 Nitrogen Data

TKN (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	—	—	<0.50	1.4	—	—	7.3	—	—	—	—
10/22/20	1.5	1.4	—	—	2.6	<0.50	—	—	—	—	<0.50
10/21/20	—	—	—	—	—	—	—	1.6	1.9	—	—
10/7/20	1.6	1.5	—	—	4.0	1.5	2.6	2.7	<0.50	—	1.6
9/23/20	1.3	2.0	—	—	1.2	0.59	0.55	1.8	1.5	—	1.0
9/9/20	<0.250	<0.250	—	—	0.748	<0.250	--	1.440	0.971	—	<0.250
8/26/20	1.4	1.9	—	—	2.4	2.5	2.1	1.1	2.9	—	1.1
8/12/20	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	1.6	—	<0.10
7/29/20	<0.10	<0.10	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	—	<0.10
7/15/20	<0.10	<0.10	<0.10	<0.10	—	<0.10	—	<0.10	<0.10	—	<0.10
7/1/20	0.45	0.20	1.5	0.51	—	0.21	—	—	—	—	0.14
6/17/20	<1.0	<1.0	<1.0	<1.0	—	<1.0	<1.0	1.1	1.4	—	<1.0
6/3/20	<0.10	<0.10	<0.10	<0.10	—	<0.10	<0.10	<0.10	1.2	—	<0.10
5/20/20	—	—	—	—	—	—	—	<0.10	0.74	0.72	—

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Total Organic N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	—	—	—	1.0	—	—	7.0	—	—	—	—
10/22/20	1.2	1.3	—	—	2.3	<0.10	—	<0.10	—	—	<0.10
10/21/20	—	—	—	—	—	—	—	--	1.8	—	—
10/7/20	1.3	1.4	—	—	3.7	1.4	2.5	1.2	<0.10	—	1.5
9/23/20	1.2	1.9	—	—	1.0	0.49	0.39	1.6	1.4	—	1.0
9/9/20	<0.25	<0.25	—	—	0.75	<0.25	—	<0.10	0.97	—	<0.25
8/26/20	1.3	1.9	—	—	2.4	2.0	1.8	0.87	2.8	—	1.0
8/12/20	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	1.5	—	<0.10
7/29/20	<0.10	<0.10	<0.10	<0.10	—	<0.10	<0.10	<0.10	<0.10	—	<0.10
7/15/20	<0.10	<0.10	<0.10	<0.10	—	<0.10	—	<0.10	<0.10	—	<0.10
7/1/20	0.18	<0.10	1.2	<0.10	—	<0.10	—	—	—	—	<0.10
6/17/20	<0.10	<0.10	<0.10	<0.10	—	<0.10	<0.10	0.25	1.4	—	<0.10
6/3/20	<0.10	<0.10	<0.10	<0.10	—	<0.10	<0.10	<0.10	0.94	—	<0.10
5/20/20	—	—	—	—	—	—	—	<0.10	0.63	0.63	—

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Ammonia as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	—	—	0.37	0.35	—	—	0.23	—	—	—	—
10/22/20	0.30	0.13	—	—	0.28	0.22	—	—	—	—	<0.10
10/21/20	—	—	—	—	—	—	—	1.6	0.12	—	—
10/7/20	0.29	<0.10	—	—	0.36	<0.10	0.11	1.5	<0.10	—	<0.10
9/23/20	0.10	<0.10	—	—	0.20	0.10	0.16	0.15	0.11	—	<0.10
9/9/20	<0.250	<0.250	—	—	<0.250	<0.250	—	1.400	<0.250	—	<0.250
8/26/20	<0.10	<0.10	—	—	<0.10	0.50	0.24	0.20	<0.10	—	<0.10
8/12/20	0.14	0.14	—	—	0.26	0.23	0.18	0.18	<0.10	—	<0.10
7/29/20	0.20	0.13	0.36	0.36	—	0.18	0.33	0.17	<0.10	—	0.13
7/15/20	0.21	0.13	0.31	0.37	—	0.17	—	0.20	0.14	—	<0.10
7/1/20	0.27	0.10	0.33	0.46	—	0.19	—	—	—	—	<0.10
6/17/20	<0.10	<0.10	<0.10	<0.10	—	<0.10	<0.10	0.85	<0.10	—	<0.10
6/3/20	<0.10	<0.10	<0.10	<0.10	—	<0.10	0.12	<0.10	0.29	—	<0.10
5/20/20	—	—	—	—	—	—	—	0.85	0.11	<0.10	—

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Nitrite as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	—	—	<0.050	<0.050	—	—	<0.050	—	—	—	—
10/22/20	<0.050	<0.050	—	—	0.070	<0.050	—	—	—	—	<0.050
10/21/20	—	—	—	—	—	—	—	0.11	<0.050	—	—
10/7/20	<0.050	<0.050	—	—	0.12	<0.050	<0.050	0.14	<0.050	—	<0.050
9/23/20	<0.050	<0.050	—	—	0.070	<0.050	<0.050	<0.050	<0.050	—	<0.050
9/9/20	<0.050	<0.050	—	—	<0.050	<0.050	—	0.10	0.057	—	<0.050
8/26/20	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	—	<0.050
8/12/20	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	0.057	—	<0.050
7/29/20	<0.050	<0.050	<0.050	<0.050	—	<0.050	<0.050	<0.050	<0.050	—	<0.050
7/15/20	<0.050	<0.050	<0.050	<0.050	—	<0.050	—	<0.050	<0.050	—	<0.050
7/1/20	<0.050	<0.050	<0.050	<0.050	—	<0.050	—	—	—	—	<0.050
6/17/20	<0.050	<0.050	<0.050	<0.050	—	<0.050	<0.050	0.094	0.094	—	<0.050
6/3/20	<0.050	<0.050	<0.050	<0.050	—	<0.050	<0.050	<0.050	0.099	—	<0.050
5/20/20	—	—	—	—	—	—	—	0.13	0.11	0.11	—

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Nitrate as N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	—	—	0.38	0.62	—	—	1.1	—	—	—	—
10/22/20	0.25	0.27	—	—	2.5	0.81	—	—	—	—	0.20
10/21/20	—	—	—	—	—	—	—	9.2	5.5	—	—
10/7/20	0.24	0.13	—	—	3.9	2.2	4.8	11.6	0.074	—	6.6
9/23/20	0.22	0.22	—	—	1.9	1.2	1.7	0.85	2.1	—	0.12
9/9/20	<0.050	<0.050	—	—	1.7	<0.050	—	8.7	4.4	—	<0.050
8/26/20	<0.050	0.052	—	—	0.32	0.15	0.51	0.89	4.2	—	<0.050
8/12/20	<0.050	<0.050	—	—	0.86	0.55	1.0	0.68	4.9	—	<0.050
7/29/20	<0.050	<0.050	<0.050	0.18	—	0.53	0.81	0.52	0.67	—	<0.050
7/15/20	<0.050	0.15	<0.050	0.24	—	0.45	—	0.56	0.88	—	<0.050
7/1/20	<0.050	<0.050	0.063	0.34	—	0.71	—	—	—	—	<0.050
6/17/20	<0.050	<0.050	<0.050	0.078	—	0.88	<0.050	8.8	3.7	—	<0.050
6/3/20	<0.050	<0.050	0.052	0.28	—	0.85	2.4	0.87	3.4	—	<0.050
5/20/20	—	—	—	—	—	—	—	10.4	5.0	5.8	—

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	—	—	0.78	1.00	—	—	1.43	—	—	—	—
10/22/20	0.58	0.43	—	—	2.88	1.06	—	—	—	—	0.23
10/21/20	—	—	—	—	—	—	—	10.9	5.72	—	—
10/7/20	0.55	0.14	—	—	4.36	2.2	4.91	13.2	0.093	—	6.70
9/23/20	0.35	0.25	—	—	2.1	1.3	1.96	1.04	2.21	—	0.16
9/9/20	0	0	—	—	1.7	0	--	10.3	4.5	—	0
8/26/20	0	0.05	—	—	0.32	0.65	0.75	1.1	4.2	—	0
8/12/20	0.14	0.14	—	—	1.13	0.8	1.28	0.88	4.9	—	0
7/29/20	0.20	0.13	0.36	0.54	—	0.74	1.17	0.70	0.70	—	0.13
7/15/20	0.21	0.28	0.31	0.64	—	0.64	—	0.77	1.04	—	0
7/1/20	0.27	0.10	0.393	0.80	—	0.92	—	—	—	—	0
6/17/20	0	0	0	0.10	—	0.89	0	9.75	3.8	—	0
6/3/20	0	0	0.052	0.28	—	0.86	2.52	0.88	3.79	—	0
5/20/20	—	—	—	—	—	—	—	11.35	5.31	5.9	—

Notes:

Total Inorganic Nitrogen = Ammonia + (Nitrate + Nitrite); lab methodology results in a combined nitrate/nitrite value, which is used here to calculate Total Inorganic Nitrogen.

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2020 Nitrogen Data

Total N (mg/L)											
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #15B**	**CSHH #16**
10/28/20	—	—	0.88	2.0	—	—	8.4	—	—	—	—
10/22/20	1.8	1.7	—	—	5.2	0.84	—	—	—	—	0.23
10/21/20	—	—	—	—	—	—	—	10.9	7.5	—	—
10/7/20	1.9	1.6	—	—	8.1	3.7	7.4	14.4	<0.10	—	8.2
9/23/20	1.5	2.2	—	—	3.1	1.8	2.3	2.7	3.6	—	1.2
9/9/20	<0.25	<0.25	—	—	2.4	<0.25	—	10.3	5.5	—	<0.25
8/26/20	1.4	2.0	—	—	2.7	2.7	2.6	2.0	7.2	—	1.1
8/12/20	<0.10	<0.10	—	—	0.87	0.57	1.1	0.70	6.5	—	<0.10
7/29/20	<0.10	<0.10	<0.10	0.18	—	0.56	0.84	0.53	0.70	—	<0.10
7/15/20	<0.10	0.15	<0.10	0.27	—	0.47	—	0.57	0.90	—	<0.10
7/1/20	0.47	0.20	1.6	0.85	—	0.94	—	—	—	—	0.14
6/17/20	<0.10	<0.10	<0.10	<0.10	—	0.89	<0.10	10.0	5.2	—	<0.10
6/3/20	<0.10	<0.10	<0.10	0.28	—	0.86	2.4	0.88	4.7	—	<0.10
5/20/20	—	—	—	—	—	—	—	10.6	5.9	6.7	—

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

CSHH #8: Testing suspended 6/3-7/29 due to concerns regarding the risk of COVID-19 spread via aerosolized STP effluent.

9/9: Data highlighted in yellow b/c TKN and ammonia samples were sent to a lab other than Pace Analytical and analyzed using "wet chemistry"; EPA methods remain the same.

7/29: Yellow highlighted data in question b/c samples were out of temperature as a result of power loss at Pace Analytical from Hurricane Isaias.

2019 Nitrogen Data

TKN (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/30/19	0.41	<0.10	—	—	0.39	<0.10	0.38	1.6	0.52	0.24
10/16/19	0.34	0.34	—	—	0.29	0.36	0.36	<0.10	<0.10	0.49
10/11/19	0.84	0.57	0.89	0.38	0.31	<0.10	0.34	0.90	0.43	—
9/18/19	<0.10	<0.10	—	—	<0.10	0.95	<0.10	<0.10	0.36	<0.10
9/4/19	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	0.31	<0.10	<0.10
8/22/19	0.46	0.62	—	—	<0.10	0.36	0.39	1.0	0.43	<0.10
8/7/19	<0.10	<0.10	—	—	<0.10	0.41	0.38	<0.10	<0.10	<0.10
7/24/19	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	0.77	<0.10
7/10/19	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	0.35	<0.10
6/26/19	0.26	0.22	—	—	0.16	0.12	<0.10	0.21	0.73	0.20
6/12/19	<0.10	0.33	0.38	0.32	0.41	0.25	0.20	<0.10	0.19	0.17
5/29/19	<0.10	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.85	<0.10
5/15/19	<0.10	<0.10	—	—	<0.10	<0.10	—	<0.10	<0.10	<0.10

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Total Organic N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/30/19	0.24	<0.10	—	—	0.26	<0.10	0.15	0.55	0.52	0.16
10/16/19	0.27	0.31	—	—	0.26	0.31	0.33	<0.10	<0.10	0.46
10/11/19	0.71	0.51	0.52	<0.10	0.23	<0.10	0.18	0.14	0.33	—
9/18/19	<0.10	<0.10	—	—	<0.10	0.80	<0.10	<0.10	0.32	<0.10
9/4/19	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8/22/19	0.32	0.55	—	—	<0.10	0.11	0.13	0.21	0.36	<0.10
8/7/19	<0.10	<0.10	—	—	<0.10	0.28	0.16	<0.10	<0.10	<0.10
7/24/19	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	0.60	<0.10
7/10/19	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	0.27	<0.10
6/26/19	0.16	<0.10	—	—	<0.10	<0.10	<0.10	<0.10	0.64	0.12
6/12/19	<0.10	<0.10	0.31	<0.10	0.19	<0.10	<0.10	<0.10	0.14	<0.10
5/29/19	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.57	<0.10
5/15/19	—	—	—	—	—	—	—	—	—	—

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

On 5/15/19, all species of nitrogen collected for stations, however, total organic nitrogen and total nitrogen calculations were not provided by Pace Analytical.

2019 Nitrogen Data

Ammonia as N (mg/L)										
Date	**CSHH#1**	**CSHH#3**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14A**	**CSHH#15A**	**CSHH#16**
10/30/19	0.17	0.13	—	—	0.14	0.18	0.23	1.00	<0.10	<0.10
10/16/19	<0.10	<0.10	—	—	<0.10	<0.10	<0.10	1.10	<0.10	<0.10
10/11/19	0.13	<0.10	0.37	0.56	<0.10	<0.10	0.16	0.76	<0.10	—
9/18/19	0.18	<0.10	—	—	0.14	0.15	0.26	0.75	<0.10	<0.10
9/4/19	0.15	<0.10	—	—	0.18	0.18	0.23	0.95	<0.10	<0.10
8/22/19	0.13	<0.10	—	—	0.30	0.26	0.26	0.79	<0.10	<0.10
8/7/19	0.15	<0.10	—	—	0.21	0.13	0.22	0.20	0.14	<0.10
7/24/19	0.26	0.13	—	—	0.33	0.31	0.33	0.43	0.17	<0.10
7/10/19	0.12	<0.10	—	—	0.16	<0.10	0.21	0.17	<0.10	<0.10
6/26/19	<0.10	0.14	—	—	0.21	0.18	0.19	0.17	<0.10	<0.10
6/12/19	0.19	0.5	<0.10	0.23	0.22	0.16	0.13	0.19	<0.10	0.14
5/29/19	<0.10	0.13	<0.10	0.13	0.18	0.11	0.13	0.16	0.28	0.15
5/15/19	0.13	0.12	—	—	0.18	0.16	—	0.23	0.15	<0.10

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Nitrite as N (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/30/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
10/16/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	0.11	<0.050	<0.050
10/11/19	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.09	<0.050	—
9/18/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	0.15	<0.050	<0.050
9/4/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	0.19	<0.050	<0.050
8/22/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	0.09	<0.050	<0.050
8/7/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
7/24/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
7/10/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
6/26/19	<0.050	<0.050	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
6/12/19	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
5/29/19	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
5/15/19	<0.050	<0.050	—	—	<0.050	<0.050	—	<0.050	<0.050	<0.050

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Nitrate as N (mg/L)										
Date	**CSHH#1**	**CSHH#3**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14A**	**CSHH#15A**	**CSHH#16**
10/30/19	0.16	0.10	—	—	0.45	0.34	0.49	5.20	3.30	0.09
10/16/19	0.29	<0.050	—	—	0.36	0.46	0.53	11.30	7.40	0.14
10/11/19	0.13	0.28	0.28	0.43	0.27	0.30	0.87	4.90	<0.050	—
9/18/19	0.35	0.10	—	—	0.26	0.19	0.51	7.70	4.40	0.08
9/4/19	0.08	<0.050	—	—	0.48	0.77	1.30	8.40	3.60	<0.050
8/22/19	<0.050	<0.050	—	—	0.33	0.91	1.00	6.70	3.00	<0.050
8/7/19	<0.050	<0.050	—	—	0.05	1.70	1.80	0.35	0.98	<0.050
7/24/19	0.08	<0.050	—	—	0.72	0.56	0.50	1.20	1.40	<0.050
7/10/19	<0.050	<0.050	—	—	0.34	0.89	1.30	0.43	1.90	<0.050
6/26/19	0.06	<0.050	—	—	0.51	0.64	1.00	0.42	2.50	<0.050
6/12/19	<0.050	<0.050	0.06	0.16	0.36	0.27	0.46	0.50	0.13	<0.050
5/29/19	<0.050	<0.050	0.07	0.26	0.14	0.27	0.37	0.30	2.80	<0.050
5/15/19	<0.050	<0.050	—	—	0.45	0.48	—	0.54	0.75	<0.050

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)

Date	CSHH #1	CSHH #3	CSHH #6	CSHH #7	CSHH #8	CSHH #12	CSHH #13	CSHH #14A	CSHH #15A	CSHH #16
10/30/19	0.33	0.229	—	—	0.59	0.52	0.72	6.2	3.3	0.089
10/16/19	0.30	0	—	—	0.36	0.46	0.53	12.5	7.4	0.15
10/11/19	0.28	0.31	0.67	1.00	0.29	0.42	1.04	5.76	0	—
9/18/19	0.54	0.11	—	—	0.41	0.36	0.77	8.65	4.4	0.09
9/4/19	0.226	0	—	—	0.66	0.96	1.53	9.55	3.6	0
8/22/19	0.13	0	—	—	0.63	1.17	1.26	7.49	3.0	0
8/7/19	0.15	0	—	—	0.261	1.83	2.02	0.55	1.12	0
7/24/19	0.34	0.13	—	—	1.05	0.87	0.83	1.63	1.57	0
7/10/19	0.12	0	—	—	0.50	0.89	—	0.60	1.9	0
6/26/19	0.057	0.14	—	—	0.72	0.82	1.19	0.59	2.5	0
6/12/19	0.19	0.50	0.058	0.43	0.58	0.44	0.62	0.73	0.14	0.14
5/29/19	0	0.13	0.073	0.39	0.32	0.38	0.50	0.46	3.18	0.15
5/15/19	0.182	0.12	—	—	0.64	0.68	—	0.78	0.94	0

Notes:

Total Inorganic Nitrogen = Ammonia + (Nitrate + Nitrite); lab methodology results in a combined nitrate/nitrite value, which is used here to calculate Total Inorganic Nitrogen.
Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).
CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

2019 Nitrogen Data

Total N (mg/L)										
Date	**CSHH #1**	**CSHH #3**	**CSHH #6**	**CSHH #7**	**CSHH #8**	**CSHH #12**	**CSHH #13**	**CSHH #14A**	**CSHH #15A**	**CSHH #16**
10/30/19	0.57	0.16	—	—	0.85	0.34	0.87	6.80	3.80	0.32
10/16/19	0.64	0.37	—	—	0.66	0.81	0.88	11.40	7.50	0.64
10/11/19	0.99	0.87	1.20	0.82	0.60	0.32	1.20	5.90	0.43	—
9/18/19	0.36	0.11	—	—	0.27	1.20	0.51	7.90	4.70	<0.10
9/4/19	<0.10	<0.10	—	—	0.48	0.78	1.30	8.90	3.60	<0.10
8/22/19	0.46	0.62	—	—	0.33	1.30	1.40	7.80	3.40	<0.10
8/7/19	<0.10	<0.10	—	—	<0.10	2.10	2.20	0.35	0.98	<0.10
7/24/19	0.12	<0.10	—	—	0.77	0.61	0.54	1.20	2.20	<0.10
7/10/19	<0.10	<0.10	—	—	0.43	0.97	1.30	0.50	2.30	<0.10
6/26/19	0.32	0.22	—	—	0.67	0.76	1.10	0.63	3.30	0.20
6/12/19	<0.10	0.35	0.43	0.51	0.77	0.54	0.69	0.55	0.32	0.17
5/29/19	<0.10	0.25	<0.10	0.26	0.14	0.27	0.37	0.30	3.70	<0.10
5/15/19	—	—	—	—	—	—	—	—	—	—

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

On 5/15/19, all species of nitrogen collected for stations, however, total organic nitrogen and total nitrogen calculations were not provided by Pace Analytical.

2018 Nitrogen Data

Ammonia as N (mg/L)																					
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#9**	**CSHH#10**	**CSHH#11**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14A**	**CSHH#15**	**CSHH#15A**	**CSHH#15B**	**CSHH#16**	**CSHH#17**	**CSHH#17A**
10/31/2018	0.13	<0.10	<0.10	--	--	--	--	<0.10	<0.10	0.32	0.13	0.14	0	--	0.18	--	<0.10	<0.10	<0.10	<0.10	<0.10
10/24/2018	0.19	--	--	0.19	0.18	0.18	0.31	<0.10	0.14	0.14	0.13	0.14	0.2	0.12	1.4	--	<0.10	<0.10	--	--	--
10/17/2018	0.44	<0.10	0.12	--	--	--	--	0.23	0.19	0.2	0.21	0.21	0.19	--	0.29	--	<0.10	<0.10	<0.10	<0.10	<0.10
10/10/2018	0.25	<0.10	0.13	0.15	0.22	0.29	0.35	0.18	0.19	0.19	0.24	0.24	0.32	0.16	1.4	0.14	0.27	0.13	<0.10	<0.10	<0.10
10/2/2018	0.2	0.16	0.16	--	--	--	--	0.2	0.17	0.28	0.22	0.21	0.22	--	0.38	--	0.22	--	0.21	0.28	0.24
9/26/2018	0.27	<0.10	0.13	--	--	--	--	0.15	0.13	0.14	0.13	0.14	0.25	--	0.8	--	<0.10	<0.10	<0.10	<0.10	<0.10
9/19/2018	0.17	<0.10	<0.10	0.16	0.28	0.38	0.6	0.17	0.14	0.2	0.21	0.2	0.32	0.21	0.25	0.19	0.22	<0.10	<0.10	<0.10	<0.10
9/14/2018	0.54	0.13	<0.10	--	--	--	--	0.17	0.2	0.22	0.2	0.23	0.22	--	1.2	--	0.28	0.38	<0.10	<0.10	<0.10
9/5/2018	0.22	<0.10	<0.10	0.17	0.22	0.45	0.52	0.15	0.12	0.14	0.13	0.14	0.19	0.27	0.21	0.11	0.12	<0.10	<0.10	<0.10	<0.10
8/29/2018	0.33	<0.10	<0.10	--	--	--	--	0.13	<0.10	0.11	0.13	0.14	--	--	1	--	<0.10	--	<0.10	0.11	<0.10
8/23/2018	0.19	0.15	<0.10	--	0.27	0.49	0.71	0.21	0.2	0.22	0.23	0.22	0.24	--	0.99	0.11	<0.10	--	0.13	<0.10	0.12
8/15/2018	0.34	<0.10	0.11	--	--	--	--	0.39	0.88	0.73	0.49	0.39	0.33	--	1.5	--	0.15	0.17	<0.10	<0.10	<0.10
8/8/2018	0.18	<0.10	<0.10	0.22	0.21	0.3	0.45	0.13	0.12	0.12	0.12	0.11	0.15	0.16	0.22	0.14	<0.10	<0.10	<0.10	<0.10	<0.10
8/2/2018	0.28	<0.10	<0.10	--	--	--	--	<0.10	0.14	0.15	<0.10	<0.10	0.18	--	1.2	--	0.11	<0.10	<0.10	<0.10	<0.10
7/17/2018	0.16	<0.10	<0.10	--	--	--	--	0.14	0.3	0.55	0.15	0.12	0.14	--	0.99	--	<0.10	<0.10	<0.10	<0.10	<0.10
7/11/2018	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--	<0.10	1.3	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
7/3/2018	0.18	<0.10	<0.10	--	--	--	--	0.18	0.17	0.27	<0.10	<0.10	0.19	--	1.1	--	0.14	<0.10	<0.10	<0.10	<0.10
6/27/2018	0.11	<0.10	<0.10	--	--	0.15	0.13	<0.10	<0.10	0.13	<0.10	<0.10	0.24	--	1.3	<0.10	0.14	0.12	<0.10	<0.10	<0.10
6/20/2018	<0.10	<0.10	<0.10	--	--	--	--	<0.10	<0.10	0.55	<0.10	<0.10	<0.10	--	<0.10	--	<0.10	<0.10	<0.10	<0.10	<0.10
6/13/2018	<0.10	<0.10	<0.10	--	--	--	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--	0.98	<0.10	0.12	0.14	<0.10	<0.10	<0.10
6/6/2018	<0.10	<0.10	<0.10	--	--	--	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--	<0.10	--	<0.10	<0.10	<0.10	<0.10	<0.10
5/30/2018	0.19	<0.10	<0.10	--	--	--	--	0.11	0.11	0.12	0.11	<0.10	0.23	--	1.1	--	0.41	0.4	<0.10	<0.10	<0.10
5/23/2018	0.23	0.14	0.66	0.23	0.19	0.36	0.36	0.17	0.3	0.64	0.21	0.2	0	0.19	0.34	0.17	0.27	0.29	--	0.13	0.12

Notes:

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow .

2018 Nitrogen Data

Nitrite as N (mg/L)																					
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#9**	**CSHH#10**	**CSHH#11**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14A**	**CSHH#15**	**CSHH#15A**	**CSHH#15B**	**CSHH#16**	**CSHH#17**	**CSHH#17A**
10/31/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050
10/24/2018	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	<0.050	<0.050	--	--	--
10/17/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050
10/10/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
10/2/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	--	<0.050	<0.050	<0.050
9/26/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
9/19/2018	--	--	--	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	--	<0.050	--	--	--
9/14/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
9/5/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
8/29/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	--	<0.050	--	<0.050	<0.050	<0.050
8/23/2018	<0.050	<0.050	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	<0.050	<0.050	--	<0.050	<0.050	<0.050
8/15/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
8/8/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
8/2/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
7/17/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050
7/11/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	0.15	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
7/3/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	0.09	--	<0.050	<0.050	<0.050	<0.050	<0.050
6/27/2018	<0.050	<0.050	<0.050	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	0.06	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
6/20/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050
6/13/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	0.12	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
6/6/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050
5/30/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	0	--	<0.050	<0.050	<0.050	<0.050	<0.050
5/23/2018	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050	<0.050	<0.050	<0.050	--	<0.050	<0.050

Notes:

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow .

2018 Nitrogen Data

Nitrate as N (mg/L)																					
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#9**	**CSHH#10**	**CSHH#11**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14A**	**CSHH#15**	**CSHH#15A**	**CSHH#15B**	**CSHH#16**	**CSHH#17**	**CSHH#17A**
10/31/2018	0.41	0.26	0.36	--	--	--	--	0.44	0.68	0.5	0.84	0.65	--	--	0.92	--	3.7	5.2	0.23	0.27	0.27
10/24/2018	0.43	--	--	0.41	0.48	0.45	0.54	0.76	1	1	0.88	0.89	1.3	0.48	7.6	--	6.1	5	--	--	--
10/17/2018	0.34	0.29	0.31	--	--	--	--	1.1	1.4	1.2	1.2	1.2	3.3	--	0.72	--	4.7	5.2	0.29	0.3	0.3
10/10/2018	0.27	0.38	0.33	0.29	0.35	0.34	0.48	0.52	0.89	0.9	0.77	0.85	1.1	0.32	8.6	0.31	4.7	5.4	0.31	0.3	0.3
10/2/2018	0.35	0.34	0.41	--	--	--	--	0.6	1.4	1.5	0.79	0.9	2.4	--	0.84	--	1	--	0.38	0.32	0.32
9/26/2018	0.31	0.25	0.3	--	--	--	--	0.57	1.1	1.2	0.59	0.63	0.59	--	4.7	--	3.8	4.2	0.25	0.25	0.26
9/19/2018	0.16	0.13	0.2	0.14	0.14	0.21	0.19	0.28	0.96	0.48	0.2	0.4	0.66	0.19	0.38	0.25	0.96	3.2	0.16	0.12	0.12
9/14/2018	0.2	0.17	0.19	--	--	--	--	0.54	0.87	0.7	0.43	0.43	0.69	--	6.4	--	3.1	2.6	0.16	0.17	0.18
9/5/2018	<0.050	<0.050	0.07	0.1	0.24	0.22	0.38	0.44	1	0.56	0.3	0.46	0.55	0.1	0.78	0.07	0.53	3.8	<0.050	<0.050	<0.050
8/29/2018	0.15	<0.050	<0.050	--	--	--	--	0.64	1.2	0.94	1.2	1.1	0	--	10.5	--	4.3	0	0.08	<0.050	<0.050
8/23/2018	0.09	0.08	0.06	--	0.16	0.1	0.24	0.43	0.72	0.57	0.74	0.71	1.2	--	4.6	<0.050	3.1	0	0.07	<0.050	<0.050
8/15/2018	0.21	0.08	<0.050	--	--	--	--	0.57	1.3	0.71	1.3	1.2	1.5	--	7.9	--	2.1	2.9	<0.050	<0.050	<0.050
8/8/2018	<0.050	<0.050	<0.050	<0.050	0.11	0.1	0.25	0.56	0.74	0.7	0.93	0.4	1.2	0.1	0.32	<0.050	1.8	1.8	<0.050	<0.050	<0.050
8/2/2018	0.07	<0.050	0.08	--	--	--	--	0.45	0.8	0.64	0.51	0.42	1.4	--	7.6	--	1.4	1.8	<0.050	<0.050	<0.050
7/17/2018	<0.050	<0.050	<0.050	--	--	--	--	0.53	1.8	1.5	2.2	1.4	3.1	--	10.2	--	1.7	1.6	<0.050	<0.050	<0.050
7/11/2018	<0.050	<0.050	<0.050	<0.050	0.11	<0.050	0.36	0.36	0.47	0.36	0.11	0.95	0	0.24	8	<0.050	1.5	1.6	<0.050	<0.050	<0.050
7/3/2018	<0.050	<0.050	<0.050	--	--	--	--	0.27	0.7	0.6	0.51	0.35	1.1	--	9.7	--	1.7	1.9	<0.050	<0.050	<0.050
6/27/2018	<0.050	<0.050	<0.050	--	--	<0.050	0.06	0.32	0.61	0.6	0.78	1.1	0.78	--	7.9	<0.050	2.1	2.5	<0.050	<0.050	<0.050
6/20/2018	<0.050	<0.050	<0.050	--	--	--	--	0.37	0.9	0.2	0.45	0.74	0.73	--	0.49	--	0.67	3.1	<0.050	<0.050	<0.050
6/13/2018	<0.050	<0.050	<0.050	--	--	--	--	0.38	0.71	0.83	1.4	1.1	1.9	--	7.8	<0.050	3.1	3.2	<0.050	<0.050	<0.050
6/6/2018	<0.050	<0.050	<0.050	--	--	--	--	<0.050	0.68	<0.050	0.18	<0.050	1.1	--	0.15	--	1.3	2.5	<0.050	<0.050	<0.050
5/30/2018	0.15	<0.050	0.07	--	--	--	--	1	0.91	0.91	0.46	0.53	0.57	--	9.1	--	4.4	3.7	<0.050	<0.050	<0.050
5/23/2018	0.09	<0.050	0.12	0.1	0.21	0.23	0.33	1	1.1	0.36	1.6	0.83	--	0.14	1.3	0.13	4.2	4.9	0	<0.050	<0.050

Notes:

Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow .

2018 Nitrogen Data

Total Inorganic Nitrogen Calculation (mg/L)

Date	CSHH#1	CSHH#2	CSHH#3	CSHH#4	CSHH#5	CSHH#6	CSHH#7	CSHH#8	CSHH#9	CSHH#10	CSHH#11	CSHH#12	CSHH#13	CSHH#14	CSHH#14A	CSHH#15	CSHH#15A	CSHH#15B	CSHH#16	CSHH#17	CSHH#17A
10/31/2018	0.54	0.26	0.36	--	--	--	--	0.44	0.68	0.82	0.97	0.79	--	--	1.1	--	3.7	5.2	0.23	0.27	0.27
10/24/2018	0.62	--	--	0.6	0.66	0.63	0.85	0.76	1.14	1.14	1.01	1.03	1.5	0.6	--	--	6.1	5	--	--	--
10/17/2018	0.78	0.29	0.43	--	--	--	--	1.33	1.59	1.4	1.41	1.41	3.49	--	1.01	--	4.7	5.2	0.29	0.3	0.3
10/10/2018	0.52	0.38	0.46	0.44	0.57	0.63	0.83	0.7	1.08	1.09	1.01	1.09	1.42	0.48	--	0.45	4.97	5.53	0.31	0.3	0.3
10/2/2018	0.55	0.5	0.57	--	--	--	--	0.8	1.57	1.78	1.01	1.11	2.62	--	1.22	--	1.22	--	0.59	0.6	0.56
9/26/2018	0.58	0.25	0.43	--	--	--	--	0.72	1.23	1.34	0.72	0.77	0.84	--	--	--	3.8	4.2	0.25	0.25	0.26
9/19/2018	--	--	--	--	--	--	--	0.45	1.1	0.68	0.41	0.6	0.98	--	--	--	--	3.2	--	--	--
9/14/2018	0.74	0.3	0.19	--	--	--	--	0.71	1.07	0.92	0.63	0.66	0.91	--	--	--	3.38	2.98	0.16	0.17	0.18
9/5/2018	0.22	0	0.07	0.27	0.46	0.67	0.9	0.59	1.12	0.7	0.43	0.6	0.74	0.37	0.99	0.18	0.65	3.8	0	0	0
8/29/2018	0.48	0	0	--	--	--	--	0.77	1.2	1.05	1.33	1.24	--	--	--	--	4.3	--	0.08	0.11	0
8/23/2018	0.28	0.23	0.06	--	0.43	0.59	0.95	0.64	0.92	0.79	0.97	0.93	1.44	--	--	0.11	3.1	--	0.2	0	0.12
8/15/2018	0.55	0.08	0.11	--	--	--	--	0.96	2.18	1.44	1.79	1.59	1.83	--	--	--	2.25	3.07	0	0	0
8/8/2018	0.18	0	0	0.22	0.32	0.4	0.7	0.69	0.86	0.82	1.05	0.51	1.35	0.26	0.54	0.14	1.8	1.8	0	0	0
8/2/2018	0.35	0	0.08	--	--	--	--	0.45	0.94	0.79	0.51	0.42	1.58	--	--	--	1.51	1.8	0	0	0
7/17/2018	0.16	0	0	--	--	--	--	0.67	2.1	2.05	2.35	1.52	3.24	--	--	--	1.7	1.6	0	0	0
7/11/2018	0	0	0	0	0.11	0.12	0.36	0.36	0.47	0.36	0.11	0.95	--	0.24	9.45	0	1.5	1.6	0	0	0
7/3/2018	0.18	0	0	--	--	--	--	0.45	0.87	0.87	0.51	0.35	1.29	--	10.89	--	1.84	1.9	0	0	0
6/27/2018	0.11	0	0	--	--	0.15	0.19	0.32	0.61	0.73	0.78	1.1	1.02	--	9.26	0	2.24	2.62	0	0	0
6/20/2018	0	0	0	--	--	--	--	0.37	0.9	0.75	0.45	0.74	0.73	--	0.49	--	0.67	3.1	0	0	0
6/13/2018	0	0	0	--	--	--	--	0.38	0.71	0.83	1.4	1.1	1.9	--	8.9	0	3.22	3.34	0	0	0
6/6/2018	0	0	0	--	--	--	--	0	0.68	0	0.18	0	1.1	--	0.15	--	1.3	2.5	0	0	0
5/30/2018	0.34	0	0.07	--	--	--	--	1.11	1.02	1.03	0.57	0.53	0.8	--	10.26	--	4.81	4.1	0	0	0
5/23/2018	0.32	0.14	0.78	0.33	0.4	0.59	0.69	1.17	1.4	1	1.81	1.03	--	0.33	1.64	0.3	4.47	5.19	--	0.13	0.12

Notes:

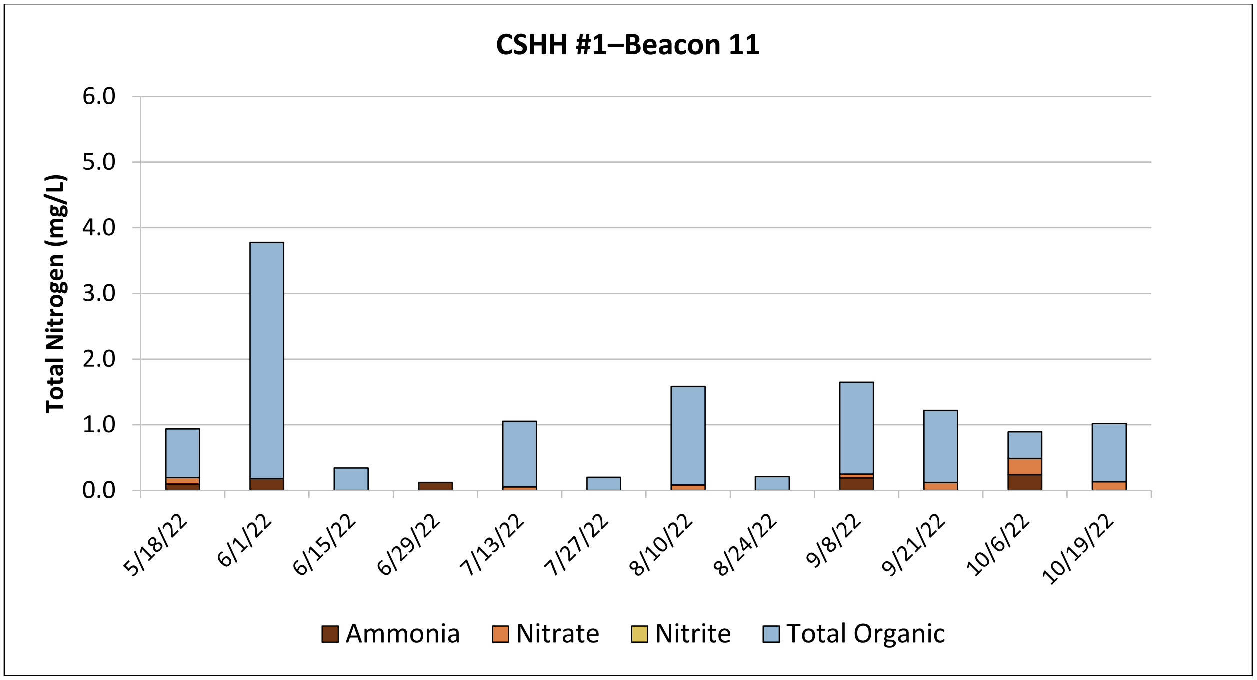
Total Inorganic Nitrogen = Ammonia + (Nitrate + Nitrite); lab methodology results in a combined nitrate/nitrite value, which is used here to calculate Total Inorganic Nitrogen.

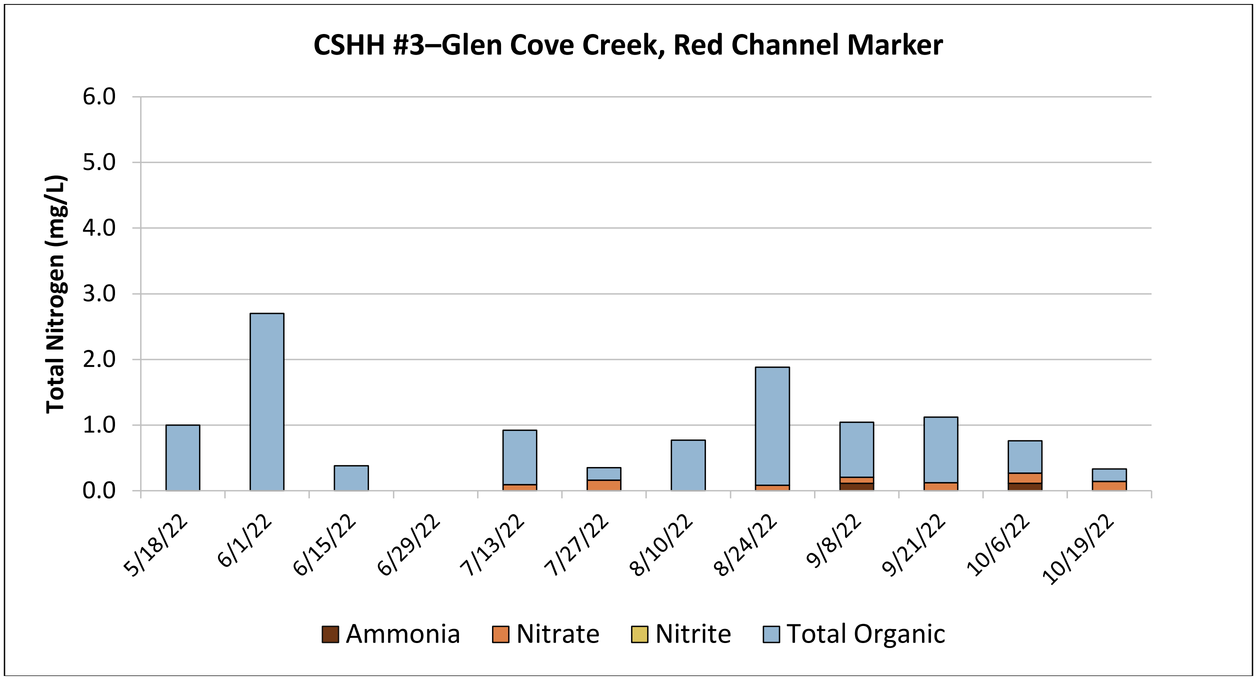
Values that are reported below the detection limit are treated as "0" (see individual tables for detection limits).

CSHH #14A and #15A are outfalls; tan highlights indicate a direct sample from flow.

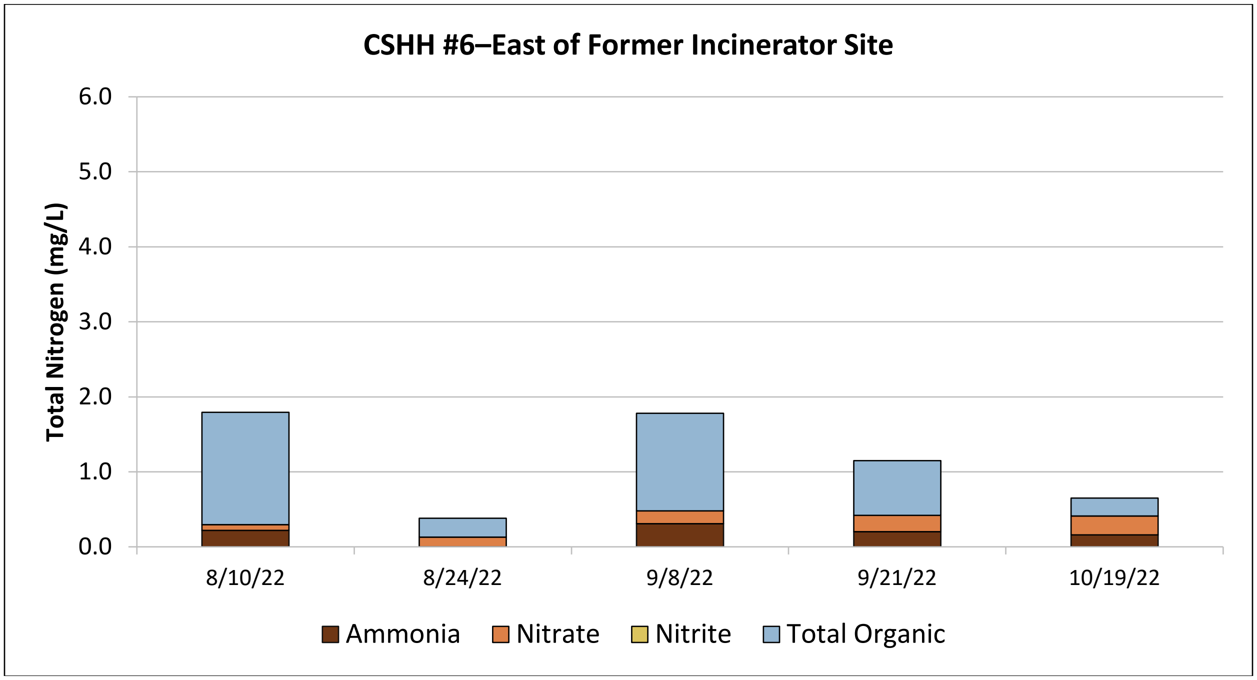
2022 Total Nitrogen Graphs

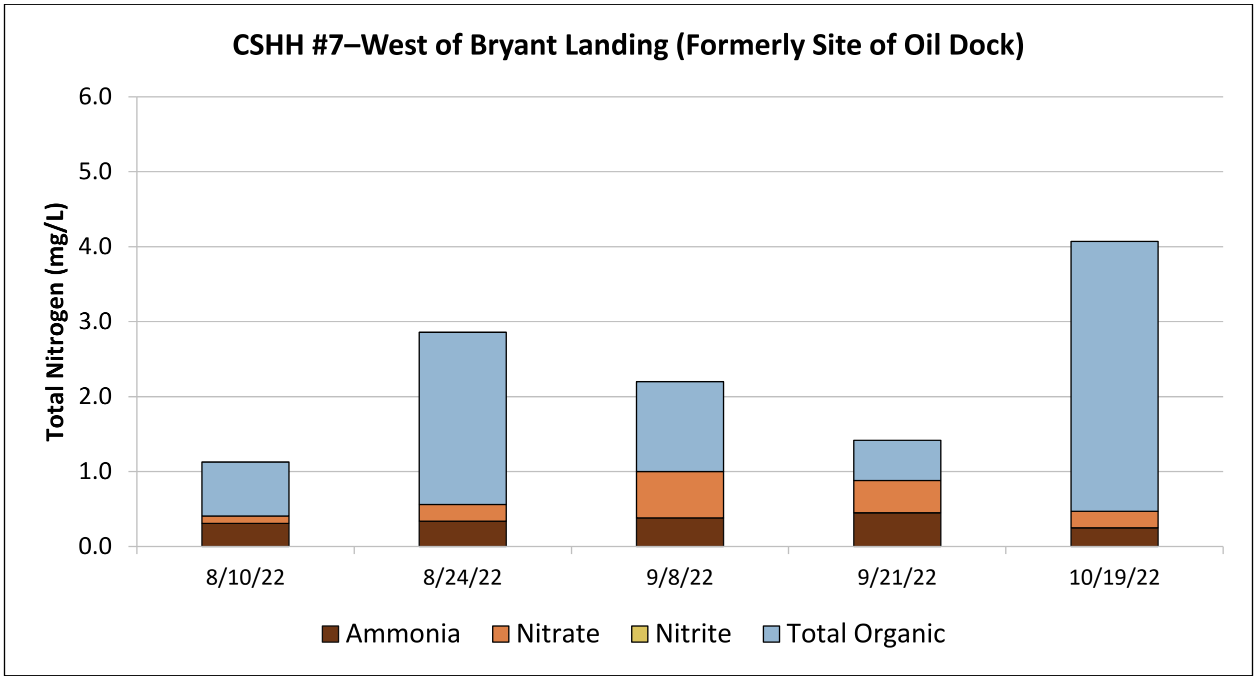
The graphs in this section display each station's total nitrogen throughout the 2022 season. The height of each vertical bar provides the total nitrogen recorded on the indicated date, but within each bar, total nitrogen is broken down into the subcategories of nitrogen it consists of. Total nitrogen comprises both organic nitrogen, shown in blue, and inorganic nitrogen—including ammonia, shown in brown, nitrate, shown in orange, and nitrite, shown in yellow. Note that total nitrogen exceeding 1.2 mg/L is considered a failing score. Note the y-axis for CSHH #13, #14A, and #15A is 12 mg/L to accommodate high values.





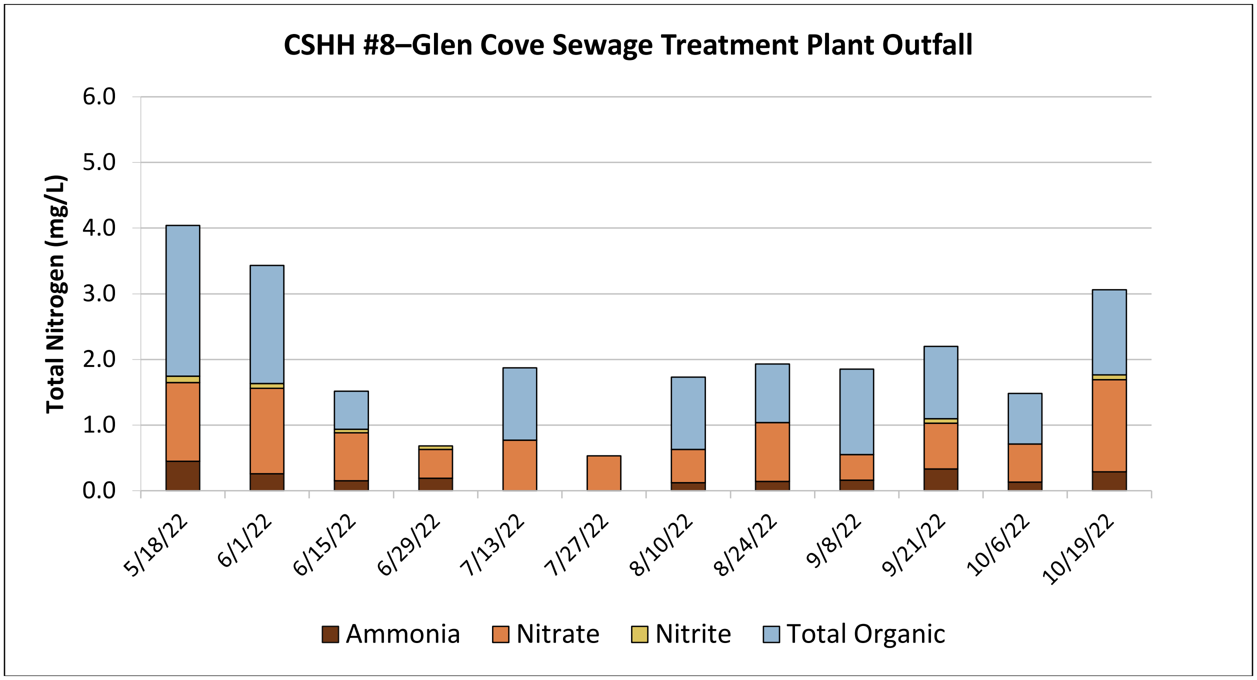
2022 Total Nitrogen Graphs

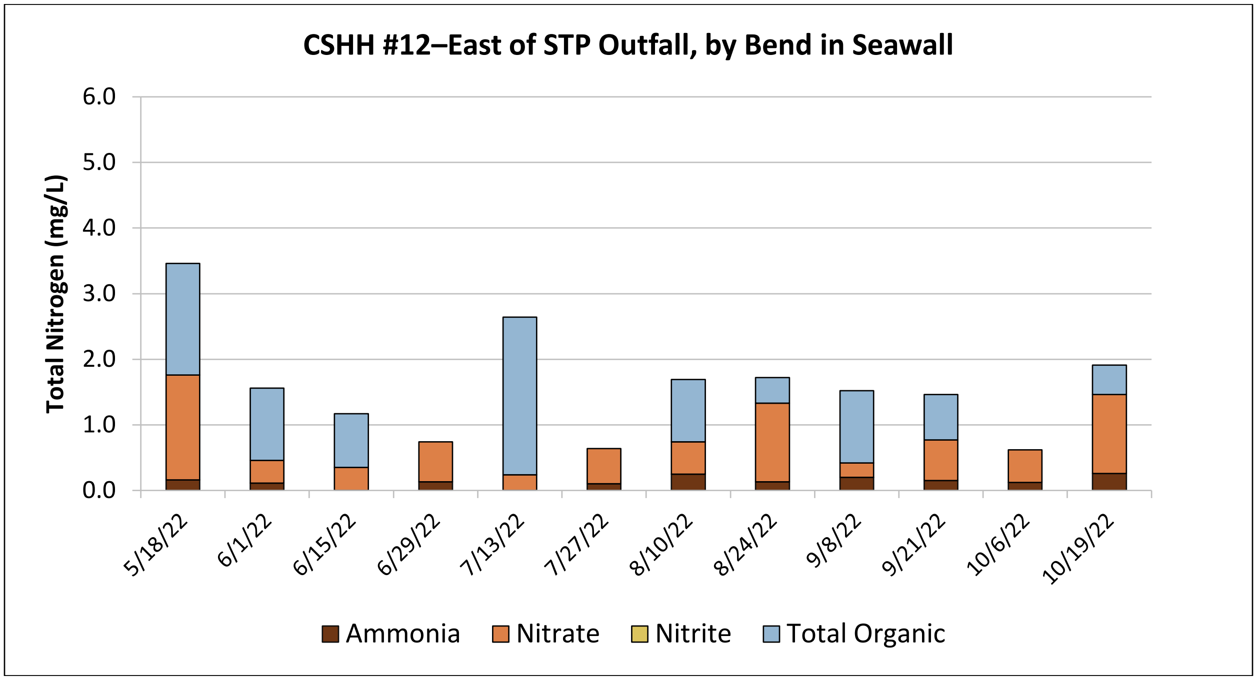




Total Nitrogen = Ammonia + Nitrate + Nitrite + Total Organic Nitrogen

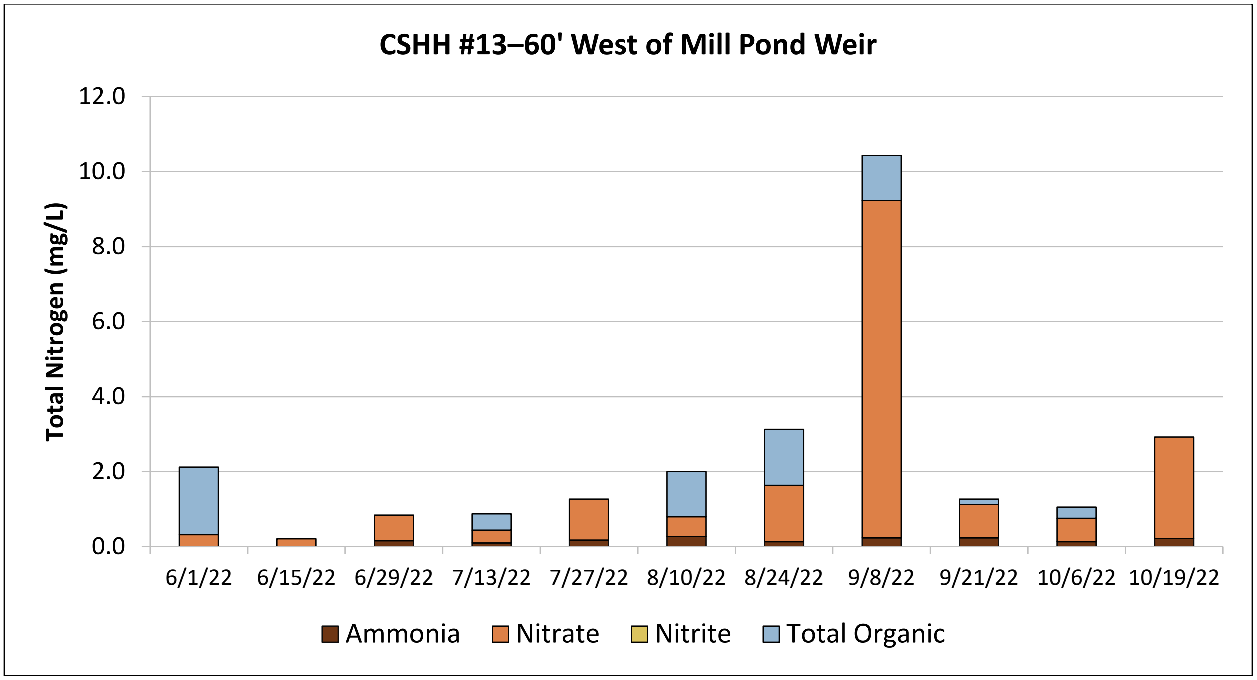
2022 Total Nitrogen Graphs

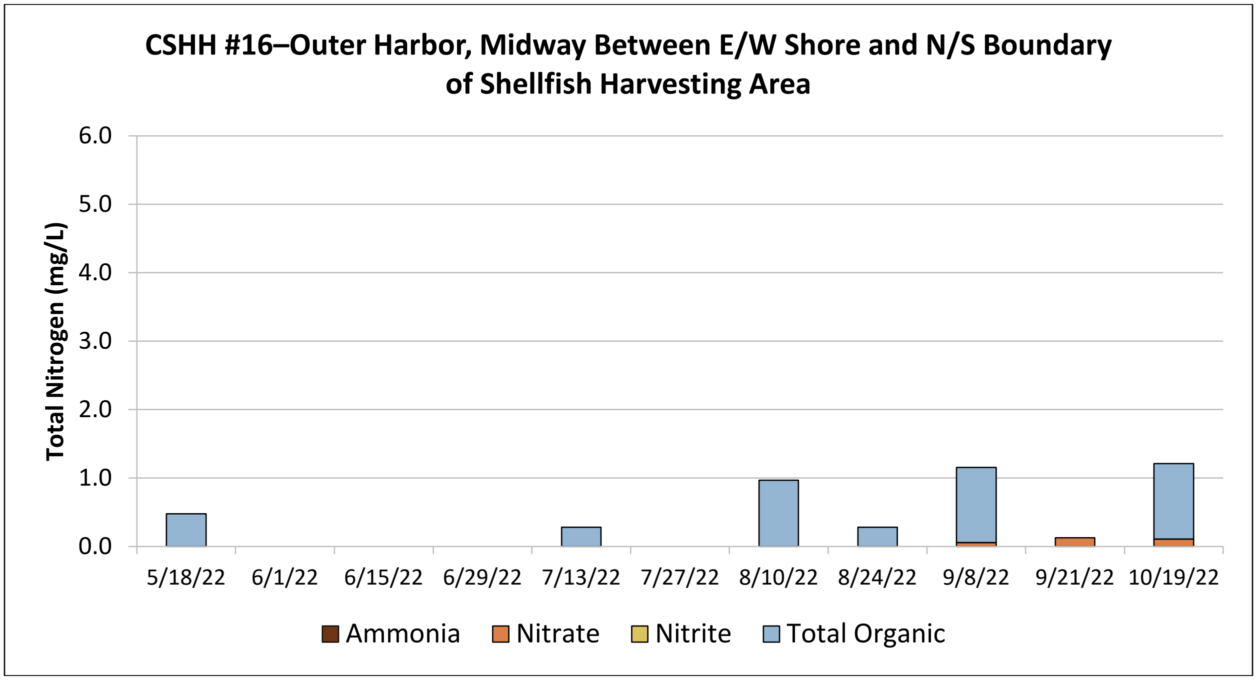




Total Nitrogen = Ammonia + Nitrate + Nitrite + Total Organic Nitrogen

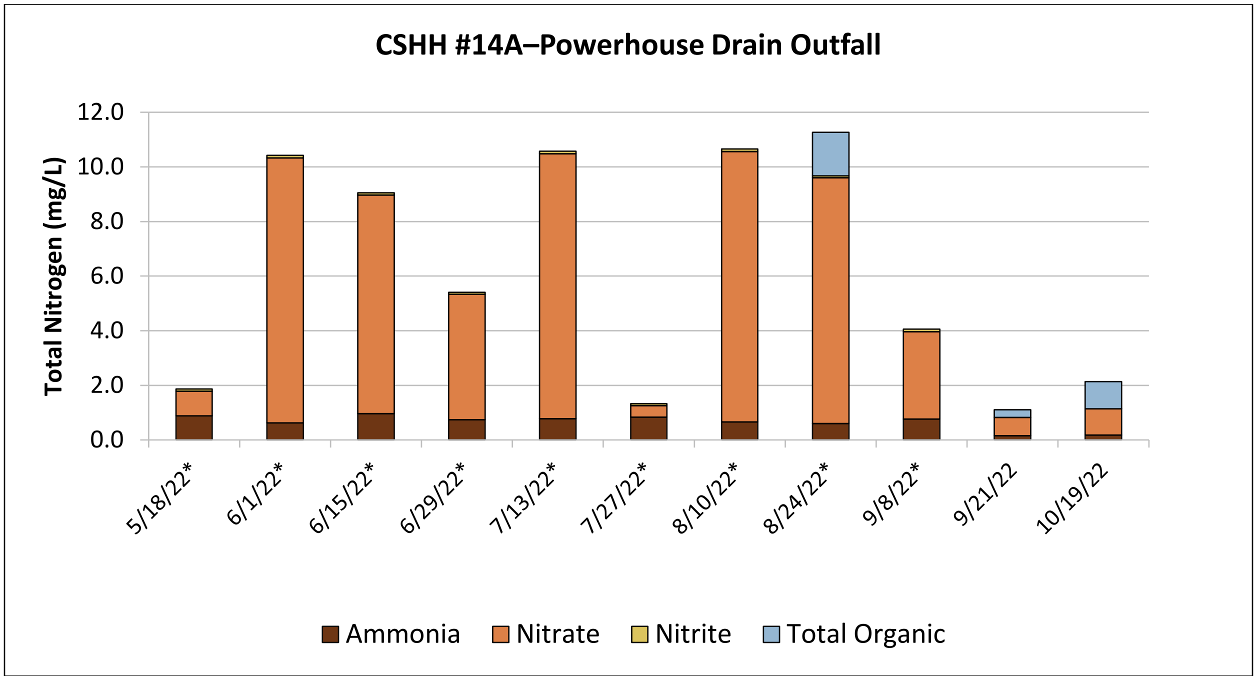
2022 Total Nitrogen Graphs

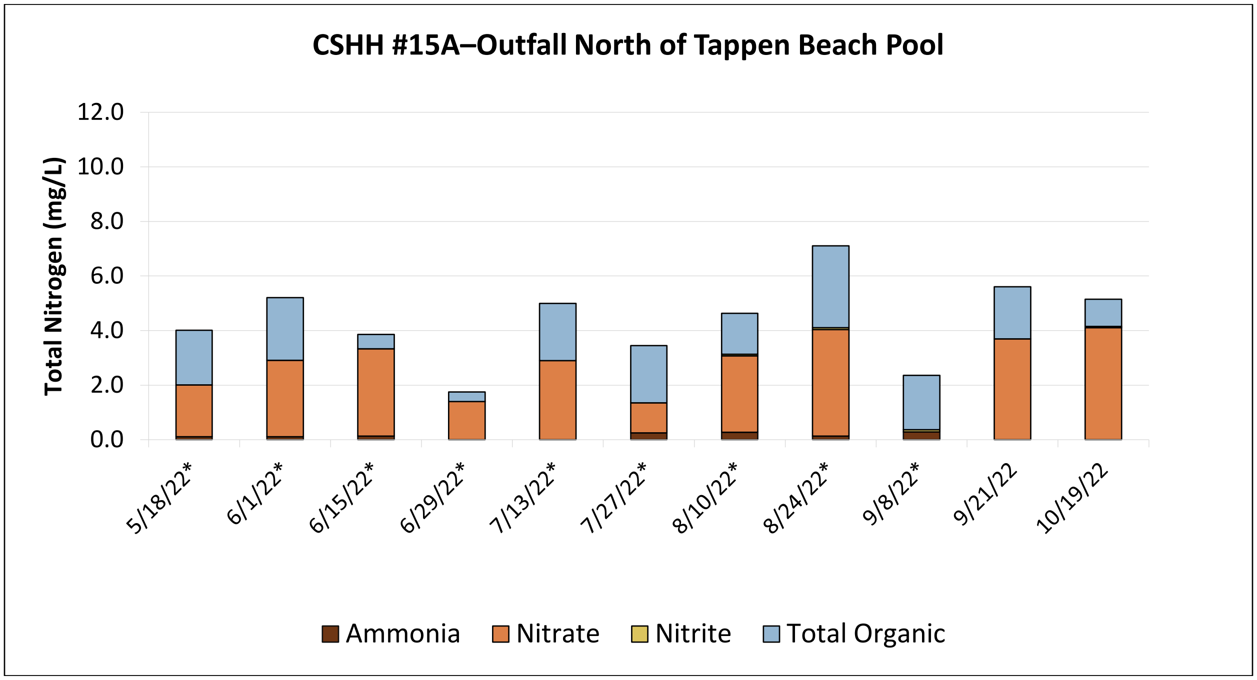




Total Nitrogen = Ammonia + Nitrate + Nitrite + Total Organic Nitrogen

2022 Total Nitrogen Graphs





*Sample taken from direct flow.

Total Nitrogen = Ammonia + Nitrate + Nitrite + Total Organic Nitrogen

2022-23 Winter Nitrogen Data

TKN (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/19/23	1.0	—
4/5/23	1.4	1.6
3/21/23	<0.50	—
3/8/23	1.2	2.3
2/22/23	<0.50	—
2/7/23	<0.50	2.6
1/17/23	1.3	—
1/4/23	0.94	<0.50
12/21/22	<0.50	—
12/8/22	0.58	0.80
11/22/22	<0.50	—
11/9/22	<0.50	<0.50

Total Organic N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/19/23	0.13	—
4/5/23	0.44	1.5
3/21/23	<0.10	—
3/8/23	0.48	2.1
2/22/23	<0.10	—
2/7/23	<0.10	2.6
1/17/23	<0.10	—
1/4/23	0.20	<0.10
12/21/22	<0.10	—
12/8/22	0.31	0.75
11/22/22	<0.10	—
11/9/22	<0.10	0.23

Ammonia as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/19/23	0.92	—
4/5/23	0.96	<0.10
3/21/23	0.95	—
3/8/23	0.74	0.25
2/22/23	1.0	—
2/7/23	1.2	<0.10
1/17/23	1.4	—
1/4/23	0.73	<0.10
12/21/22	0.12	—
12/8/22	0.27	<0.10
11/22/22	0.34	—
11/9/22	0.15	0.14

Nitrite as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/19/23	0.091	—
4/5/23	0.064	0.054
3/21/23	<0.050	—
3/8/23	<0.050	<0.050
2/22/23	0.068	—
2/7/23	0.064	<0.050
1/17/23	0.078	—
1/4/23	0.062	<0.050
12/21/22	<0.050	—
12/8/22	<0.050	<0.050
11/22/22	<0.050	—
11/9/22	<0.050	<0.050

Nitrate as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/19/23	9.3	—
4/5/23	7.5	3.9
3/21/23	8.3	—
3/8/23	5.9	5.5
2/22/23	9.0	—
2/7/23	8.3	6.6
1/17/23	8.2	—
1/4/23	4.9	5.6
12/21/22	0.72	—
12/8/22	1.4	5.7
11/22/22	0.82	—
11/9/22	0.66	4.5

Total Inorganic Nitrogen Calculation (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/19/23	10.3	—
4/5/23	8.5	4.0
3/21/23	9.3	—
3/8/23	6.6	5.8
2/22/23	10.1	—
2/7/23	9.6	6.6
1/17/23	9.7	—
1/4/23	5.6	5.6
12/21/22	0.87	—
12/8/22	1.8	5.7
11/22/22	1.2	—
11/9/22	0.82	4.6

Total N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/19/23	10.5	—
4/5/23	8.9	5.6
3/21/23	8.3	—
3/8/23	7.1	7.9
2/22/23	9.1	—
2/7/23	8.4	9.3
1/17/23	9.6	—
1/4/23	5.9	5.6
12/21/22	0.85	—
12/8/22	2.0	6.5
11/22/22	1.2	—
11/9/22	0.71	4.9

Notes:
A value given with a less than symbol indicates that the results were below the detection limit. CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow. On 3/31/21, Pace Analytical outsourced nitrite testing to American Analytical.

2021-22 Winter Nitrogen Data

TKN (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/13/22	<2.5	—
3/30/22	<0.50	<0.50
3/16/22	0.90	—
3/2/22	<0.50	<0.50
2/15/22	0.68	—
2/2/22	0.82	<0.50
1/19/22	<0.50	—
1/5/22	<0.50	<0.50
12/22/22	1.9	—
12/8/21	<0.50	<0.50
11/24/21	5.0	—
11/10/21	2.0	1.0

Total Organic N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/13/22	<0.10	—
3/30/22	<0.10	<0.10
3/16/22	<0.10	—
3/2/22	<0.10	<0.10
2/15/22	<0.10	—
2/2/22	0.79	<0.10
1/19/22	<0.10	—
1/5/22	<0.10	<0.10
12/22/22	1.4	—
12/8/21	<0.10	<0.10
11/24/21	3.6	—
11/10/21	0.53	0.83

Ammonia as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/13/22	1.2	—
3/30/22	1.1	<0.10
3/16/22	1.2	—
3/2/22	1.5	<0.10
2/15/22	1.5	—
2/2/22	<0.10	<0.10
1/19/22	1.4	—
1/5/22	0.85	<0.10
12/22/22	0.53	—
12/8/21	1.3	<0.10
11/24/21	1.3	—
11/10/21	1.5	0.21

Nitrite as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/13/22	<0.050	—
3/30/22	0.062	<0.050
3/16/22	<0.050	—
3/2/22	<0.050	<0.050
2/15/22	<0.050	—
2/2/22	<0.050	<0.050
1/19/22	0.066	—
1/5/22	<0.050	<0.050
12/22/22	0.054	—
12/8/21	0.098	<0.050
11/24/21	0.092	—
11/10/21	0.11	<0.050

Nitrate as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/13/22	8.2	—
3/30/22	8.5	6.0
3/16/22	7.4	—
3/2/22	7.6	6.0
2/15/22	9.2	—
2/2/22	0.20	7.5
1/19/22	8.4	—
1/5/22	1.3	0.22
12/22/22	2.6	—
12/8/21	7.2	5.4
11/24/21	6.9	—
11/10/21	8.5	5.7

Total Inorganic Nitrogen Calculation (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/13/22	9.5	—
3/30/22	9.7	6.0
3/16/22	8.6	—
3/2/22	9.1	6.1
2/15/22	10.8	—
2/2/22	0.20	7.5
1/19/22	9.8	—
1/5/22	2.3	0.24
12/22/22	3.2	—
12/8/21	8.6	5.5
11/24/21	8.3	—
11/10/21	10.2	5.91

Total N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/13/22	8.3	—
3/30/22	8.6	6.0
3/16/22	8.3	—
3/2/22	8.0	6.1
2/15/22	10	—
2/2/22	1.0	7.5
1/19/22	8.7	—
1/5/22	1.4	0.24
12/22/22	4.6	—
12/8/21	7.3	5.5
11/24/21	12.0	—
11/10/21	10.7	6.8

Notes:
A value given with a less than symbol indicates that the results were below the detection limit. CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow. On 3/31/21, Pace Analytical outsourced nitrite testing to American Analytical.

2020-21 Winter Nitrogen Data

TKN (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	<0.50	—
3/31/21	0.64	1.5
3/17/21	8.4	—
3/3/21	0.753	<0.250
2/17/21	1.5	0.52
1/20/21	1.2	—
1/6/21	1.3	1.6
12/23/20	0.89	—
12/9/20	0.87	1.5
11/25/20	1.7	1.3

Total Organic N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	<0.10	—
3/31/21	<0.10	1.4
3/17/21	7.0	—
3/3/21	<0.10	<0.10
2/17/21	<0.10	0.38
1/20/21	<0.10	—
1/6/21	<0.10	1.6
12/23/20	<0.10	—
12/9/20	<0.10	1.4
11/25/20	1.5	1.3

Ammonia as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	1.2	—
3/31/21	1.3	0.14
3/17/21	1.5	—
3/3/21	1.6	0.12
2/17/21	1.6	0.14
1/20/21	1.7	—
1/6/21	1.7	<0.10
12/23/20	1.8	—
12/9/20	1.6	0.14
11/25/20	0.25	<0.10

Nitrite as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	0.075	—
3/31/21	0.0500	0.0500
3/17/21	<0.050	—
3/3/21	0.054	<0.050
2/17/21	0.089	<0.050
1/20/21	0.055	—
1/6/21	0.075	<0.050
12/23/20	0.064	—
12/9/20	0.11	<0.050
11/25/20	<0.050	<0.050

Nitrate as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	9.4	—
3/31/21	7.7	4.8
3/17/21	10.3	—
3/3/21	8.1	5.8
2/17/21	6.6	5.0
1/20/21	8.1	—
1/6/21	7.8	5.6
12/23/20	7.4	—
12/9/20	8.0	4.9
11/25/20	0.35	2.6

Total Inorganic Nitrogen Calculation (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	10.7	—
3/31/21	9.0	4.94
3/17/21	11.9	—
3/3/21	9.7	6.02
2/17/21	8.3	5.24
1/20/21	9.8	—
1/6/21	9.6	5.7
12/23/20	9.2	—
12/9/20	9.7	5.14
11/25/20	0.63	2.6

Total N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/14/21	9.5	—
3/31/21	8.3	6.4
3/17/21	18.8	—
3/3/21	8.8	5.9
2/17/21	8.2	5.6
1/20/21	9.3	—
1/6/21	9.2	7.3
12/23/20	8.3	—
12/9/20	8.9	6.5
11/25/20	2.1	3.9

Notes:

A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

On 3/31/21, Pace Analytical outsourced nitrite testing to American Analytical.

2020 Winter Nitrogen Data

TKN (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/23/20	<0.50	0.59
3/11/20	<0.10	<0.10
2/12/20	0.31	<0.10
1/15/20	<0.10	<0.10

Total Organic N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/23/20	<0.10	0.54
3/11/20	<0.10	<0.10
2/12/20	<0.10	<0.10
1/15/20	<0.10	<0.10

Ammonia as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/23/20	0.92	<0.10
3/11/20	1.3	<0.10
2/12/20	1.2	<0.10
1/15/20	1.2	0.1

Nitrite as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/23/20	0.064	<0.050
3/11/20	<0.050	<0.050
2/12/20	<0.050	<0.050
1/15/20	0.28	0.13

Nitrate as N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/23/20	8.5	4.9
3/11/20	8.2	6.6
2/12/20	7.5	6.2
1/15/20	7.0	7.5

Total Inorganic Nitrogen Calculation (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/23/20	<0.10	0.54
3/11/20	<0.10	<0.10
2/12/20	<0.10	<0.10
1/15/20	<0.10	<0.10

Total N (mg/L)		
Date	**CSHH #14A**	**CSHH #15A**
4/23/20	8.5	5.5
3/11/20	8.2	6.7
2/12/20	7.8	6.2
1/15/20	7.3	7.7

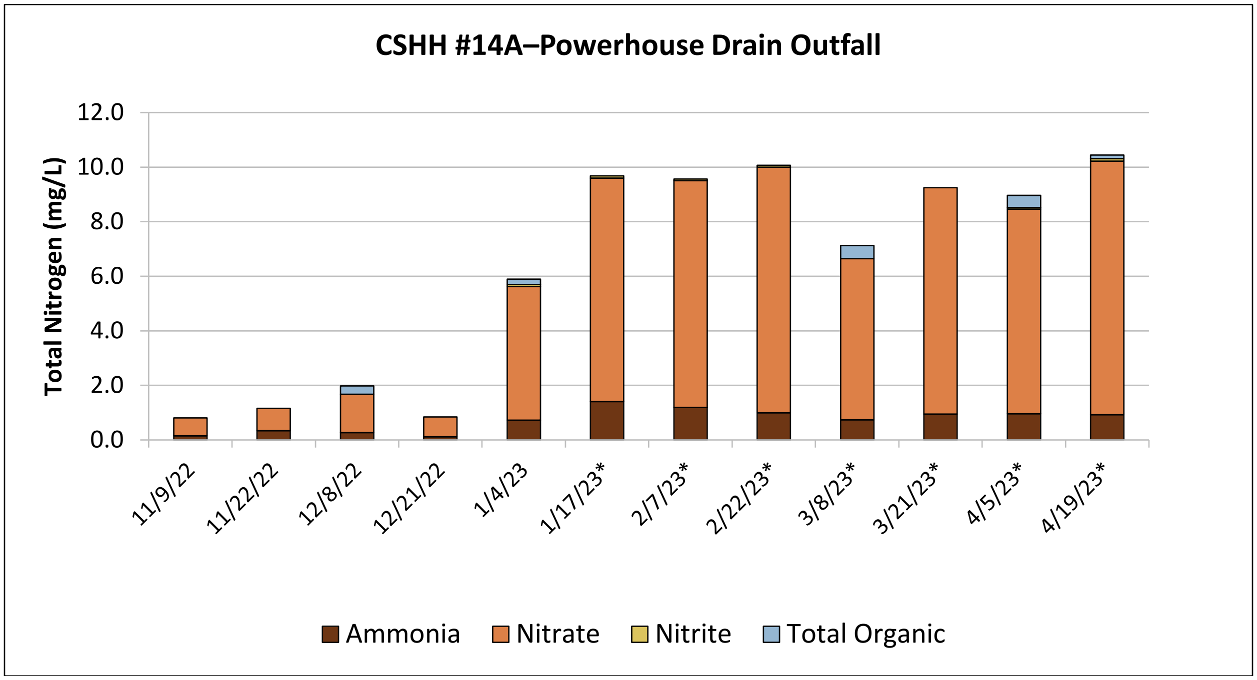
Notes:

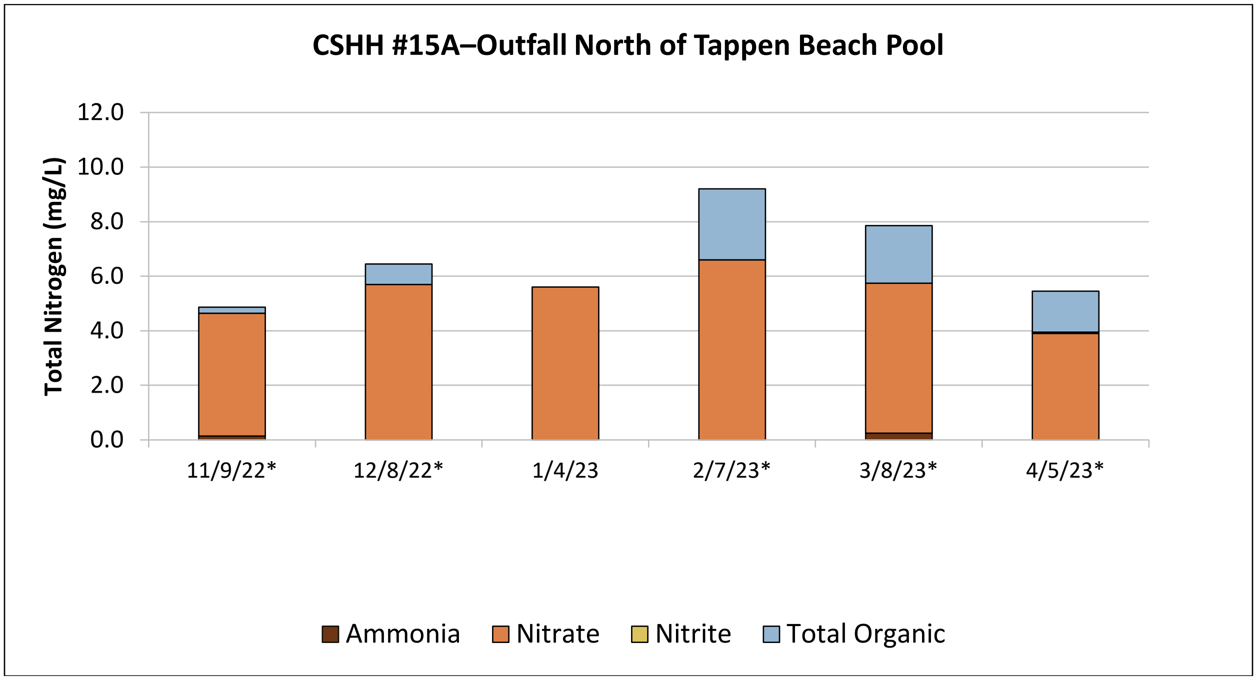
A value given with a less than symbol indicates that the results were below the detection limit.

CSHH #14A, #15A, and #15B are outfalls; tan highlights indicate a direct sample from flow.

2022-23 Winter Total Nitrogen Graphs

The graphs in this section display each station's total nitrogen for the 2022-23 winter-monitoring program. See page D-33 for a full description of total nitrogen graphs.





*Sample taken from direct flow.

Total Nitrogen = Ammonia + Nitrate + Nitrite + Total Organic Nitrogen

Appendix E

Hempstead Harbor Water-Quality Monitoring
2022 Data Usability Assessment

1.1 Background

The Coalition to Save Hempstead Harbor (CSHH) oversees a routine water-monitoring program for 21 stations, including 10 “in-harbor stations” and 11 “outfall stations,” to document water quality conditions and pollutant sources in Hempstead Harbor and its watershed and to support local municipal, county, and state-level water resource management decisions. In-harbor water-quality monitoring includes measuring parameters related to the ecological health of the harbor and sample collection to measure nitrogen and bacteria levels. The outfall-monitoring program involves identifying critical areas of pathogen loading in the harbor. Sampling begins in May and continues until the end of October.

The monitoring data are used by the Coalition to Save Hempstead Harbor, Hempstead Harbor Protection Committee, Nassau County Department of Health, Nassau County Department of Public Works, the Interstate Environmental Commission, the New York State Department of Environmental Conservation, the Connecticut Department of Energy and Environmental Protection, Long Island Sound Study, other nongovernmental/environmental organizations, and the communities surrounding Hempstead Harbor.

The monitoring program helps assess the impact of watershed management improvements on the harbor, collects data to supplement agency data for beach closure and shellfish monitoring, and tracks the impact of environmental policy in the watershed communities. The data are used to produce an annual report for CSHH and local municipal members of the Hempstead Harbor Protection Committee to:

- Identify and study seasonal-scale trends in water quality
- Monitor aquatic habitats
- Identify potential causes for negative events (e.g., algal blooms and fish kills)
- Investigate long-term trends in water-quality parameter levels
- Guide local and regional environmental planning, policy, and compliance efforts (e.g., Phase II Stormwater Program, TMDL development, the Long Island Nitrogen Action Plan, and the Long Island Sound Nitrogen Reduction Strategy)
- Measure progress towards meeting water-quality goals in the watershed
- Help determine whether the opening of additional shellfish-harvesting areas within the harbor is feasible
- Identify pollutant sources for targeting reduction efforts

1.2 Planning—Quality Assurance Project Plan

CSHH conducted water-quality monitoring under an EPA-approved (2020) Quality Assurance Project Plan (QAPP) for the 2022 water-quality monitoring season, which served as the main quality assurance planning project document. The QAPP and its appendices (equipment calibration procedures, standard operating procedures, etc.) were made available to all project personnel, including the Quality Assurance (QA) Manager, QA Officer, Project Manager/Field Team Leader, and Field Samplers. Copies of the QAPP and related quality assurance documentation are retained for recordkeeping and for future reference.

1.3 Sampling

Prospective Field Samplers (staff, volunteers, and/or municipal employees) met with the Program Manager/Field Team Leader regarding the monitoring program. Individuals who conducted sampling received formal training, which included review and discussion of the QAPP and sampling Standard Operating Procedures (SOP) (sample collection procedures, sample handling and labeling, potential safety hazards, and equipment maintenance, inspection, and calibration) before collecting water-quality samples. These individuals adhered to the sampling design outlined in the sampling SOPs throughout the duration of sample collection. The Project Manager/Field Team Leader periodically monitored field activities, which included reviewing sampling procedures and field data sheets, to ensure compliance with sampling SOPs.

Any deviations from typical sampling (e.g., missed samples due to weather or tidal conditions) were recorded in field notes. Information from field data sheets was recorded electronically following sampling events. Data entry was conducted by two CSHH members, and the electronic copy of the data was immediately checked against the field data sheet. The QA Officer also compared field data forms with electronic records to ensure accuracy at least once per month. A field audit was conducted at least once per season by the Project Manager/Field Team Leader and consisted of overseeing sampling procedures. An equipment maintenance audit was conducted at least once over the monitoring season by the Project Manager/Field Team Leader and consisted of overseeing precheck, post check, and calibration procedures. Any deficiencies were reported to the QA Manager. Physical copies of the field data sheets are kept for at least five years in the annual logbook at the CSHH office. Equipment and instruments were calibrated within 24 hours before sampling based on user manual guidelines—calibration records for field equipment were also maintained and kept for future reference. Post-checks of equipment were also conducted immediately following sampling events.

Both vertical profiles and grab samples were collected. Vertical profiles were taken at up to 13 stations to measure the following field parameters: dissolved oxygen, water temperature, salinity, pH, and turbidity, as well as chlorophyll a (for frame-of-reference purposes). Results were not confirmed by a fixed laboratory, but a LaMotte 5860-01 kit (Winkler Titration), a LaMotte 5858-01 kit, and a calibrated thermometer were used at one location per sampling event to confirm the validity of the multiparameter meter (Eureka Manta+ 35) results for dissolved oxygen (bottom), pH (surface), and water temperature (bottom), respectively. Grab samples were collected at up to 21 stations weekly for bacteria analysis, for both fecal coliform and enterococci. Also, grab samples were collected at up to 10 stations biweekly for nitrogen analysis to measure total Kjeldahl nitrogen, ammonia, nitrite, and nitrate. Two NYS DOH ELAP certified laboratories were used for sample analysis: the Nassau County Department of Health laboratory for bacteria analysis and the Pace Analytical Services, LLC laboratory for nitrogen analysis.

1.4 Analysis

Analytical procedures were adhered to as outlined in the project planning documents. The Project Manager/Field Team Leader completed data review during or soon after monitoring events and unusual values were flagged (e.g., missing values, or unexpectedly large or small values) in the data. The cause of the data deficiency was determined and a decision was made on the usability of the data, which was then either accepted, marked as conditional, or discarded. The QA Officer then reviewed the data for usability according to data quality objectives. Additionally, laboratory deliverables were reviewed by the Project Manager/Field Team Leader and met the project requirements outlined in the QAPP.

1.5 Review of Data and Data Deliverables

The QAPP outlined data quality indicators including precision, bias/accuracy, representativeness, comparability, completeness, and sensitivity for each parameter measured. The results of data collection were reviewed at least once per month by the QA Officer to ensure accuracy. Laboratory data deliverables were reviewed by the Project Manager/Field Team Leader for adherence to the quality objectives outlined in the QAPP. Data were reviewed and validated as outlined in the QAPP. In lieu of data review or validation reports, notes on the validity of the data were included in comments in the data sheet (e.g., marking data as conditional or flagging seemingly high values that were still deemed accurate).

1.6 Project Oversight

Performance evaluation samples were not required for this project. A duplicate sample was taken for approximately one in every 10 samples to confirm the results of field and fixed laboratory analysis. The duplicate field samples were analyzed for the same parameters as the corresponding primary samples. As with other samples, proper sample handling and custody procedures were followed for delivery of samples to the lab. Laboratory-reported results for primary and field quality control (QC) samples were within project acceptance limits.

1.7 Data Usability Assessment

Table 1 and **Table 2** summarize acceptance criteria for accuracy, precision, and sensitivity of specific field and laboratory monitoring parameters.

Table 1

Acceptance Criteria for Field Monitoring Parameters

Parameter	Units	Accuracy	Precision (Allowable RPD)	Approx. Expected Range	Sensitivity
Depth (calibrated line)	Meters (m)	± 0.1 m	20%	0 – 12 m	0.1 m
Depth (Eureka Manta+ 35)	Meters (m)	0 to 10 m ± 0.02 m (± 0.2% of FS) 0 to 25 m ± 0.05 m (± 0.2% of FS) *FS = Full Scale*	20%	0 – 12 m	0.01 m
GPS coordinates (Garmin Montana 680t)	Decimal degrees (dec. deg.)	± 7.8 m https://www.gps.gov/systems/gps/performance/accuracy/	For reference point on land, within 10 m (e.g., =0.0001 dec. deg.)	N/A	1.02 m
Air/water temperature (digital thermometer)	Degrees celsius (°C)	± 1 °C	10%	-15 – 36 °C	0.1 °C
Water temperature (Eureka Manta+ 35)	Degrees celsius (°C)	± 0.1°C	10%	4 – 26 °C	0.01°C
Salinity (Eureka Manta+ 35)	Practical salinity scale (pss) = parts per thousand (ppt)	± 1% of reading or ± 0.1 ppt, whichever is greater	10%	5 – 30 ppt	4 digits
Dissolved oxygen (LaMotte 5860-01, Winkler titration method)	Milligrams per liter (mg/l) = parts per million (ppm)	± 0.2 ppm	20%	0 – 14 ppm	0.2 ppm
Dissolved oxygen (Eureka Manta+ 35)	Milligrams per liter (mg/l) = parts per million (ppm) percent saturation (% sat.)	0 – 20 mg/l: ± 0.2 mg/l 0 – 200%: ± 1% of reading or ± 0.1% air sat., whichever is greater	20%	0 – 14 mg/l 0 – 120% sat.	0.01 mg/l 0.1% air sat.

Parameter	Units	Accuracy	Precision (Allowable RPD)	Approx. Expected Range	Sensitivity
Turbidity (Eureka Manta+ 35)	Nephelometric turbidity unit (NTU)	0 – 400 NTU: ± 1% of reading ± 1 count	20%	0 – 30 NTU	4 digits
Water clarity (Secchi disk)	Meters (m)	± 0.1 m	10%	0 – 4 m	0.25 m
pH (LaMotte 5858-01 wide-range indicator)	N/A	5.0 – 10.5	(Color metric)	6.5 – 8.5	0.5
pH (Eureka Manta+ 35)	N/A	± 0.2	5%	6.8 – 8.5	0.01

Table 2
Acceptance Criteria for Laboratory Monitoring Parameters

Parameter	Method	Detection Limit	Accuracy	Precision
Fecal coliform	Membrane filter, SM 9222D-2006	< 1 CFU/100 ml	± 20	20%
Enterococci	Membrane filter, EPA 1600	< 1 CFU/100 ml	± 20	20%
Total Kjeldahl nitrogen	EPA 351.2, Rev. 2.0	< 0.10 mg/l	± 20	20%
Ammonia	EPA 350.1, Rev. 2.0	< 0.10 mg/l	± 20	20%
Nitrate	EPA 353.2, Rev. 2.0	< 0.050 mg/l	± 20	20%
Nitrite	EPA 353.2, Rev. 2.0	< 0.050 mg/l	± 20	20%

Precision

- Duplicate field measurements were taken for one station per sampling day at the first in-harbor station sampled (representing approximately 10% of all samples) for 24 sampling events.
- Relative percent difference (RPD), as outlined in **Table 1** and **Table 2**, was used as precision acceptance criteria. RPD was calculated as follows:

$$\mathrm{RPD} = \frac{\left|\mathrm{Conc(p)} - \mathrm{Conc(d)}\right|}{(\frac{1}{2})(\mathrm{Conc(p)} + \mathrm{Conc(d)})} * 100$$

where:

Conc(p) = Primary Sample Concentration, the first sample collected at that location
Conc(d) = Duplicate Sample Concentration, the second sample collected at that location

- **Table 3** summarizes the results of the precision acceptance criteria for primary samples and their corresponding duplicate samples for parameters analyzed in the field. No measurements were recorded for water clarity (Secchi disk) or air temperature for any of the duplicate samples. Laboratory QA/QC was reviewed by CSHH as lab results were received to ensure that all results fell within acceptable limits defined for precision criteria.

Table 3

Summary of Precision Acceptance Criteria Results for 2022 Season

Parameter	Precision as RPD	Number of Sampling Events Outside Precision Criteria	Dates on Which RPD Value is Exceeded
Water temperature (surface)	10%	0	N/A
Water temperature (bottom)	10%	0	N/A
Salinity (surface)	10%	0	N/A
Salinity (bottom)	10%	0	N/A
Dissolved oxygen (surface)	20%	4	8/3 (23%), 8/10 (30%), 8/24 (31%), 9/14 (21%)
Dissolved oxygen (bottom)	20%	2	7/27 (23%), 10/19 (20%)
pH (surface)	5%	6*	5/25 (7%), 6/1 (10%), 6/22 (8%), 6/29 (6%), 8/17 (8%), 9/14 (9%)
pH (bottom)	5%	0	N/A
Turbidity (surface)	20%	5**	5/18 (31%), 6/15 (32%), 6/22 (40%), 7/13 (38%), 7/27 (31%)
Turbidity (bottom)	20%	9**	5/18 (34%), 5/25 (21%), 6/8 (64%), 6/15 (22%), 6/29 (23%), 8/24 (20%), 9/8 (26%), 10/19 (21%), 10/27 (35%)
Depth	20%	0	N/A

* Number of pH surface readings outside precision criteria likely influenced by an equipment malfunction (see more under Accuracy).
** Turbidity was not measured on 9/28/22.

Accuracy

- Field-measurement accuracy was assessed by performing calibrations and post-checks of the field monitoring equipment the day prior to and the day of monitoring events, respectively. The Eureka Manta+ 35 was calibrated according to procedures outlined in the user manual. Each parameter was successfully calibrated as per the sensor response factor (SRF) indicated by the instrument. Calibration records are logged and maintained by CSHH and are available upon request. Quality control checks of the equipment were performed at the first monitoring station visited, generally CSHH #1, by completing the following checks:
    - Comparing bottom DO results from the Eureka Manta+ 35 to a result obtained via Winkler titration.
    - Comparing surface pH results from the Eureka Manta+ 35 to a result obtained via LaMotte wide-range color-comparator.
        - Early in the 2022 monitoring season, pH values from the Eureka Manta+ 35 multiparameter meter were noticeably lower than the results of the LaMotte reagent kit. The suspected pH malfunction was confirmed, a new pH sensor was installed and put into use starting October 6, and all affected data was flagged.
    - Comparing bottom water temperature results from the Eureka Manta+ 35 to a result obtained via calibrated electronic thermometer.
- Laboratory accuracy was evaluated from laboratory control samples (trip blanks) and surrogate samples, published historical data, method validation studies, and experience with similar samples. No laboratory control samples were flagged for contamination or for being outside of standards.
- Parameter-specific acceptance criteria for accuracy are summarized in **Table 1** and **Table 2**.

Representativeness

- Sampling sites were selected to be representative of the conditions for a specific area of the water body (or a specific pollution source).
- Outfall monitoring stations were not representative of estuarine water quality but are considered representative of conditions in areas within close proximity to freshwater inflow and/or similar pollutant loadings.
- Sample-collection timing and frequency at in-harbor stations were chosen to capture data that were representative of a range of conditions (e.g., wet/dry weather, rising/ebb tide, and seasonal variability).

Comparability

Established field protocols were used for vertical profiles and sampling, and standard laboratory analytical methods were used for sample analysis, consistent with previous CSHH water-quality monitoring events. Vertical profiles were performed and samples were collected generally on the same day of the week and at the same time of day.

Completeness

Data were collected for 24 monitoring events for vertical profiles, 12 events for nitrogen grab samples, and 24 events for bacteria grab samples. The goal was to collect data for at least 80% of the anticipated vertical profiles and the anticipated number of grab samples (for in-harbor and outfall bacteria and nitrogen monitoring) for each monitoring event.

- Six stations (#4-7, #14, and #15) were difficult to consistently access due to varying tidal cycles. Failure to collect sampling data at these sites does not affect the completeness of the data. It was anticipated that the monitoring sites would be accessible a minimum of once every three to four weeks (an average of at least five times) over the 24-event monitoring season. This goal was met, as each station was sampled at least five times during the sampling period.
- Data collection was evaluated for completeness for vertical profiles at stations #1-3, #8, #13, and #16-17 which included the following parameters: water temperature, salinity, dissolved oxygen, pH, water clarity, and turbidity. All sampling events with the exception of 10/6 (57%) met or exceeded the 80% completeness criterion.
- Data collection was evaluated for completeness with respect to grab samples for bacteria and nitrogen sampling.
    - Data collection for stations #1-3, #8-13, #14A, #15A, #16-17, and #17A was evaluated for completeness for the following parameters: fecal coliform and enterococci. All sampling dates exceeded the 80% acceptance criterion except for 10/6 (79%).
    - Data collection for stations #1, #3, #8, #12-13, #14A, #15A, and #16 was evaluated for completeness for the following parameters: total Kjeldahl nitrogen (TKN), ammonia, nitrate, and nitrite. All sampling days met or exceeded the 80% acceptance criterion for sample collection except for 10/6 (63%).

Sensitivity

- Sensitivity limits were determined by the laboratory analytical method or the field instrument (from published specifications). The sensitivity limits for each parameter measured in the field are outlined in **Table 1**.
- Laboratory analytical methods have preset limits of detection for fecal coliform, enterococci, ammonia, nitrate, nitrite, and total Kjeldahl nitrogen, as outlined in **Table 2**.

Conclusion: A majority of sampling events met the completeness goal outlined in the QAPP. Procedures were in place to ensure accuracy, precision, representativeness, and comparability of the data. Additionally, there are annotations in the data—color-coded notes indicating data where values appear low/high but have been validated for accuracy, as well as field notes indicating reasons for missing data—which provide additional detail on data quality for consideration when analyzing the data. Although deviations from the precision acceptance, accuracy, and completeness criteria should be noted and considered when analyzing the data, the data collected by the Coalition to Save Hempstead Harbor during the 2022 water-quality monitoring season can be considered appropriate for use for its intended purposes.

Appendix F

Water-Monitoring Data Sheet, Core Program

Collection Date: Wed. other _______________ ___/___ /2022 **Time:** _______________

GPS Land Reference: ____ **BP:** _________ **Depth:** ______

Monitor Name: Carol DiPaolo, Mark Ring, Michelle Lapinel McAllister

Site Name: CSHH #1, Beacon 11_________________________________ **Location**: Hempstead Harbor

Weather: fog/haze drizzle intermittent rain rain snow clear partly cloudy

% Cloud Cover: 0% 25% 50% 75% 100% other __________

Wind Direction: N NE NW S SE SW E W Velocity: _______kt (mph)

Rainfall:		Date	Amount
Previous 24 hrs accumulation	______in	__________	__________
Previous 48 hrs accumulation	______in	__________	__________
Previous week's accumulation	______in	__________	__________

Tidal Stage: ☐ incoming ☐ outgoing ☐ hours to high tide: _______ H:________ L:________

Water Surface: ☐ calm ☐ ripple ☐ waves ☐ whitecaps

Water Color:
☐ normal: ☐ brown ☐ green ☐ other ____________________________
☐ abnormal: ☐ brown ☐ green ☐ other ____________________________

Water Observations:
☐ jelly fish
☐ odors
☐ oil slick
☐ dead fish
☐ sea weed
☐ floatables
☐ dead crabs
☐ bubbles
☐ ice
☐ algal bloom
☐ foam
☐ turbidity (suspended particles)

Plankton count ________ type ________ sample taken: ☐ surface ☐ ______ below surface

Comments____

____

____

____

____

____

____

____

____

____

____

____

____

Water-Monitoring Data Sheet

Date: ___ /___ /2022

Station: CSHH #________ GPS: 40.______________073.______________ Time: _________ Grab Samples: N____ B____

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH	Secchi (m)	Chlorophyll (ug/L)	Turbidity (NTU)
				(%)	(ppm)				
Wind	Surface								
_____	0.5								
	1								
	2								
Air °C	3								
_____	4								
	5								
Repeat	0.5								
	1								
	2								
	3								
	4								
	5								

Station: CSHH #___________ GPS: 40.______________073.______________ Time: _________ Grab Samples: N____ B____

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH	Secchi (m)	Chlorophyll (ug/L)	Turbidity (NTU)
				(%)	(ppm)				
Wind	Surface								
	0.5								
	1								
_____	2								
	3								
	4								
Air °C	5								
	6								
_____	7								
	8								
	9								
	10								
	11								

Station: CSHH #________GPS: 40.________________073.______________ Time: _________ Grab Samples: N____ B____

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH	Secchi (m)	Chlorophyll (ug/L)	Turbidity (NTU)
				(%)	(ppm)				
Wind	Surface								
	0.5								
	1								
_____	2								
	3								
	4								
Air °C	5								
	6								
_____	7								
	8								
	9								
	10								
	11								

Note: Bottom depth of sampling represented here is not the total depth. Total depth includes an addition of 0.3 m, which is the distance from the depth sensor on the Eureka to the bottom of the platform. Total depth is reflected in the data entry Excel spreadsheet.

Water-Monitoring Data Sheet–Wildlife Observations

Date __________

Birds

Upper Harbor	Lower Harbor
☐ Bald Eagles ____________	____________
☐ Cormorants ____________	____________
☐ Ducks, Mallards ________ ducklings ________	________ ducklings ________
☐ Egrets, Great ____________	____________
☐ Snowy ____________	____________
☐ Geese, Canada ________ goslings ________	________ goslings ________
☐ Brandt ____________	____________
☐ Hooded Gulls ____________	____________
☐ Herons, Blue ____________	____________
☐ Black-Crowned Night ____________	____________
☐ Green ____________	____________
☐ Belted Kingfisher____________	____________
☐ Ospreys ________ chicks ________	________ chicks________
☐ Plover-type, Killdeer ____________	____________
☐ Swans, mute ________ cygnets________	________ cygnets________
☐ Terns ____________	____________
☐ Other ____________	____________

Jellyfish

- ☐ Comb, Sea Walnuts ____________
  - ☐ Sea Gooseberries ____________
- ☐ Lion's Mane ____________
- ☐ Moon ____________

Fish

- ☐ Baitfish ____________
- ☐ Blue ____________
- ☐ Bunker ____________
- ☐ Striped Bass ____________
- ☐ Small Shrimp ____________

Crabs

- ☐ Asian shore ____________
- ☐ Blue-claw ____________
- ☐ Horseshoe ____________

Other Wildlife

____

Human Activities

☐ Barges/tugs, Pt. W gravel op.________ Gladsky ________ Raison________ DiNapoli ________

Global Fuel ____________

☐ Boats, power ________ sailboats ________ kayaks ________ crew ________

shellfishing________near Matinecock Pt.________ Webb Inst. ________ other ________

☐ Anglers, at beaches________ at piers ________

☐ Other ____________

Floatables Observations (type, approximate number)

☐ Bottles, glass ________ plastic ________ ☐ cans ________ ☐ paper ________ ☐ plastic bags/pieces ________

☐ Styrofoam, cups ________ pieces ________ ☐ wood, boards ________ pieces ________ other ________

☐ Other____________

Hempstead Harbor Core Program
Calibration Data Sheet Eureka Manta+ 35

• Calibrations to be completed **DAY BEFORE** or **MORNING OF** Field Sampling Date •
• Post-Readings to be completed the **AFTERNOON OF** or **DAY AFTER** Field Sampling Date •

Calibrations • Person: ______________ **Date:** ______________ **Time:** ______________

Post-Readings • Person: ______________ **Date:** ______________ **Time:** ______________

Handheld S/N: 197407 **Sonde S/N:** MT04172710

◊ COMPLETE **BEFORE** SAMPLING ◊

① Fill cup with **AIR-SATURATED WATER** (Reagent Grade Water)

② Record **CHLOROPHYLL (µg/L)** reading in air-saturated water

Chl µg/L ···· ☐

③ Calibrate **DISSOLVED OXYGEN (HDO%)**

Barometric Pressure (mmHg) ······· ☐

Pre-Calibration Reading

HDO% ···· ☐

Post-Calibration Reading

SRF ··· ☐ HDO% ··· ☐

④ Calibrate **TURBIDITY • 2-Point Calibration**

→**1st Cal Value: ZERO** (Reagent Grade Water)

Pre-Calibration Reading

Turbidity 0 NTU ··· ☐

→**2nd Cal Value: NON-ZERO** (Turbidity Standard)

Pre-Calibration Reading

Turbidity 100 NTU ··· ☐

Post-Calibration Reading

Turbidity **100 NTU** ··· ☐ SRF*··· ☐

*SRF: Will need to look up in Cal Records

⑤ Calibrate **CONDUCTIVITY STANDARD (50,000 µS/cm)**

Pre-Calibration Reading

SpCond µS/cm ··· ☐

Post-Calibration Reading

SRF ··· ☐ SpCond µS/cm ··· ☐

*pH

⑥ Loosen cup to read **DEPTH (0 m)**

Pre-Calibration Reading

Depth m ··· ☐

Post-Calibration Reading

SRF ··· ☐ Depth m ··· ☐

◊ COMPLETE **AFTER** SAMPLING ◊

① Fill cup with **AIR-SATURATED WATER** (Reagent Grade Water)

Post-Readings

HDO %Sat ··· ☐ Chl µg/L ··· ☐

Turbidity 0 NTU ··· ☐

② Fill cup with **TURBIDITY STANDARD (100 NTU)**

Post-Reading

Turbidity 100 NTU ··· ☐

③ Fill cup with **CONDUCTIVITY STANDARD (50,000 µS/cm)**

Post-Reading

SpCond µS/cm ···· ☐

*pH

④ Loosen cup to read **DEPTH (0 m)**

Post-Reading

Depth m ··· ☐

	Reagent Grade Water	**Turbidity Standard** 100 NTU	**Conductivity Standard** 50,000 µS/cm
Manufacturer	Ricca	YSI	YSI
Lot Number	2202917	22C22100212	22C100474
Expiration	7/31/23	3/31/23	9/17/23

Accuracy Range Table	
HDO% (100%)	97 – 103
Chl *a* (0 µg/L)	-0.30 – 0.30
Turbidity (0 NTU)	-3.00 – 3.00
Turbidity (100 NTU)	97.0 – 103.0
SpCond (50,000 µS/cm)	48,500 – 51,500
Depth (0 m)	-0.1 – 0.1

GPS of reference station: (circle one) [✓ **NAD-83**] **WGS-84**

• within 2 days of sampling day • in decimal degrees •

Lat.:	**Long.:**

*See page 2 for pH calibration checks.

Sonde Calibration Data Sheet

Eureka Manta+ 35

♦COMPLETE **BEFORE** SAMPLING♦

5a. Calibrate **pH STANDARD • 2-Point Calibration**

Pre-Calibration Reading

➔ **1st Cal Value: pH 7 •••** ☐

➔ **2nd Cal Value: pH 10 •••** ☐

Post-Calibration Reading

➔ **2nd Cal Vaue: pH 10 •••** ☐

SRF ••• ☐

♦COMPLETE **AFTER** SAMPLING♦

Post-Readings

3a. Fill cup with **pH STANDARD**

➔ **1st Cal Value: pH 7 •••** ☐

➔ **2nd Cal Value: pH 10 •••** ☐

	pH 7 Standard	**pH 10 Standard**
Manufacturer	LaMotte	LaMotte
Lot Number	2088504	1232125
Expiration	4/30/24	9/30/23

Change pH reference standard monthly.

Date of pH reference standard replacement:

____

Accuracy Range Table	
pH 7	6.8 – 7.2
pH 10	9.8 – 10.2

Hempstead Harbor Core Program
Calibration Datasheet YSI ProPlus

• Calibrations to be completed **DAY BEFORE** or **MORNING OF** Field Sampling Date •
• Post-Readings to be completed the **AFTERNOON OF** or **DAY AFTER** Field Sampling Date •

Calibrations • Person: ______________________________ **Date:** ______________________ **Time:** ____________________

Post-Readings • Person: ____________________________ **Date:** ______________________ **Time:** ____________________

Handheld S/N: 14B104664 **Sonde S/N:** 18M100228

◊ COMPLETE **BEFORE** SAMPLING ◊

① Calibrate **CONDUCTIVITY STANDARD (50,000 µS/cm)**

Pre-Calibration Reading

SpCond µS/cm • • •

Post-Calibration Reading

SpCond µS/cm • • •

② Calibrate **pH • 2-Point Calibration**

Pre-Calibration Reading

→ 1st Cal Value: pH 7 • • •
→ 2nd Cal Value: pH 10 • • •

Post-Calibration Reading

pH 10 • • •

③ Calibrate **DISSOLVED OXYGEN (HDO%)** with **WATER-SATURATED AIR** (Reagent Grade Water)

- place a small amount of clean water (1/8 inch) in the storage cup
- make sure there are no water droplets on the DO membrane or temperature sensor
- screw the cap back on, disengage one or two threads to ensure atmospheric venting (make sure the DO and temperature sensors are not immersed in water)
- wait approximately 10 minutes for the storage container to become completely saturated

Barometric Pressure (mmHg) • • • • • • •

Pre-Calibration Reading

HDO% • • •

Post-Calibration Reading

HDO% • • •

☐ DO cap changed (once per month); follow instructions on pg. 21 of YSI Professional Plus User Manual

◊ COMPLETE **AFTER** SAMPLING ◊

① Fill cup with **CONDUCTIVITY STANDARD (50,000 µS/cm)**

Post-Reading

SpCond µS/cm • • •

② Fill cup with **pH 7.00 Standard**

Post-Reading

pH 7.00 • • •

③ Fill cup with **pH 10.00 Standard**

Post-Reading

pH 10.00 • • •

④ Follow WATER-SATURATED AIR procedure on left

Post-Reading

HDO% • • •

	Conductivity Standard 50,000 µS/cm	**pH 7 Buffer**	**pH 10 Buffer**	**Reagent Grade Water**
Manufacturer				
Lot Number				
Expiration				

Accuracy Range Table	
SpCond (50,000 µS/cm)	48,500 – 51,500
pH 7	6.8 – 7.2
pH 10	9.8 – 10.2
HDO% (100%)	97.0 – 103.0

GPS of reference station: (circle one) [✓ **NAD-83**] **WGS-84**

• within 2 days of sampling day • in decimal degrees •

Lat.:
Long.:

Nassau Co. DOH PHL 209 Main Street Hempstead, NY 11550	FORM NAME: COALITION TO SAVE HEMPSTEAD HARBOR ☐ QC ☐ Equip Maint ☐ Training ☐ Comp Doc ☑ Other	
LABORATORY SECTION ☐ Chemistry ☑ Environmental Microbiology ☐ Clinical Microbiology	Form. No.: Beach Monitoring Daily Sampling Log - 1 Date: 12/14/2021	Rev: 3 Created By: CONNIE IANNUCCI

BEACH MONITORING DAILY SAMPLING LOG

COALITION TO SAVE HEMPSTEAD HARBOR

Elap ID
#10339

NASSAU COUNTY DEPARTMENT OF HEALTH
DIVISION OF PUBLIC HEALTH LABORATORIES
209 MAIN STREET, HEMPSTEAD, NY 11550
DAVID TAMAYEV, MD, MICROBIOLOGY TECHNICAL DIRECTOR
TELEPHONE (516) 572-1202 FAX (516) 572-1206

Michelle Lapinel McAllister
COLLECTOR'S NAME **DATE**

ALL SAMPLES SUBMITTED IN STERILE POLYSTYRENE VESSELS CONTAINING SODIUM THIOSULFATE (UNLESS OTHERWISE SPECIFIED)

Field Number		**Location**	**Time**	**Temperature**		**Wind**	**Weather**	**Wave Height**	**Laboratory Use Only**			
				Air	**Water**				**Lab Number**	**Fecal Coliforms CFU/100 mL**	**Enterococci CFU/100 mL**	**Comments**
CSHH-1		BEACON ELEVEN										
CSHH-1A												
CSHH-2		BELL BUOY 6										
CSHH-3		RED MARKER GLEN COVE CREEK										
CSHH-8		GLEN COVE STP										
CSHH-9		FIRST PIPE WEST OF STP OUTFALL										
CSHH-10		PIPE AT CORNER OF SEAWALL WEST OF STP OUTFALL										
CSHH-11		50 YARDS EAST OF STP OUTFALL										
CSHH-12		EAST OF STP OUTFALL BY BEND IN SEAWALL										
CSHH-13		60 FEET WEST OF MILL POND WEIR										

COMMENTS/REMARKS:

REPORT TO: **RECREATIONAL FACILITIES**
200 COUNTY SEAT DRIVE
MINEOLA, NY 11501

***ESTIMATED COUNT**
TNTC = "TOO NUMEROUS TO COUNT"

DATA ENTRY: PROOFED:

TEST	**TECHNOLOGY**	**METHOD**
Fecal Coliform CFU/100 ml.	MF-QN	SM 9222D-2006
Enterococci CFU/100 ml	MF-QN	EPA 1600

TEMP CONTROL:
TIME RECEIVED:
DATE RECEIVED:
DATE ANALYZED:
SAMPLE ACCEPTABLE: YES ☐ NO ☐
ANALYSIS SUCCESSFUL: YES ☐ NO ☐

LABORATORY ACCREDITATION NOTICE:

The results provided on this report have been produced in compliance with "NELAC" (National Environmental Laboratory Accreditation Conference) standards and relate only to the identified sample. Any deviations from the accepted "NELAC" collection requirements for non-potable samples are appropriately noted. This report shall not be reproduced except in full without the written approval of the laboratory. Current New York State laboratory certification status is maintained under ELAP ID #10339.

VERIFICATION REVIEW

Name: **Title:** **Date:**

Comments:

Nassau Co. DOH PHL 209 Main Street Hempstead, NY 11550	FORM NAME: COALITION TO SAVE HEMPSTEAD HARBOR ☐ QC ☐ Equip Maint ☐ Training ☐ Comp Doc ☑ Other	
LABORATORY SECTION ☐ Chemistry ☑ Environmental Microbiology ☐ Clinical Microbiology	Form. No.: Beach Monitoring Daily Sampling Log - 1 Date: 12/14/2021	Rev: 3 Created By: CONNIE IANNUCCI

BEACH MONITORING DAILY SAMPLING LOG

COALITION TO SAVE HEMPSTEAD HARBOR

Elap ID
#10339

NASSAU COUNTY DEPARTMENT OF HEALTH
DIVISION OF PUBLIC HEALTH LABORATORIES
209 MAIN STREET, HEMPSTEAD, NY 11550
DAVID TAMAYEV, MD, MICROBIOLOGY TECHNICAL DIRECTOR
TELEPHONE (516) 572-1202 FAX (516) 572-1206

Michelle Lapinel McAllister
COLLECTOR'S NAME **DATE**

ALL SAMPLES SUBMITTED IN STERILE POLYSTYRENE VESSELS CONTAINING SODIUM THIOSULFATE (UNLESS OTHERWISE SPECIFIED)

Field Number		**Location**	**Time**	**Temperature**		**Wind**	**Weather**	**Wave Height**	**Laboratory Use Only**			
				Air	**Water**				**Lab Number**	**Fecal Coliforms CFU/100 mL**	**Enterococci CFU/100 mL**	**Comments**
CSHH-14A		CEMENT OUTFALL ADJACENT TO POWER PLANT										
CSHH-15A		SCUDDER'S POND OUTFALL @ SEAWALL N. OF TAPPEN POOL										
CSHH-15B		SCUDDER"S POND WEIR										
CSHH-16		OUTER HARBOR MIDWAY BETWEEN EAST/WEST SHORE										
CSHH-17		OUTSIDE RESTRICTED AREA OF CRESCENT BCH ACROSS FROM WHITE BLDG										
CSHH-17A		INSIDE RESTRICTED AREA OF CRESCENT BCH ACROSS FROM WHITE BLDG & STREAM										
TRIP BLANK												

COMMENTS/REMARKS:

REPORT TO: **RECREATIONAL FACILITIES**
200 COUNTY SEAT DRIVE
MINEOLA, NY 11501

Tide: High / Low **Time**: ______
Tide: High / Low **Time**: ______

14A: Mixed / Direct **15A**: Mixed / Direct

***ESTIMATED COUNT**
TNTC = "TOO NUMEROUS TO COUNT"

DATA ENTRY: PROOFED: RAIN 24 : RAIN 48: SOURCE: Sea Cliff rain gauge

TEST	**TECHNOLOGY**	**METHOD**
Fecal Coliform CFU/100 ml.	MF-QN	SM 9222D-2006
Enterococci CFU/100 ml	MF-QN	EPA 1600

TEMP CONTROL: TIME RECEIVED: DATE RECEIVED:

DATE ANALYZED:

SAMPLE ACCEPTABLE: YES ☐ NO ☐ ANALYSIS SUCCESSFUL: YES ☐ NO ☐

LABORATORY ACCREDITATION NOTICE:

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VERIFICATION REVIEW		
Name:	**Title:**	**Date:**
Comments:		

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A **Required Client Information:**		**Section B** **Required Project Information:**		**Section C** **Invoice Information:**		
Company:	Coalition to Save Hempstead Harbor	Report To:	Carol DiPaolo	Attention:		
Address:	PO Box 159	Copy To:	cshh.org@gmail.com	Company Name:		
Sea Cliff, NY 11579				Address:		**Regulatory Agency**
Email:	cshh.org@gmail.com	Purchase Order #:		Pace Quote:		
Phone:	(516) 801-6792 Fax	Project Name:	HEMPSTEAD HARBOR MONITORING	Pace Project	betty.harrison@pacelabs.com	**State / Location**
Requested Due Date:		Project #:		Pace Profile #:	7288	NY

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

SAMPLE ID

One Character per box. (A-Z, 0-9 / , -)
Sample Ids must be unique

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to	SAMPLE TYPE (G=GRAB C=CO	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Y/N Analyses Test	No2/NO3,	NO2	NH3	TKN	Total Nitrogen	Total Organic Nitrogen							Residual Chlorine (Y/N	
1	CSHH #1	WT	G						2	1	1								X	X	X	X	X	X								
2	CSHH #3	WT	G						2	1	1								X	X	X	X	X	X								
3	CSHH #6	WT	G						2	1	1								X	X	X	X	X	X								
4	CSHH #7	WT	G						2	1	1								X	X	X	X	X	X								
5	CSHH #8	WT	G						2	1	1								X	X	X	X	X	X								
6	CSHH #12	WT	G						2	1	1								X	X	X	X	X	X								
7	CSHH #13	WT	G						2	1	1								X	X	X	X	X	X								
8	CSHH #14A	WT	G						2	1	1								X	X	X	X	X	X								
9	CSHH #15A	WT	G						2	1	1								X	X	X	X	X	X								
10	CSHH #16	WT	G						2	1	1								X	X	X	X	X	X								
11																																
12																																
13																																
14																																SAMPLE CONDITIONS

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME				

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Michelle Lapinel McAllister

SIGNATURE of SAMPLER:

DATE Signed:

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

prepared by

COALITION TO SAVE HEMPSTEAD HARBOR
EST. 1986

Report printed on recycled paper.