Hempstead
Harbor
Protection
Committee

Long Island, New York

2018
Water-Quality Report
Hempstead Harbor

(Full Report, Including Appendices)

Revised September 2020.

prepared by

Coalition to Save Hempstead Harbor

FUSS & O'NEILL

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Horseshoe Crabs - John Waldman
Gull with Sea Star - Michelle Lapinel McAllister
Clearnose Skate - Paul Boehm
(large background photo) View of Hempstead Harbor Looking North - Carol DiPaolo

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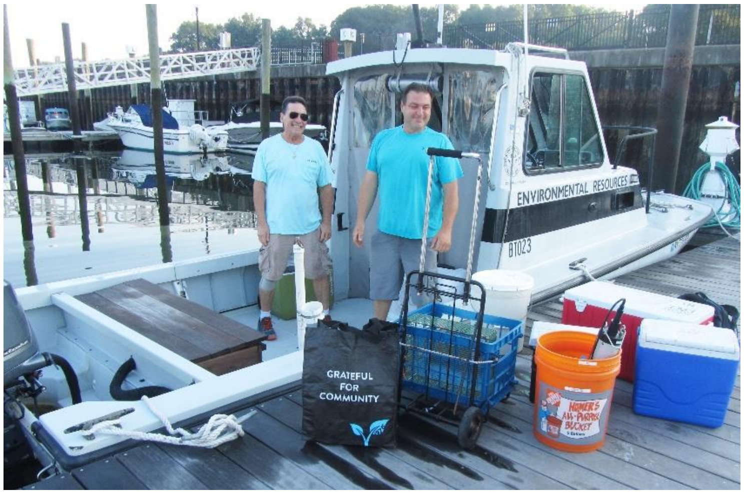

TOBAY Environmental Resources staffers Antonio Alfieri (r) and John Bundas (l) (photo by Carol DiPaolo, 8/29/18)

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). 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 monitoring groups and agencies 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 (HHPC) (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.)

During 2007, a copy of the QAPP, water-quality data, and other information from the water-monitoring program was 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 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. At the start, Hempstead Harbor's water-quality monitoring program, therefore, included dissolved oxygen as a critical monitoring parameter (among others).

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.

Scudder's Pond restoration and construction work: coir banks for stream from upper pond (l) and new stormwater basin for country club cottages (r) (photos by Carol DiPaolo, 3/11/14)

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. 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, which had been identified as the second largest contributor of bacteria to the harbor.

Part of the CSHH crew volunteering for an early spring cleanup of Scudder's Pond (photo by Henriette Rohl, 4/21/18)

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 will help us understand what happens to bacteria levels during cold winter months as well as examine changes in bacteria levels as construction work at the pond proceeded and following the completion of the restoration in June 2014. Although regular winter monitoring for Scudder's Pond ended in April 2016, samples continue to be collected periodically during winter months to check on conditions as we continue winter monitoring of the powerhouse outfall.

In 2015, three new stations were established in the outer harbor for the regular monitoring season. These stations are located within the area 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 nonmunicipal 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 implemented 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

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 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). More recently, CSHH 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.)

In 1996, CSHH initiated the creation of the **Water-Monitoring Work Group**, a soundwide network of environmental agencies and nonprofits connected with water-monitoring programs around Long Island Sound. The 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. The soundwide network established as a result of the work group remains an important resource to determine the location and extent of various water conditions around the sound.

In 1998, CSHH published ***Hempstead Harbor: Its History, Ecology, and Environmental Challenges***. The book supports the goals of the water-monitoring program in encouraging community members to learn about Hempstead Harbor as an important 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 (as well as the 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 Web site at www.MYSound.uconn.edu, so that water-quality data from Hempstead Harbor could be viewed on the Web. The Town of Oyster Bay became an important partner in this project, having contributed the stationary probe and use of a boat and staff to assist with probe maintenance. In 2005, logistical problems and lack of funding to purchase and maintain necessary new equipment prevented the continuation of this program.

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.

CSHH continues to serve on **review committees** for restoration-plan proposals such as the Scudder's Pond Restoration Program and Glenwood Road/Powerhouse Drain Stormwater Pollution Abatement Plan. In 2009, CSHH initiated a work group of local community organizations to focus on development of a townwide land-preservation plan. The work group considered various land-use planning vehicles. It also considered a proposal to review the Town of Oyster Bay's Groundwater and Open Space Protection Plan (2006) in light of current local land-use and harbor preservation efforts. A first step toward a broader land-use preservation plan is 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**, which was charged with addressing climate change and ways to measure the impacts on Long Island Sound. (This was part of a bistate–New York and Connecticut–approach to understanding climate-change indicators for Long Island Sound and selecting appropriate sites to measure them. In 2011, the *Sentinel Monitoring for Climate Change in the Long Island Sound Estuarine and Coastal Ecosystems of New York and Connecticut* was completed; in 2013 a pilot program was implemented to monitor key climate change indices (sentinels) at locations within Long Island Sound and evolved into the current Climate Change and Sentinel Monitoring Program.)

In April 2011, CSHH organized an **emergency cleanup of plastic disks** that were 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. Throughout the rest of the season, disks continued to wash up on Hempstead Harbor beaches as well as along the shores of other bays around Long Island Sound and are still found occasionally during annual beach cleanups.

In September 2018, CSHH coordinated local activities as part of the **International Coastal Cleanup**, as it has for all but two years since 1992. CSHH sponsored three other local beach and shoreline cleanups in 2018.

Volunteers at the International Coast Cleanup at Tappen Beach included students from Jericho High School and local residents (photos by Carol DiPaolo, 9/15/18)

CSHH continues to work with other environmental groups and agencies around Hempstead Harbor and Long Island Sound. For example, in November 2011, CSHH helped to scope out the density of blue mussels at a site in Hempstead Harbor; the site had been used as part of the National Status and Trends Mussel Watch program since 1986 (a project sponsored by the National Oceanic and Atmospheric Administration (NOAA)). In March 2012, CSHH was asked to scope out the density of ribbed mussels in Hempstead Harbor as part of another NOAA project.

CSHH has also participated on **advisory committees** that have been created to develop local revitalization plans for harbor communities. CSHH served as a member of the Glen Cove Creek Reclamation Committee, Glenwood Landing Steering Committee, the Roslyn Waterfront Committee, the Glen Cove Waterfront Citizens' Planning Committee, and the Glen Cove Master Plan Task Force, among others.

In 2013, CSHH and HHPC were 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 selected to have the first embayment report cards to serve as pilot projects to help launch the larger, **soundwide report-card system**. Both harbors were selected because of their longstanding and credible water-quality monitoring programs and availability of the necessary water-quality data. The project, developed by scientists from the University of Maryland and funded by a 2013 Long Island Sound Futures Fund grant award, was completed in 2015.

In 2016, CSHH was asked to participate in the **Unified Water Study (UWS) for Long Island Sound embayments**. 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 an embayment report card can be developed comparing ecological conditions in bays around Long Island Sound. In 2017 and 2018, CSHH again participated in the UWS, coordinating the biweekly 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. 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**.

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 HHPC (Long Island's first inter-municipal 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 County of Nassau, 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, the Board of Directors of Friends of Cedarmere, the Board of Directors of the Coalition Against an UnSound Crossing, and represents the Village of Mill Neck on the Oyster Bay/Cold Spring Harbor Protection Committee. These ties and cooperative effort save each municipality expenses and provide a coordinated approach to solving harbor problems and a year-round focus on harbor issues.

The HHPC prepared **the Scudder's Pond Subwatershed Plan** (2006) and has 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 for the **Powerhouse Drain 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, 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 educational efforts** include 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; and the installation of pet-waste stations around 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, the Oyster Bay/Cold Spring Harbor Protection Committee, the Northport Water Quality Protection Committee, and the Peconic Estuary Protection Committee.

Section of Hempstead Harbor shoreline trail and signage (photos by Carol DiPaolo, 5/20/15)

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 to achieve this for the remaining portions of the harbor.

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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 spills, sewage spills, toxic contamination, stormwater runoff, air pollution, and industrial discharges. The worst of these effects were noted in the mid-1980s.

Powerhouse drain at low tide adjacent to site where the brick building and power plant substation stood until 2015 (l) and view looking west at the Bar Beach sand spit (r) (photos by Carol DiPaolo, 3/3/16)

Efforts to restore the harbor resulted in the closure of a landfill, two incinerators, and a sewage treatment plant. Dramatic changes around the harbor have resulted in improved 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 2008, Nassau County purchased the plant from the City of Glen Cove; in January 2015, United Water Long Island began operation of the plant along with other county-owned plants.) 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.

The remediation of some hazardous waste sites has been completed, and remediation of others is still underway.

Wetland-restoration planting at Bar Beach lagoon in 2003 (l) and in 2005 (center) (photos by Kevin Braun) and view from the completed section of the shoreline trail (r) (photo by Carol DiPaolo, 5/2/15)

Wetlands 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, and plans are being implemented to extend the trail farther.

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 re-covered 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.

Today, Hempstead Harbor continues to support many diverse uses and activities. Fuel is transported to the Glenwood Landing terminal (Global Partners LP), which is near 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, yacht clubs, and fishing clubs, which are concentrated in the northern 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 Hempstead Harbour Club is located at the end of Garvies Point Road in Glen Cove and near the entrance of Glen Cove Creek (photo by Carol DiPaolo, 9/18/18)

A challenge that must be met in planning for the future of Hempstead Harbor is to balance these diverse and often competing interests. 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." Specific environmental challenges and priorities that remain for Hempstead Harbor include stormwater runoff abatement; continued improvements in water quality and reductions in bacteria 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 the full copy of this report and the electronic version compare parameters (such as rainfall and bacteria levels) that show expected correlations but also noticeable variability. The data collected over the years are a critical resource as we look for trends that point to the health of the harbor.

Assessing the health of Hempstead Harbor, as well as Long Island Sound, is complicated. There are many variables. Some things we can control–such as nitrogen discharges and other pollution from both point and nonpoint sources; other things we can't control–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 learn about the interrelationships that occur in Hempstead Harbor. This information enables us to work with others on a harborwide and soundwide basis to discover causal effects of human activities, so that we can plan and implement best management practices to assure a healthy environment for the future.

2.1 Quality Assurance Project Plan

The first Quality Assurance Project Plan (QAPP) for the Hempstead Harbor water-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 EPA to reflect changes in the program in 2011 and 2014. A new QAPP, initiated in 2018, was completed and approved in early 2019.

The approval of the QAPP by the US Environmental Protection Agency, Region 2, broadens the use of the program's data by additional outside organizations, enables the program to receive federal funding for future monitoring efforts, reiterates the ongoing commitment of CSHH to provide high-quality monitoring data for Hempstead Harbor, and demonstrates the reliability of the data presented in this and previous water-quality reports.

To further this goal, a data usability assessment is included at Appendix F.

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 in the northern portion of the harbor, between the sand spit of 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 a few others that are 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 of the stations for the core program correspond to stations established for the Unified Water Study (UWS) for Long Island Sound embayments, as described at *Section 2.3,* and these are indicated in *Table 1*.

2.2.1 Station Locations

Below is 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 at 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 Harbor Club and Sea Cliff Beach
- CSHH #8, at the Glen Cove sewage treatment plant (STP) outfall pipe
- CSHH #9, about 10 ft west of CSHH #8
- CSHH #10, about 20 ft west of CSHH #8, at the end of the seawall
- CSHH #11, about 50 ft east of CSHH #8, at the end of the floating dock
- 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 feet from the Mill Pond weir
- CSHH #15, about 50 yds from Scudder's Pond outfall, at northwest corner of the Tappen Beach pool area
- CSHH #15A, at the Scudder's Pond outfall pipe, 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

Aerial view of Glen Cove Creek: Sea Cliff Beach, Sea Cliff Yacht Club and dock (foreground), Glen Cove marinas, and Glen Cove STP (7/08) (photo by Joel Ziev)

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, at the North Hempstead Beach Park (formerly Bar Beach) sand spit
- 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, the station farthest south in the harbor, on the east shore just before the walkway for the Sterling Glen and Horizon communities (totaling 208 senior rental units at Bryant Landing) 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 the Sterling Glen and Horizon buildings.)
- CSHH #14, about 50 yds from powerhouse outfall
- CSHH #14A, directly from the powerhouse outfall

Figure 1
Core-Program Station Locations

Figure 2
Station Locations for Harbor Sections and Glen Cove Creek

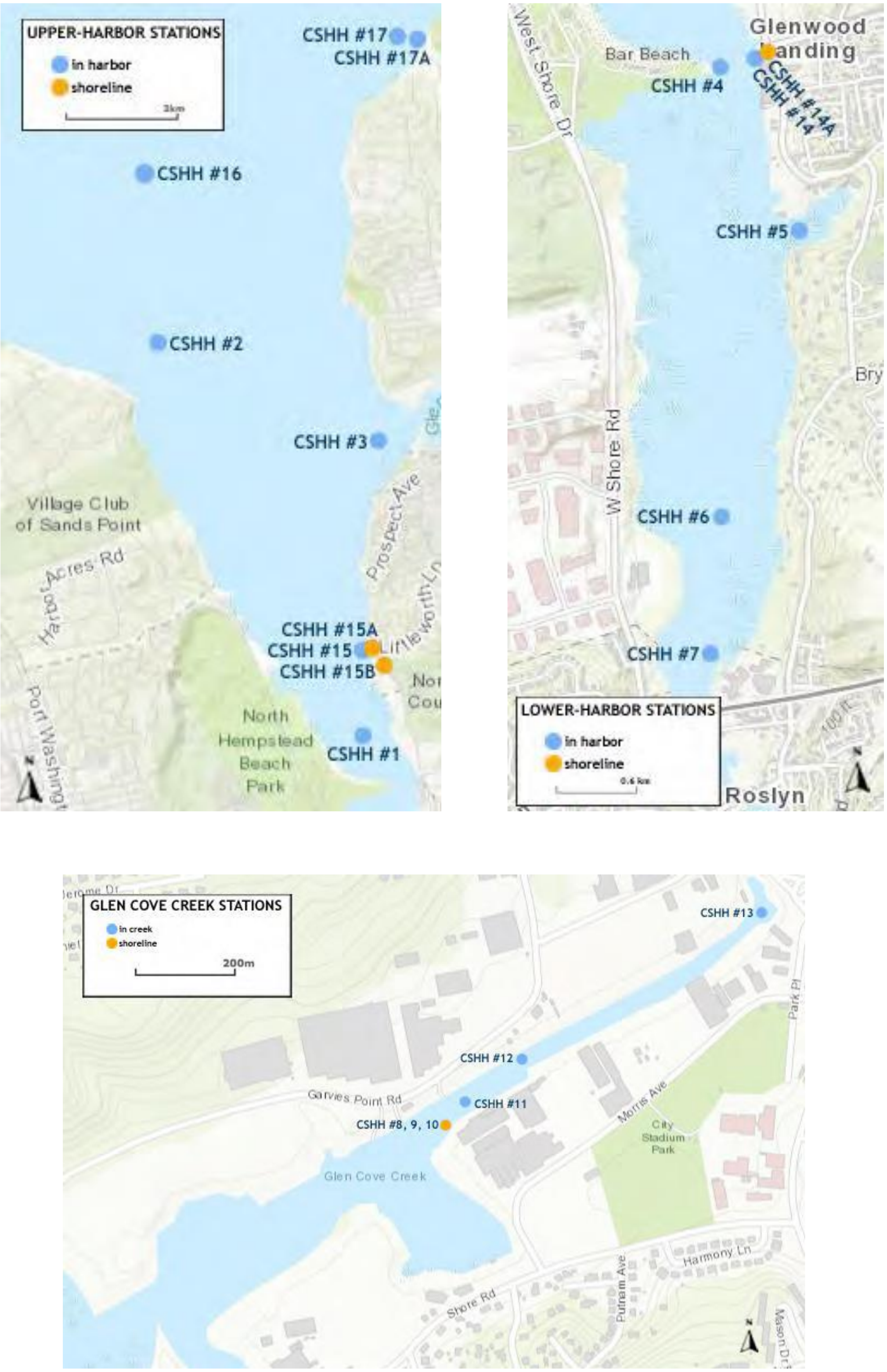


Table 1
Latitude/Longitude Points for Monitoring Stations (NAD 83 Datum)

Station ID	Latitude N	Longitude W
Upper-Harbor Stations		
CSHH #1, Beacon 11 (Corresponds to 2018 UWS station HEM-0-01)	40.83189	073.65353
CSHH #2, Bell 6 (Corresponds to UWS station HEM-0-04)	40.86099	073.67362
CSHH #3, red channel marker (Corresponds to UWS station HEM-0-03)	40.85373	073.65202
CSHH #8, adjacent to STP outfall pipe	40.85849	073.64204
CSHH #9, 10 ft west of #8	40.85850	073.64195
CSHH #10, 20 ft west of #8	40.85846	073.64198
CSHH #11, 50 ft east of #8	40.85852	073.64141
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 Pool	40.83837	073.65263
CSHH #15B, at Scudder's Pond weir	40.83709	073.65144
CSHH #16, north of Bell 6 (Corresponds with 2018 UWS station HEM-0-05)	40.87349	073.67493
CSHH #17, just outside the Crescent Beach restricted shellfish area (Corresponds to 2018 UWS station HEM-0-06)	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) 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 Swam Creek. (Construction on the north side of Glen Cove Creek and the increased number of barges at the head of the creek in 2018 sometimes impaired access to CSHH #13.)

Garvies Point development project along north side of Glen Cove Creek, view looking east toward head of the creek (photo by Carol DiPaolo, 8/29/18)

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 (established in 2010), 15, 15A, and 15B for bacteria analysis by the NCDH (using water-quality standards for bathing beaches) as an alternative way to monitor discharges from the powerhouse drain (#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 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, 6/6/18)

2.2.3 Frequency of Testing and Testing Parameters

Testing for the core Hempstead Harbor monitoring program 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 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. However, in 2018 weekly sample collection was 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 until 2016 when the facility used for the lab analysis 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). A listing of core-program testing parameters, samples collected, 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, salinity, water temperature, and pH are recorded with an electronic meter. In 2017 and 2018, the Eureka Manta+ 35, which was provided to all groups participating in the UWS (see *Section 2.3*), was used by CSHH for both the core Hempstead Harbor monitoring program and the UWS program. (The YSI ProPlus meter, which had been used since 2014, is maintained as a backup instrument.) For the core program, the electronic meter is used at 1-meter-depth increments at every station. A sample of bottom water is also tested for DO using the Winkler titration method at the first station that is monitored for the day (generally CSHH #1) as a quality-assurance check of the electronic meter. A quality assurance test is also performed for pH using a LaMotte test kit–a wide-range indicator that uses a color comparator.

In 2017 and 2018, the Eureka Manta+ 35 was also used to measure turbidity (the LaMotte 2020e portable turbidity meter, which had been used previously, is maintained as a backup instrument). 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 because monitoring events for both programs are scheduled for consecutive days, Chl a levels were recorded for the core monitoring program as merely a frame of reference (see *Section 3.6*).

Platform for the Eureka Manta+ 35 meter (top left) and water-monitoring crew members (photos by Carol DiPaolo, 8/29/18 and 9/26/18, and Michelle Lapinel McAllister, 6/6/18)

Table 2
CSHH Monitoring–Program Parameters

Parameter	Location	Analyzer or Method	Location of Analysis
Dissolved Oxygen	Vertical profiles starting half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Dissolved Oxygen	One location for electronic meter validation	LaMotte 7414	Field
Water Temperature	Vertical profiles starting at half meter below surface and then 1-meter intervals at CSHH #1-8, 13,14, 15, 16, and 17	Eureka Manta+ 35	Field
Water Temperature	One station for electronic meter validation	Calibrated thermometer	Field
Air Temperature	One measurement at each station during monitoring	Calibrated electronic thermometer	Field
Salinity	Vertical profiles starting at a half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
pH	Vertical profile starting at a half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+	Field
pH	One station for electronic meter validation	LaMotte 2218 reagent	Field
Turbidity	Vertical profiles starting at a half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Clarity	CSHH #1-8, 13, 14, 15, 16, and 17	LaMotte Secchi disk	Field
Chlorophyll a	Vertical profiles starting at half meter below surface and then 1-meter intervals at CSHH #1-8, 13, 14, 15, 16, and 17	Eureka Manta+ 35	Field
Fecal Coliform	Grab sample half-meter depth at CSHH #1-13, 14, 15, 16, 17, and 17A and just below surface or from outfall flow at 14A, 15A, and 15B	Membrane filter	Nassau County Department of Health
Enterococci	Grab sample at half meter depth at CSHH #1-13, 14, 15, 16, 17, and 17A and just below surface or from outfall flow at 14A, 15A, and 15B	Membrane filter	Nassau County Department of Health
Ammonia	Grab sample at half meter depth at CSHH #1-13, 14, 15, 16, 17, and 17A and just below surface or from outfall flow at 14A, 15A, and 15B	SM22 4500	Pace Analytical Services, LLC
Nitrate	Grab sample at half meter depth at CSHH #1-13, 14, 15, 16, 17, and 17A and just below surface or from outfall flow at 14A, 15A, and 15B	EPA 353.2 Rev.2.0	Pace Analytical Services, LLC
Nitrite	Grab sample at half meter depth at CSHH #1-13, 14, 15, 16, 17, and 17A and just below surface or from outfall flow at 14A, 15A, and 15B	EPA 353.2 Rev.2.0	Pace Analytical Services, LLC
Precipitation	Village of Sea Cliff	Visually read rain gauge	Field

2.3 Unified Water Study

In 2017 and 2018, the Coalition to Save Hempstead Harbor participated in the *Unified Water Study: Long Island Sound Embayment Research* (UWS), funded by the Long Island Sound Funders Collaborative and coordinated by Save the Sound. CSHH was one of 12 groups that initially participated in the program in 2017. 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 2018, 21 groups monitored 24 locations, ranging geographically from Queens, NY, to Stonington, 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).

2.3.1 UWS Station Locations

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

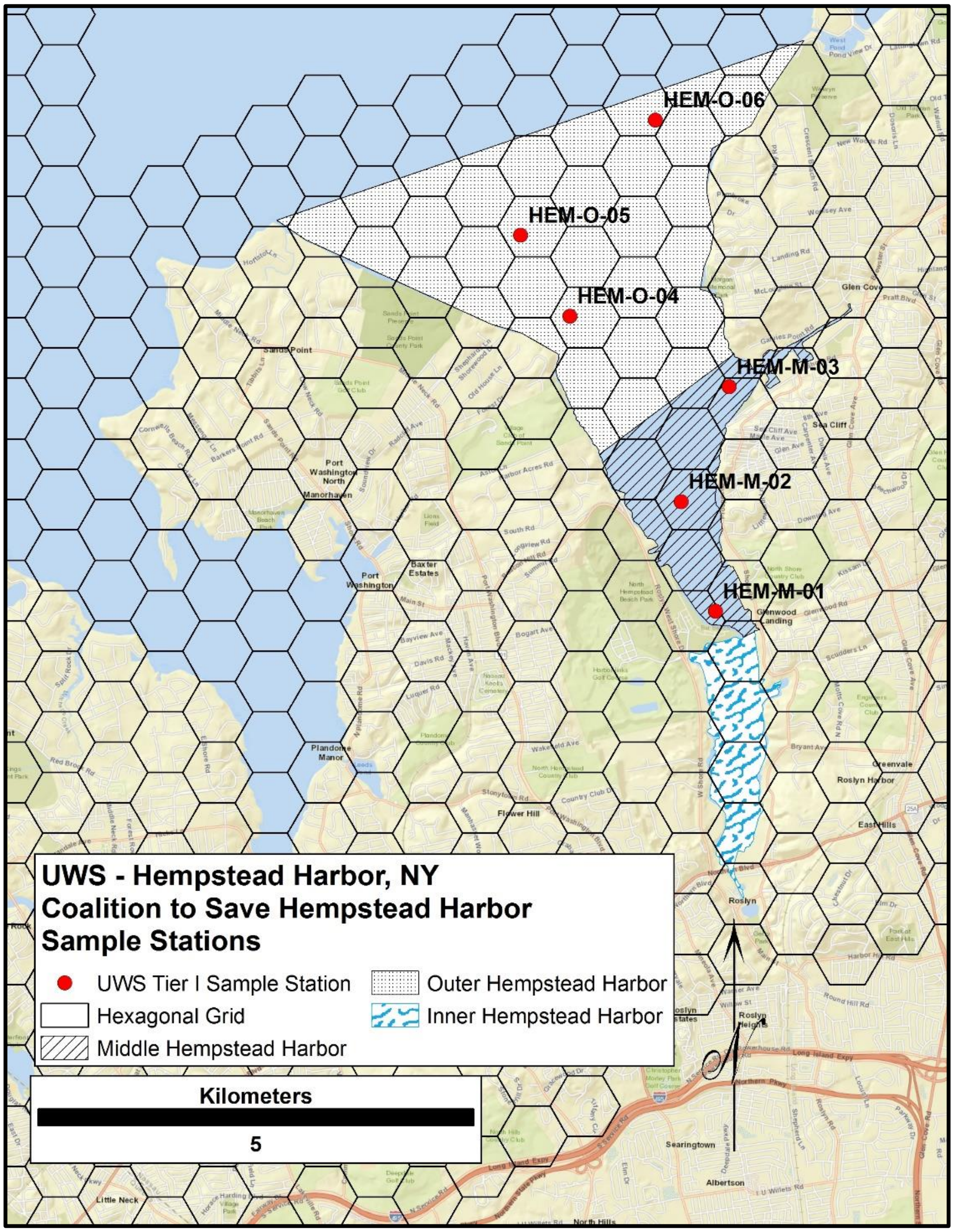
- HEM-0-01, same as CSHH #1
- HEM-0-02 (new for 2018)
- HEM-0-03, same as CSHH #3
- HEM-0-04, same as CSHH #2
- HEM-0-05, same as CSHH #16
- HEM-0-06, same as CSHH #17.

See *Figure 3* for a hexagonal grid showing the location of UWS stations.

These stations are monitored biweekly, from May through October. For each sampling date, monitoring of all stations must be completed within three hours of sunrise.

Data from the 2018 UWS sampling is included in *Appendix E*.

Figure 3
Location of the Hempstead Harbor UWS Stations Sampled in 2018



Credit: Hexagonal grid provided by Peter Linderoth, Save the Sound

2.3.2 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, 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, two chlorophyll filtrations were performed along with taking meter readings from the same water that is filtered, and two of the filters were sent to the Interstate Environmental Commission's laboratory for analysis (see also S*ection 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). For Hempstead Harbor, CSHH selected unraked areas of three 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 Tappen Beach Pool (l) and close-up of red and green seaweed (r) in the area used for the UWS macrophyte assessment (photos by Carol DiPaolo, 7/16/18)

3 Monitoring Results

This section summarizes results of the CSHH and UWS sampling programs. Where possible, data from the CSHH program from 1995-2017 are compared with 2018 data. *Appendices A, B, C, D,* and *E* include graphs and tables constructed with the data collected during this period. *Appendix F* includes a data usability assessment.

3.1 Dissolved Oxygen

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. DO is indirectly affected by nutrient enrichment, particularly nitrogen, which can enter Hempstead Harbor through stormwater runoff, discharges from sewage treatment plants, or leaching from failing septic systems. Nitrogen accelerates the growth of phytoplankton or algae and increases the density of organisms that grow. The increased number and growth rate cause frequent or prolonged “blooms.” When the cells in the plankton 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 to these direct effects of low DO levels, indirect effects can also occur. Low DO levels can cause some bacteria to produce hydrogen sulfide, which is a gas that can be toxic to fish.

Key Findings – Dissolved Oxygen

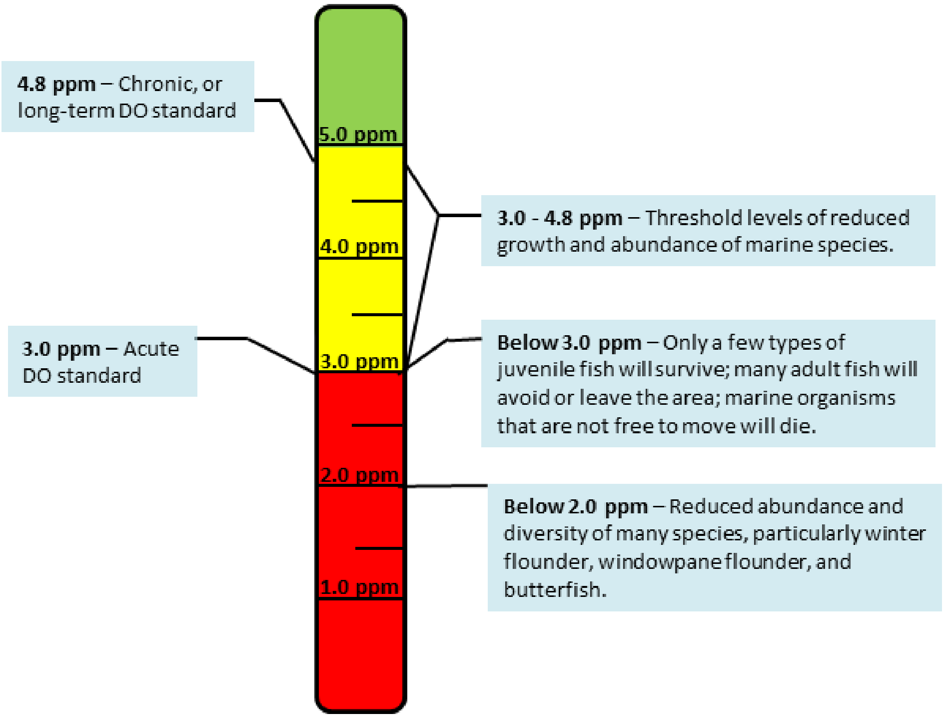
- Healthy DO levels (greater than 5.0 ppm) were observed in 68.3% of all measurements taken in 2018.
- Hypoxic conditions (less than 3.0 ppm, adverse impacts to aquatic organisms are expected) were observed in 5.8% of 2018 readings and at 8 of 13 stations sampled.
- In 2018, hypoxic conditions occurred from early-August to mid-September.
- There were no anoxic (less than 1.0 ppm) readings in 2018.
- Station CSHH #13 tends to have lower than typical DO levels.
- In 2018, DO levels about the same as those in the previous year, and similar to the long-term average.

Although many 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 more organic matter is decaying and rates of photosynthesis are declining. Therefore, productive aquatic ecosystems with larger nutrient loads are more prone to low DO levels. The impact of temperature and salinity on DO levels in these ecosystems is generally of secondary importance. Generally, as temperature and salinity increase, the dissolved oxygen concentration decreases. 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.

Prior to 2008, DO levels above 5.0 ppm were considered healthy; DO levels below 5.0 ppm were considered to cause various adverse impacts (related to growth, reproduction, and survival of organisms). The severity of impacts, and threshold DO levels where impacts occur, are strongly species dependent. (For example, bottom-dwelling marine species would be more affected by low DO than species that can move more easily to higher-oxygen areas.)

A revised dissolved oxygen standard was implemented by the NYSDEC 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 aquatic species. The acute DO standard is 3.0 ppm, which means that if DO concentrations fall below 3.0 ppm, conditions are considered hypoxic; under hypoxic conditions, most juvenile fish will not be able to survive, many adult fish will avoid or leave the area, and species that cannot leave the area will 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.

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



ppm = parts per million

However, states often interpret effects of environmental conditions on marine life differently; for example, Connecticut's DO standard was 5.0 ppm through 2010 (it was changed to 4.8 ppm in 2011), and it specified maximum periods for which exposure to low DO is allowed. These standards are similar to the New York standards, although not completely consistent.

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 photosynthesis by algae, and undersaturated at night (50% or lower) due to decay of dead organic matter (respiration).

This report evaluates 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.

(No fish kills occurred during 2001 through 2004 despite extended periods of hypoxia. A clam kill occurred in 2005 south of Bar Beach, near CSHH #5, but this kill reportedly resulted from lunar/tidal effects and not hypoxia. A small, localized fish kill occurred in August 2006 from an unusual condition off of Morgan Beach–low DO and hydrogen sulfide produced by sulfur bacteria present in the decomposition of algal cells. No fish kills in Hempstead Harbor were observed or reported in 2007-2014. Two limited bunker kills occurred late in the season in 2015 when DO levels had increased−in October and November–and corresponded with the large bunker populations that remained in the harbor through the beginning of January 2016. No fish kills were reported in Hempstead Harbor in 2016-2017. However, late in the season in 2018, we noticed a very limited fish kill near the head of Glen Cove Creek; about four dozen small Atlantic menhaden ("peanut" bunker) were observed floating on the surface as we were headed toward our monitoring station CSHH #13 (which was blocked by barges). We had seen large schools of peanut bunker in other parts of the creek that morning, and they seemed normally active.

Lower DO levels may be the result of a variety of factors, including anthropogenic influences such as nutrient enrichment from 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, although typical effects are relatively minor (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.

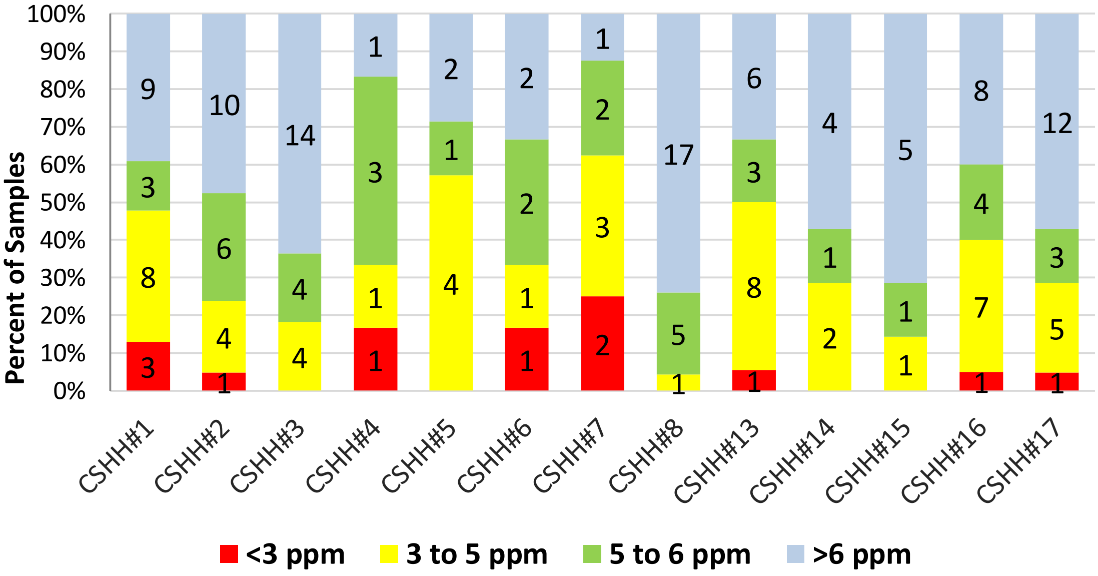
Across the 13 stations where bottom dissolved oxygen was measured in 2018, there were 11 recorded instances of hypoxic conditions (*Figure 5).* Five stations had no measurements indicative of hypoxic conditions, whereas 1 station (CSHH #7) exhibited hypoxic conditions on over 20% of the monitoring days (though this amounted to only 2 days where hypoxic conditions were measured at the station; *Figure 5*). Station CSHH #1 had the highest occurrence of hypoxic observations (3 observations), followed by CSHH #7 (2 observations) and CSHH #2, CSHH #4, CSHH #6, CSHH #13, CSHH #16, and CSHH #17 (1 observation each). There is no discernible spatial pattern to the distribution of hypoxic conditions; both the stations with no hypoxic conditions and those with the highest percentage of hypoxic observations were spread throughout the harbor. This suggests that both the lower and outer harbor experience similar fluctuations in DO, and more locally specific factors are likely the driver behind hypoxic conditions. Overall, across all monitoring stations, 5.8% of all 2018 observations exhibited hypoxic conditions (where DO < 3.0 ppm; *Figure 6*), 25.9% of observations fell in the 3.0-5.0 ppm range, 20.1% fell in the 5.0-6.0 ppm range, and 48.2% of observations showed bottom DO levels above 6.0 ppm.

The percentage of DO measurements with hypoxic conditions in 2018 (5.8% or 11 measurements for bottom DO; 0.5% or 1 measurement for surface DO) was substantially lower than the previous four years' percentages for both bottom DO and surface DO. The 2018 percentages are also among the lowest recorded since 2004. Lower percentages of hypoxic conditions have been observed in only 4 of the preceding 14 years for surface DO, and the 2018 percentage is the lowest recorded value for bottom DO (*Figure 6*).

Figure 5

2018 Average Bottom Dissolved Oxygen for Stations in Hempstead Harbor

Each vertical bar represents one of CSHH's monitoring sites. Colored bars indicate percentage of all samples taken at a location that fall into each of the four color-coded categories. Numbers inside the bars indicate the number of observations (sample size) within each bar segment. Red bars are representative of hypoxic conditions.



Anoxic conditions (< 1 ppm) were not observed in 2018. Since 2004, anoxic conditions have been observed for 25 bottom DO readings and 1 surface DO reading. A large portion of these anoxic observations occurred at CSHH #13 (24% of bottom DO anoxic readings as well as the sole anoxic surface DO reading). Forty percent of anoxic bottom DO readings have occurred at stations within or near Glen Cove Creek (CSHH #3, #8, and #13). An equal number (10 observations or 40%) occurred at CSHH #2, in the outer harbor.

All of the hypoxic conditions recorded in 2018 occurred from early-August through mid-September. This is consistent with the previous year's observations, as well as with periods of higher air and water temperatures when the solubility of oxygen in water decreases. The period of hypoxic and anoxic conditions may lengthen in the future based on climate projections for warmer overall air temperatures. A comparison of the number of days and months in which hypoxic conditions are observed may be a useful indicator of changing temperature conditions.

There are no obvious temporal trends in bottom DO levels over the period of record (1995 to present). At most locations, average bottom DO fluctuates between 4 ppm and 7 ppm; the overall average bottom DO reading over time for all stations has been 5.7 ppm (7.5 ppm for surface DO). Station CSHH #13, located at the head of Glen Cove Creek, is the most obvious outlier, with lower than typical DO levels (*Figure 7*).

Figure 6
Percent of Observations with Hypoxic Conditions over Time
Monitoring-season averages are shown for both bottom dissolved oxygen and surface dissolved oxygen.

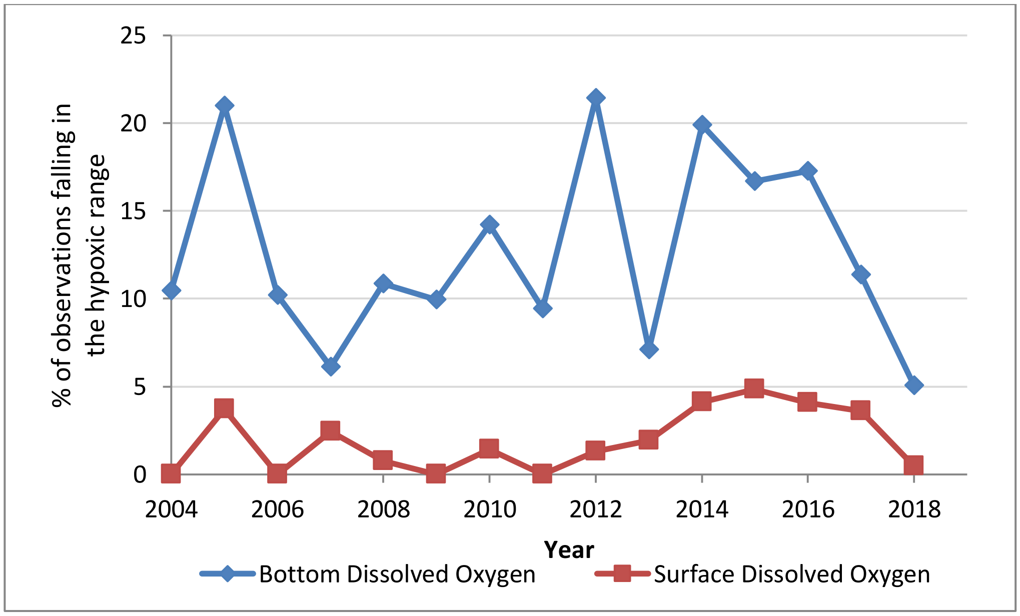
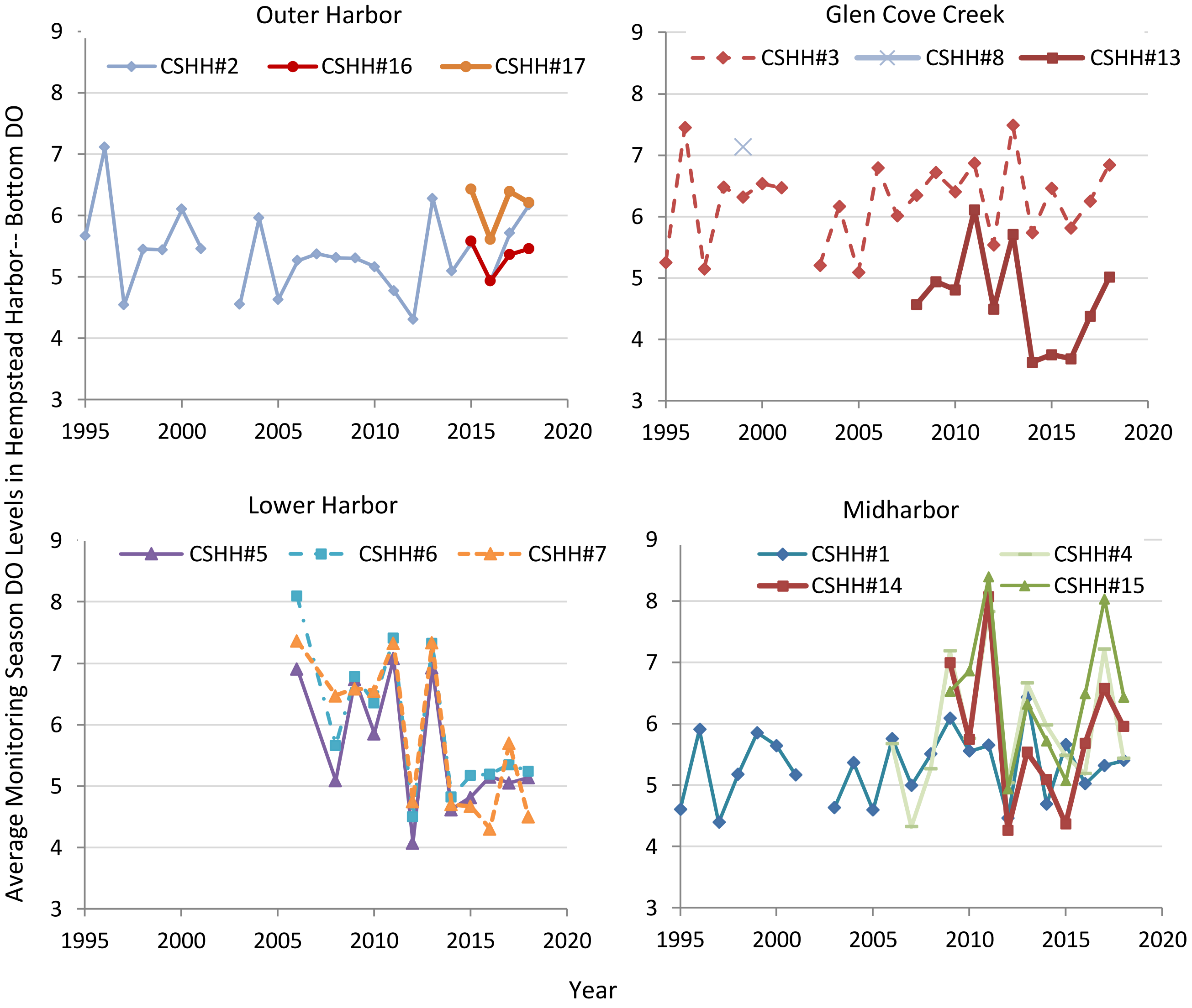


Figure 7
Average Monitoring–Season DO Levels in Hempstead Harbor

Monitoring-season averages are depicted for each station since 1995 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the trajectory of a given station's measurements over time.



3.2 Temperature

Water temperature is monitored to record seasonal and annual changes of temperature 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. As stated by the Long Island Sound Resource Center (referencing a 2010 report by J. O'Donnell), a warming trend has been observed in Long Island Sound (about 1.8°F [1°C] warmer per century), when temperatures are averaged throughout the sound. A difference has also been observed between the western and eastern portions of the sound: the western portion, influenced most by fresh water inputs, is cooler than the eastern portion, influenced most by ocean water. The water temperature effects of climate change are not discernible in Hempstead Harbor probably because the shallower water and tidal flushing are affected most by the cooler water of western Long Island Sound.

Key Findings – Temperature

- Water and air temperatures are least variable at CSHH stations in the outer harbor and within the area of Glen Cove Creek and most variable in the lower harbor.
- Average water temperature at CSHH stations in 2018 was 2.7% warmer than the long-term average.
- Average 2018 air temperature at CSHH stations was 4.8% (1.0 °C) warmer than the long-term average.

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 8.3 ppm.

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 the majority of 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, vertical mixing continues through much of the season.

See *Figure 8* for average annual water temperature for each monitoring location for the period of record. 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.

View from rocks at Tappen Beach pool looking northeast to Shore Road and north to the frozen harbor and sound (photos by Carol DiPaolo, 1/8/18)

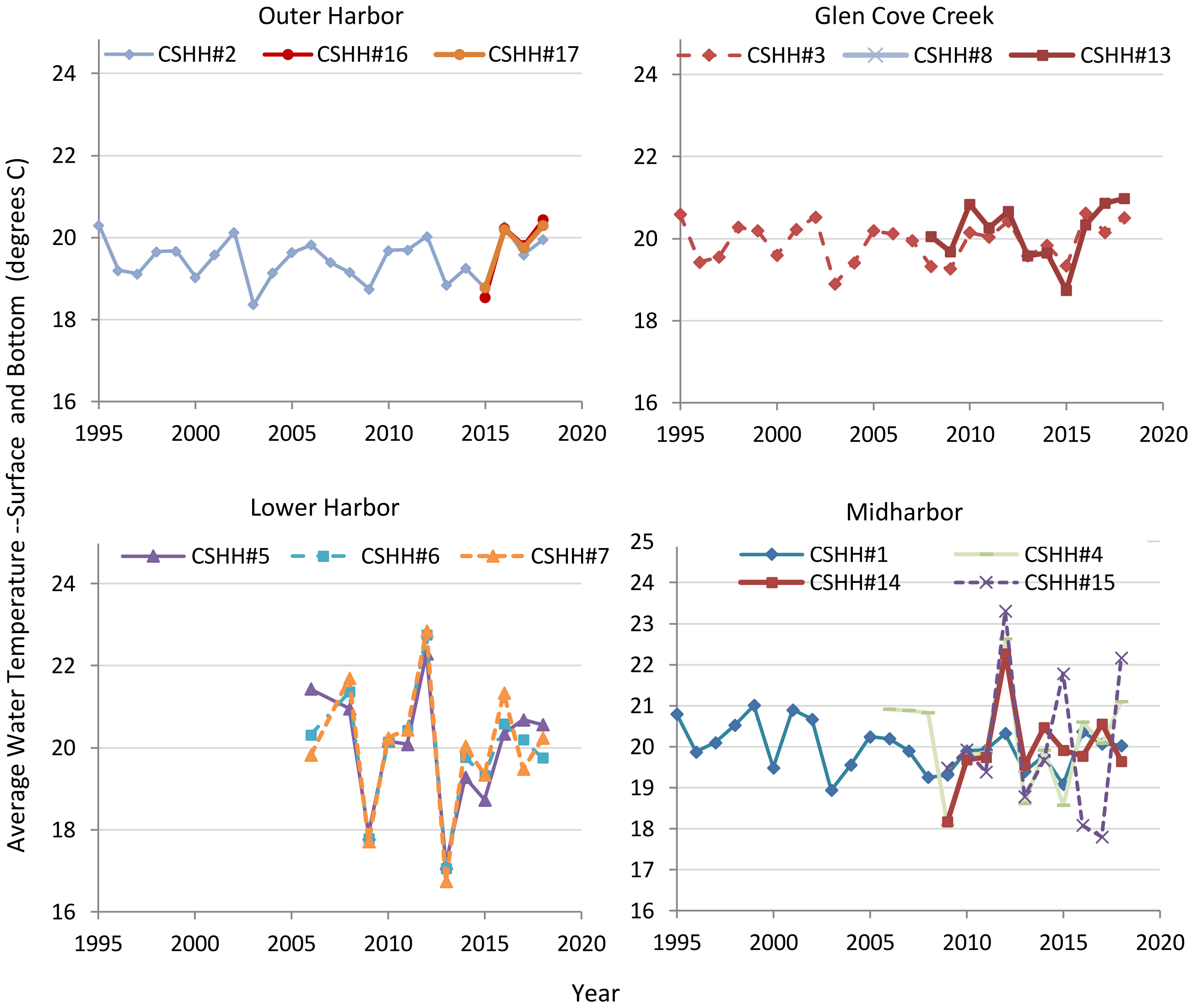
Average water temperatures tend to be least variable in the outer harbor and the area around and within the mouth of Glen Cove Creek and most variable in the lower harbor (*Figure 8*). Station CSHH #1, in the middle section of the harbor, appears to have a more stable average temperature than the surrounding stations.

Overall, 2018 surface water temperature averaged 20.7 ºC, and average bottom water temperature was 20.1 ºC. The long-term average water temperature for the period since 1995 is 19.9 ºC; 2018 average water temperature was 2.7% higher than the long-term average. Surface and bottom water temperatures were significantly different from one another in 2018, with bottom temperatures 0.6 ºC cooler, on average, than their surface-water counterparts. (A statistical analysis was applied to the temperature difference using a paired t-test (i.e., pairing differences in testing results on the same date and at the same station to determine the probability that the result occurred by chance; the analysis indicated there was only a small probability of this occurring by chance (<0.0001%).) (See *Appendix A* for additional water temperature monitoring data.)

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, temperature more strongly indicates the time of day that CSHH monitored a certain location. However, because monitoring events began at similar times each season and have similar durations, changes in temperature averaged between sites during a season could be indicative of annual variability in weather conditions.

Figure 9 presents average monitoring-season air temperatures recorded at all stations since 1995. As with water temperature, air temperature is least variable in the outer harbor and the area around and within the mouth of Glen Cove Creek, where average monitoring season temperatures have stayed within a narrow 4 ºC window from approximately 20 ºC to 24 ºC (*Figure 9*). Average air temperatures in the lower harbor and midharbor have been much more variable, ranging from about 14.5 ºC to almost 26 ºC. As was seen with water temperature, within the midharbor group, station CSHH #1 is less variable than nearby stations; its pattern is more similar to that of the outer harbor and stations within and near Glen Cove Creek. The 2004 monitoring season was the coolest on record, with an average

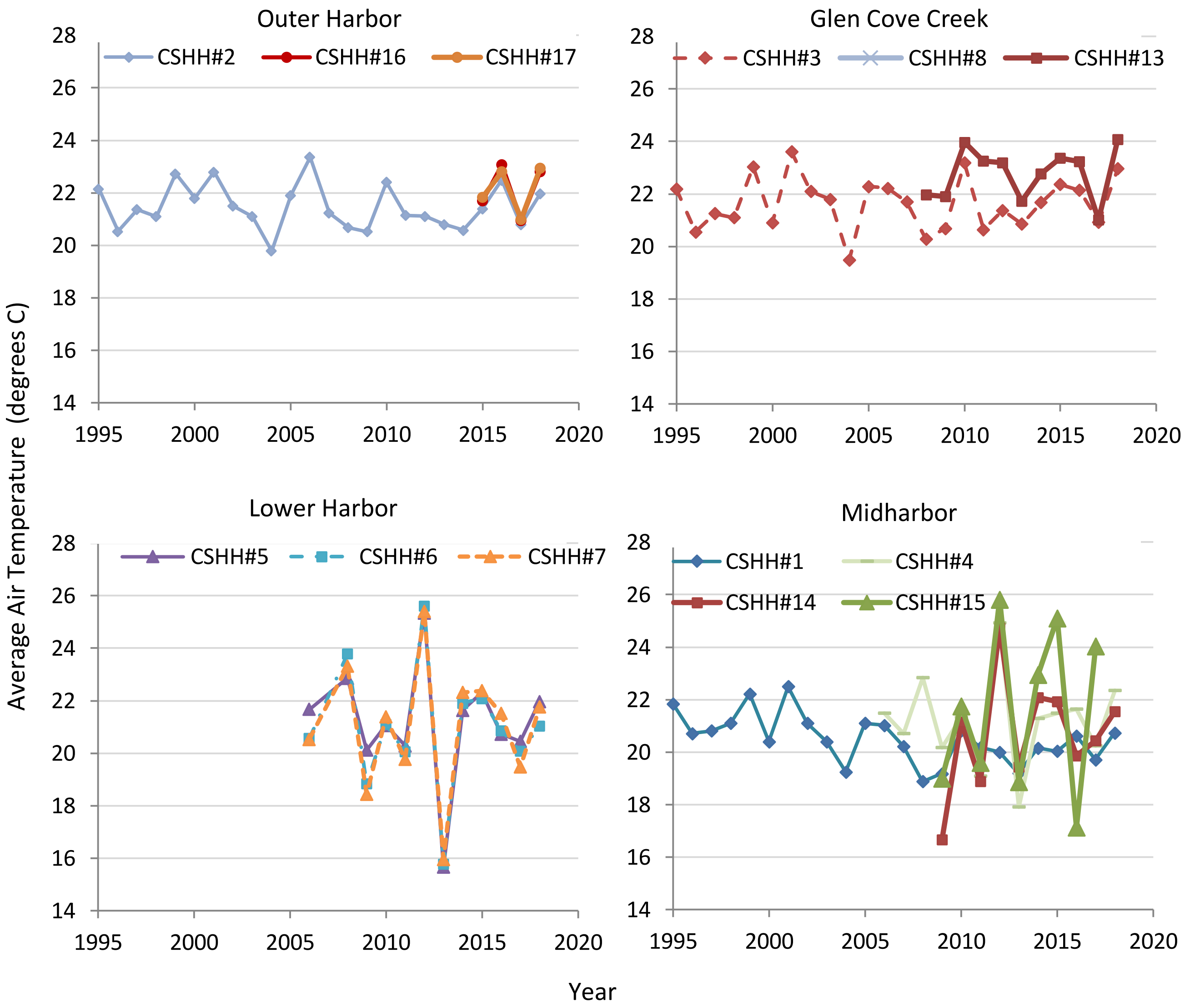
Figure 8
Average Water Temperature Recorded During Seasonal Monitoring Events
Monitoring-season averages are depicted for each station since 1995 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the trajectory of a given station's measurements over time.



temperature of 19.5°C recorded at the three stations included in the study at that time. Conversely, 2001 was, on average, the hottest at 23.0°C. 2018 average air temperature across all stations was 22.5 °C, making it the fourth hottest season recorded in the study. The long-term average air temperature across all years since 1995 is 21.5 °C. Average 2018 air temperature was 4.7% (1.0 °C) warmer than the long-term average.

Figure 9
Average Air Temperature Recorded During Seasonal Monitoring Events

Monitoring-season averages are depicted for each station since 1995 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the trajectory of a given station's measurements over time. (An outlier for CSHH #15 in 2017 has been removed—the unusually low 'average' temperature of 8.8 °C was an artifact of the fact that only one observation was taken at the station and it took place in mid-October.)



3.3 Salinity

Monitoring salinity assists in determining whether the harbor is being influenced by tidal water or, instead, by freshwater from the watershed (i.e., from streams, stormwater, wastewater, or other discharges). Like temperature, salinity is an indicator of the water's oxygen-holding capacity and whether the water column is stratified.

Salinity affects DO levels; there is lower DO saturation in salt water than in fresh water. 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 levels within an estuary are generally affected by proximity to freshwater inflows, such as rivers or discharges from sewage treatment plants, and through direct precipitation and runoff.

Key Findings – Salinity

- At 25.07 ppt, the average salinity level across all stations in 2018 was 1.1% lower than the long-term average.
- Stations CSHH #13 and CSHH #8 in Glen Cove show a different pattern of salinity values than many of the other stations.
- Salinity at stations close to shore (especially CSHH #4, and CSHH #13) is linked to the previous day's rainfall, confirming the localized influence of stormwater runoff on near-shore salinity and overall water quality.

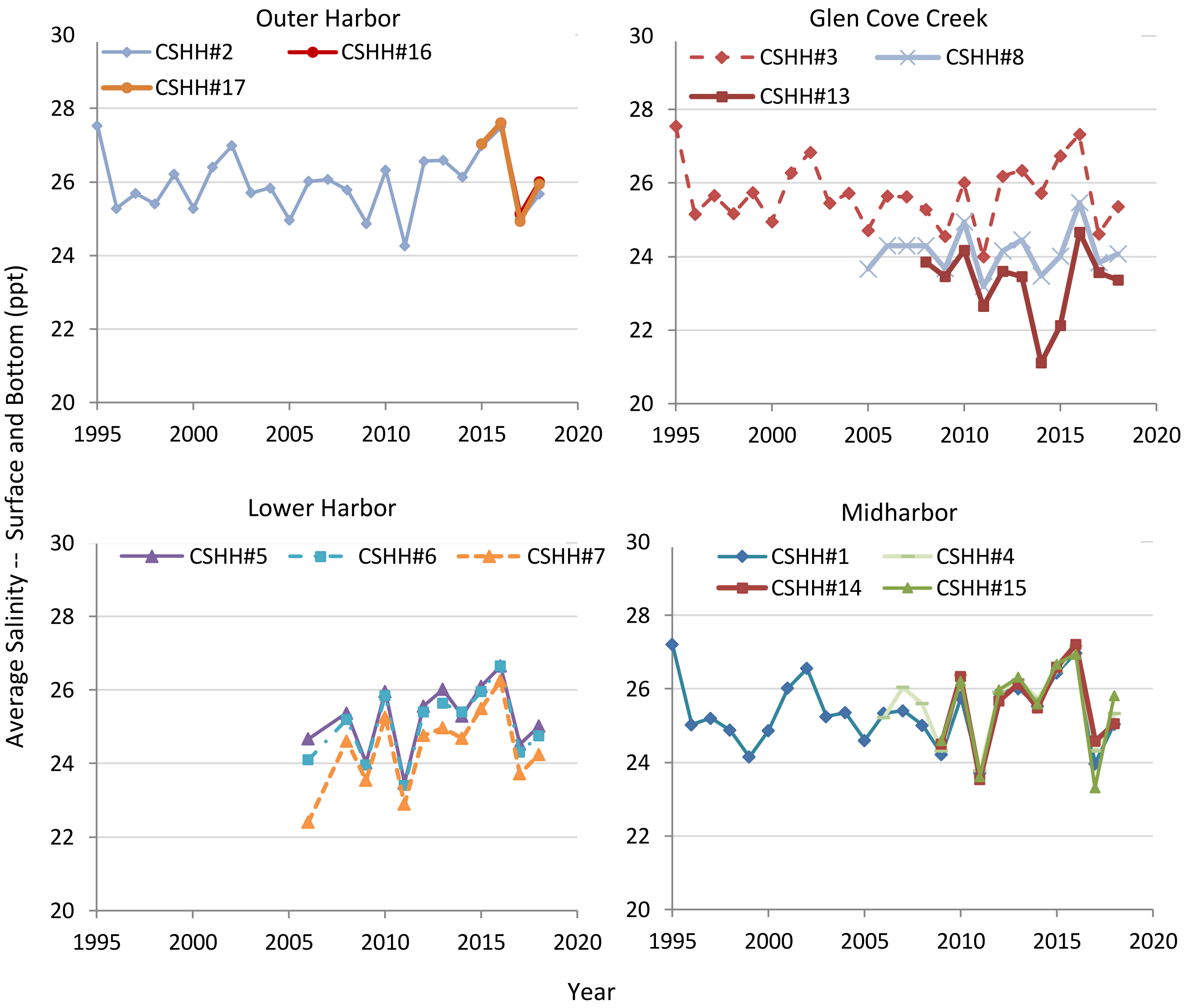
Figure 10 presents average annual salinity levels at all monitoring stations for the period of record. Salinity levels in Hempstead Harbor generally vary less than in Long Island Sound. During the 2018 testing season, salinity readings for most monitoring stations in Hempstead Harbor ranged from 18.50 ppt to 27.14 ppt, although two unusually low readings were recorded at stations CSHH #8 and CSHH #13

Additionally, salinity levels measured at the bottom of the harbor are generally higher than those near the surface, because high-salinity water is denser and tends to sink. As expected, in 2018, statistical analysis performed via a paired t-test (as described above in *Section 3.2*) indicates that surface and bottom salinity values were significantly different from one another (p-value < 0.0001), with surface salinity levels 0.73 ppt lower on average than bottom salinity levels. This further suggests that slight stratification is occurring in the harbor.

The long-term average salinity level within the harbor during the monitoring season since 1995 is 25.35 ppt, with annual averages ranging from a low of 23.5 ppt in 2011 to a high of 27.43 ppt in 1995. Average salinity level across all stations in 2018 was 1.1% lower than the long-term average, at 25.07 ppt.

As with several other indicators, the stations within or near Glen Cove Creek seem to follow a different pattern from many of the other stations (this is particularly true of CSHH #13 and CSHH #8, because CSHH #13 is near a large outfall that drains stormwater and fresh water from Cedar Swamp Creek, and CSHH #8 is below the large outfall for the Glen Cove STP; see *Figure 10*). Station CSHH #13's 2018 average was 6.8% lower than the overall 2018 average salinity; CSHH #8 was 4.0% lower than the overall 2018 average. See *Appendix A* for additional salinity data results.

Figure 10
Measured Average Salinity in Hempstead Harbor
Monitoring-season averages are depicted for each station since 1995 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the trajectory of a given station's measurements over time.



Taken as a whole, the 2018 monitoring season data indicate only a very weak relationship between salinity and precipitation. The relationship for the data as a whole is similar when salinity is compared either with the previous day's rainfall (24-hour rainfall) or with the previous two day's rainfall (48-hour rainfall). However, two stations demonstrate stronger dilution effects from precipitation than the others. Roughly 4-9% of the variation in salinity at stations CSHH #4 and CSHH #13 can be explained by differences in previous day's rainfall (statistical analysis indicates R^2=0.040 and R^2=0.093, respectively). These relationships become weaker when salinity is compared with 48-hour rainfall rather than 24-hour rainfall.

Collectively, these results suggest that near-shore salinity is influenced by contributions of stormwater runoff and other freshwater inputs from the harbor watershed. This makes sense, as both stations are close to shore, and CSHH #13 is located near an outfall pipe that discharges a mix of stormwater and freshwater into Glen Cove Creek. In 2017, CSHH #8, which is located near the discharge from the sewer treatment plant, also showed a relatively strong dilution effect compared with other stations, but the relationship in 2018 was much weaker. Other stations near the shore (e.g., CSHH #14 and CSHH #15) may experience the same effect, but there were relatively few observations at these stations in 2018 from which to establish a meaningful correlation at those locations. On the other hand, salinity at stations located further from shore does not appear to be affected by precipitation in a measurable way.

3.4 pH

Figure 11 presents averaged surface and bottom pH for all monitoring stations from years 2005-2018.

Monitoring pH (a measure of acidity or alkalinity) helps in following trends in aquatic life and water chemistry. Carbon dioxide (CO_2) released by bacteria respiration and uptake via plant photosynthesis affect aquatic pH over short periods (hours to days), whereas the increase in atmospheric CO_2 may affect aquatic pH over decades. Also, recent 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 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.]

Key Findings – pH

- 2018 pH levels were 1.2% (surface pH) and 1.1% (bottom pH) lower than the long-term average.
- Overall, after decreasing (i.e., becoming more acidic) for the past three seasons, average pH increased (turned slightly more basic) in 2018.
- CSHH #14 and CSHH #15 show an opposite trend, with consistent increases in pH for the past 5 to 6 seasons, followed by a sharply acidic turn in 2018.

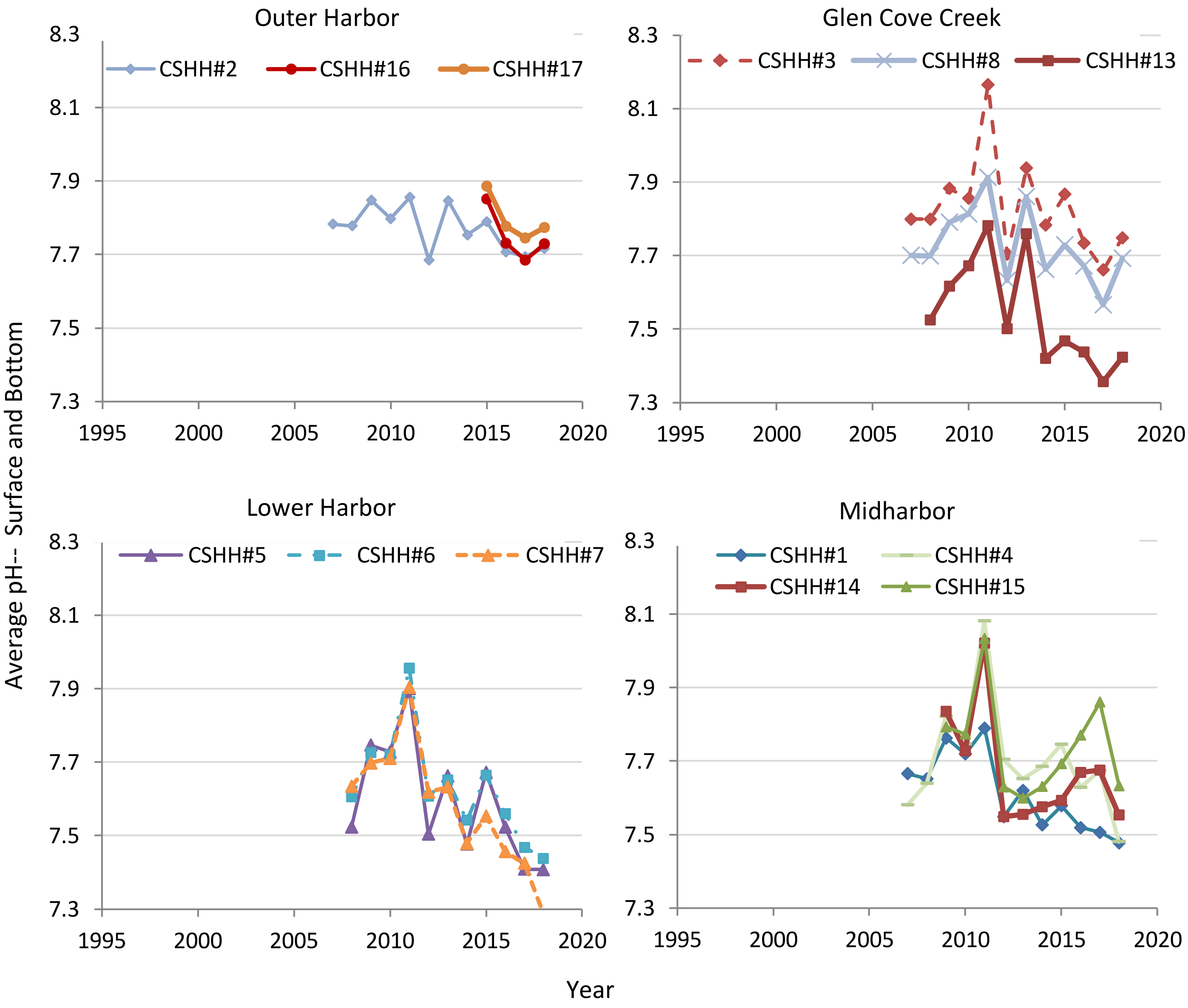
Average pH levels in Hempstead Harbor in 2018 were 7.68 for surface pH and 7.54 for bottom pH, approximately 1.2% and 1.1% below the long-term averages of 7.78 and 7.63.

Overall average pH across all monitoring stations had been decreasing (i.e., becoming more acidic) for the past three seasons (2015 through 2017), but turned slightly upward in 2018. This pattern is seen for most individual stations as well. In contrast, two stations in the mid-harbor group (CSHH #14 and CSHH #15) have been exhibiting gradually increasing average pH for the last 5-6 years, but took a marked downward turn in 2018 (*Figure 8*).

Figure 11

Measured Average pH in Hempstead Harbor during Seasonal Monitoring Events

Monitoring-season averages are depicted for each station since 2005 (or since inception of data collection for that station). Stations are grouped according to their proximity to one another and loosely by region of the harbor, to allow for inspection of spatial patterns. Within each grouping, each station is represented with a unique color and symbol. Connected dots indicate the trajectory of a given station's measurements over time.



3.5 Turbidity/Water Clarity

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 algae 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 – Turbidity/Water Clarity

- 2018 Secchi-disk readings indicated improved water clarity over typical harbor conditions.
- Average turbidity readings in 2018 were 17.2% higher than the long-term average.
- In 2018, the highest average turbidity was seen at stations CSHH #13 and CSHH #7.

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, algae, or other suspended matter in the water (these give the harbor its usual green to brown color). Secchi readings are typically 1 to 2 meters for Hempstead Harbor during the summer months and from 0.25 to 3 meters during the monitoring season. For 2018, the range of Secchi readings (0.5 to 3.25 meters) for the monitoring season indicated an improvement over typical readings. The average Secchi reading in 2018 across all stations was 1.44 meters, slightly deeper than the 2017 average and approximately 21.0% deeper (indicating greater water clarity) than the long-term average for the harbor.

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 may cause harm to fish growth and survival as well as affect gill function in both naturally low and highly turbid waters.

The US EPA's Quality Criteria for Water report (1986) stated that turbidity could affect both freshwater and marine species of fish in the following ways:

1. Kill the fish or reduce their growth rate, resistance to disease, etc.
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, e.g., Johnson and Hines 1999; Meager 2005). (At this time, regulatory agencies have not articulated a background turbidity level for Hempstead Harbor and Long Island Sound.)

In New York, the water-quality standard for marine waters is that there shall be “no increase that will cause a substantial visible contrast to natural conditions.”

Because of the previously cited significance of turbidity on the marine environment, turbidity sampling was initiated for Hempstead Harbor stations in July 2008. At each station monitored, turbidity is measured in nephelometric turbidity units (NTUs). (Prior to 2017, a LaMotte 2020e meter was used to measure turbidity, requiring grab samples, which were collected generally at two depths–at a half meter below the surface and at Secchi-disk depth; since 2017, a multiparameter meter has been used for a vertical profile of the water column.)

Given that the Secchi-disk depth decreases as the water 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 (the greater the transparency), the lower the number measured by the meter in NTUs (the lower the turbidity).

In 2018, turbidity readings ranged from essentially 0.0 to 19.56 NTUs at the sampling depth of one-half meter below the surface, compared with a range from 0.9 to 62.79 NTUs in 2017. (Note that four negative readings occurred on May 23, 2018; these have been rounded to 0.0. Negative values may occur in low-turbidity conditions or may indicate an error in sampling or inaccurate calibration of the equipment.) The average reading in 2018 was 3.60 NTUs and the median was 3.24 NTUs. The 2018 average turbidity was 17.2% higher than the long-term average for the harbor, but significantly lower than the 2017 average of 5.26 NTUs. The 2017 average was driven by three unusually high measurements, one each at CSHH #8, CSHH #2, and CSHH #3. In 2018, all readings for CSHH #2 and CSHH #3 were within the typical range; CSHH #8 had a maximum reading of 8.78 NTUs and an average for the 2018 season of 4.85 NTUs. The highest average turbidity in 2018 was seen at stations CSHH #13 (average turbidity 6.92 NTUs) and CSHH #7 (average turbidity 5.33 NTUs). The overall range of readings since 2008 (when turbidity monitoring began) is 0.0 to 62.79 NTUs. See *Appendix A* for additional turbidity data.

3.6 Chlorophyll

Chlorophyll is a photosynthetic pigment that causes the green color in algae and other 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 (a subset of algae) living in it. Chlorophyll is also present in cyanobacteria, often called "blue-green algae" although they are bacteria, not algae. Phytoplankton can be used as indicator organism to determine the health of a water body, and measuring chlorophyll is a direct way of tracking algal growth. 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" and can cause the depletion of dissolved oxygen and may cause 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.

The Long Island Sound Water Quality Monitoring Program (CTDEEP) reported that between 1991 and 2011 Long Island Sound had an average Chl a of 13.4 µg/L.

Chlorophyll a has only been measured as part of the CSHH monitoring program since July 2016, when a FluoroSense handheld fluorometer was used. The process to determine Chl a generally requires a field reading and then filtering a representative sample, collected during 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 the case of the 2016 data, field readings were recorded, but filtrations were completed for only two monitoring events, and so the data are considered incomplete. In 2017 and 2018, Chl a field readings are recorded for the core monitoring program and used only as a frame of reference. For the 2017 and 2018 UWS, field readings were recorded and two filtrations were completed for each monitoring event. The data were corrected following the completion of the lab analysis of the filters. The UWS Chl a field readings are included in *Appendix E.*

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.

3.7.1 The Nitrogen Cycle

Nitrogen is generally made available to a marine ecosystem from the atmosphere (called fixation) and from the watershed. Nitrogen fixation is usually a smaller source of nitrogen than the watershed sources. Inputs of nitrogen from the watershed are in the form of ammonia, nitrite, or nitrate. (*Figure 12* presents a diagram of the nitrogen cycle in the water environment.)

Ammonia and nitrate generally originate from fertilizer and human or animal wastes that can end up in water bodies from old or failing septic systems and wastewater treatment plants and from stormwater runoff. Nitrate is also a product of properly functioning treatment plants, which convert ammonia to nitrate.

Webb Institute on the east shore of Hempstead Harbor. (photo by Carol DiPaolo, 9/14/18)

Ammonia and nitrate are important for organisms, which require nitrogen for growth and reproduction. Nitrogen forms amino acids, proteins, urea, and other compounds that are needed for life. These forms of nitrogen are referred to as organic nitrogen.

Many forms of organic nitrogen are quickly converted to ammonia in water. One form of ammonia can form a gas and be released into the atmosphere. Some forms are toxic to marine life in high concentrations.

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, which is released to the atmosphere.

Sewage treatment plants can be upgraded to provide biological nutrient (nitrogen) removal. The Glen Cove treatment plant was upgraded to do so. Older 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 already has been treated with oxygen. Highly specialized bacteria remove the oxygen from the nitrate, releasing nitrogen gas and removing the nitrogen from the wastewater stream.

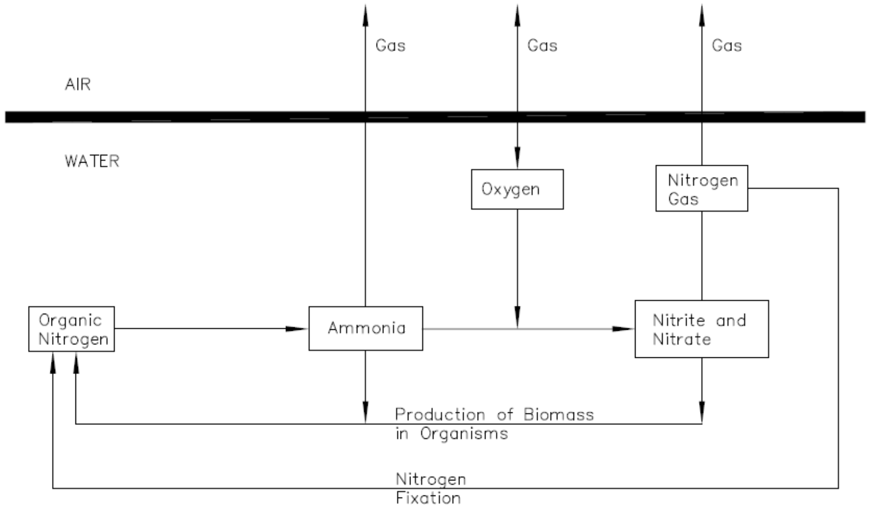
3.7.2 Nitrogen Monitoring by CSHH

Through September 2016, CSHH collected samples weekly at CSHH #1-3, #8, #13, #16, and #17 and, when tidal and weather conditions allow, at CSHH #4-7, #14, and #15 to test for ammonia, nitrite, and nitrate. In 2004-2006, the samples that were sent to the town lab for ammonia analysis produced results that indicated interferences (possibly from the saltwater, turbidity, or water color), so ammonia testing was conducted in the field using a

LaMotte test kit. Through September 2016, nitrite and nitrate samples continued to be analyzed at the Town of Oyster Bay lab, by Lockwood, Kessler and Bartlett, Inc., using an electronic Hach kit. Beginning in 2012, only the salicylate method was used in the field for ammonia testing (rather than both the Nessler and salicylate methods as was used in previous years). In October 2016, closure of the town lab and the absence of resources necessary to go to another facility for sample analysis prevented further nitrite and nitrate testing through 2017. Ammonia samples continued to be tested in the field. Beginning in 2018, water samples were collected 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 nitrite, nitrate, and ammonia (onboard testing for ammonia was suspended).

Figure 12
Nitrogen in Marine Environments

(Adapted from: Surface Water Quality Modeling, Steven Chapra, McGraw-Hill, 1997)



The presence of ***ammonia (NH_3)*** in the harbor can indicate nutrient enrichment. Ammonia is usually only detected when wastewater systems, including septic tanks, cesspools, and publicly owned treatment works (POTWs), are malfunctioning and discharging to the harbor. However, elevated ammonia levels can also be present in the harbor from stormwater discharges or may even indicate a large presence of fish.

In 2016, ammonia was detected between June and November at various sampling locations in Hempstead Harbor. However, most of the occurrences of detectable ammonia were at CSHH #1, which was somewhat unusual compared with earlier years, when CSHH #8 typically had the most occurrences. This coincided with a large presence of Atlantic menhaden throughout the harbor and a reformulation of the LaMotte test kit for ammonia that was used that year. In 2017 and again in 2018 (the year Pace Analytical performed the ammonia analysis), ammonia was detected at most stations, with levels ranging from 0.10 ppm to 1.50 ppm, with a majority of the results at the 0.10-0.20 ppm levels. In both years, a large presence of Atlantic menhaden was noted, although a little less so in 2018.

As stated above, ammonia represents the end product of protein metabolism, but what is important for water-quality concerns is whether it is 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, NH_4+, which is innocuous. The relative concentration of each form 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). pH has the largest effect on increasing ammonia toxicity.

Nitrate (NO_3) and ***nitrite (NO_2)*** 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.

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

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 inputs, 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.

Plots showing all years of nitrogen data are included in *Appendix C*. Across years, there was little variability in most locations in 2006-2009 but significant variability in 2012-2018. Ideally, in order to confirm any possible trends, nitrogen data should continue to be collected and analyzed with prior years' data.

3.8 Bacteria

For Hempstead Harbor, Nassau County Department of Health and New York State Department of Environmental Conservation are the agencies that have jurisdiction in opening or closing swimming beaches and shellfish beds, respectively. Both agencies use ***fecal indicator***

Key Findings – Bacteria

- Fecal indicator bacteria levels at the outer harbor stations are generally lower than at other stations, as they are less influenced by discharges from shore.
- Among area beaches, North Hempstead Beach Park (North) had the highest average fecal indicator bacteria levels in 2018, whereas North Hempstead Beach Park (South) had the lowest.
- Beaches were preemptively closed due to precipitation on 17 days.
- Bacteria levels for Scudder's Pond-related outfalls continue to indicate a downward trend, following the pond restoration.
- The Powerhouse Drain outfall has consistent exceedances of bacteria levels.

bacteria levels and other factors to determine whether beaches or shellfish beds require temporary or extended closures.

Coliform and **enterococci bacteria** are the types that are measured and used for water-quality standards. They are typically found in human and warm-blooded animals and are, therefore, used as the 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 and birds, and **enterococci** are most prevalent in the human digestive system.

3.8.1 Beach-Closure Standards

In October 2000, Congress enacted the Beaches Environmental Assessment and Coastal Act of 2000 (BEACH Act), which 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.

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

1. 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.
2. 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 and birds, 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.

Tappen Beach Park and marina at eastern shore of Hempstead Harbor (7/08) (photo by Joel Ziev)

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.

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 closed beaches as a precautionary measure following rain events that exceeded 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 ½ inch or more of rain in a 24-hour period. Therefore, even though water quality has improved remarkably, beach closures started to increase because of the preemptive closures. As mentioned above, in 2015, the preemptive closures were replaced by advisories, but the effect is the same.

In 2018, area beaches were closed as a precautionary measure on 17 days (based on a threshold of ½-inch of precipitation over a 24-hour period). The dates of closure included 5/27, 6/4, 6/21, 6/28, 7/15, 7/18, 7/22, 7/23, 7/26, 7/28, 8/4, 8/8, 8/9, 8/11, 8/13, 8/15, and 8/18. The total Beach Days Closed for the 2018 season was 177 days. (Note that in calculating Beach Days 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). NCDH also continues to monitor Crescent Beach, a private beach in Glen Cove, which has been closed since 2009 due to high bacteria levels near the beach and in the stream that runs alongside the beach and into the harbor. (The high bacteria levels were thought to be caused by failing septic systems upland of the beach. However, in 2018, additional tests, including DNA/source tracking, were conducted that pointed to wildlife as the source of the bacteria. In August 2018, DEC stated that the tests "confirmed that there is no direct or indirect discharge from septic systems along the stream corridor." However, DEC stated that it will continue its investigation to see whether faulty septic systems near Crescent Beach or other locations may be leaking waste that travels through groundwater into the stream. More testing was planned along with a feasibility study for addressing the issue through different treatment technologies.)

Monthly average beach data is presented in *Table 3*. In addition, time series plots of bacteria-monitoring results are presented in *Appendix B*. Given the inherent variability in microbial water quality, these data are most useful for determining whether certain monitoring locations have consistently higher or lower bacteria concentrations or whether a monitoring location is particularly influenced by rainfall, wind, and currents.

3.8.3 Monitoring CSHH Stations for Bacterial Levels

CSHH collects samples for bacteria analysis at 21 CSHH monitoring stations in Hempstead Harbor (14 stations on a weekly basis and others depending on weather and tidal conditions). Five of these sites (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. In 2015, 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.

Unusual discharges from some of the outfall pipes monitored in Glen Cove Creek were noted in 2004-2006 and were brought to the attention of Glen Cove city officials, NCDH, HHPC, NC Department of Public Works (DPW), and DEC. In 2006, representatives from Glen Cove, the city's consultants, and CSHH arranged a boat trip to view the discharge pipes along the creek. Also in 2006, Glen Cove received a NY Department of State grant to map and source the outfalls along both the north and south sides of the creek. As several water samples from the area continued to show high levels of fecal coliform and enterococci, further investigation was needed.

In 2007, a follow-up meeting prompted further testing by NCDPW and NCDH, but there were no definitive answers as to the source of the bacteria. In 2008, NCDPW further investigated the discharge pipes in question using a camera, and NCDH did dye testing at a possible source, but efforts by both county departments and the City of Glen Cove provided inconclusive results.

Dye testing to identify sources of discharges in Glen Cove Creek
(photos by Carol DiPaolo, 6/7, 6/13, 11/28/17, (l-r)

CSHH continues to monitor all of the stations in the creek and inform Glen Cove, NCDPW, NCDH, and NYS DEC of any unusual conditions. Occasionally, a white flow is observed from CSHH #10 and noted on both the CSHH data sheets and those delivered to NCDH with the bacteria samples. In 2015, NCDH further investigated possible sources of the white flow. As was the case in 2017, unusual discharges were noted several times throughout the 2018 monitoring season: white flow from CSHH #10 on three sampling dates and brown discharges on two dates, only one of which was explained (the malfunction during a cleanout of the UV system at the Glen Cove STP on the opposite side of the creek). Results from additional tests performed on samples collected from the white discharge in September 2018 showed high levels of calcium carbonate, magnesium, and water hardness, but the source of the discharge remains inconclusive.

Glen Cove Creek discharges: malfunction of pump station during cleanout of the STP UV system (top, l, 7/11/18); brown discharge from north bulkhead (top, center, 7/17/18); white discharge from CSHH #10 (top, r, 10/31/18); brown discharge at CSHH #9 and water sample (bottom, 9/19/18) (photos by Carol DiPaolo)

Other areas of concern that CSHH regularly monitors for bacteria levels are the outfalls 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, but were the focus of the Hempstead Harbor winter monitoring program starting in 2013 through 2018.

In 2013, years of planning finally culminated in the implementation of the Scudder's Pond Subwatershed Plan (2006). The winter monitoring of CSHH #15A and #15B in 2013 was intended to help determine what happens to bacteria levels from the pond during cold winter months as well as observing levels during the construction period at the pond. Monitoring continued through 2017 to help determine whether the structural changes made to the pond help diminish stormwater runoff and are effective in decreasing bacteria loading to Hempstead Harbor. CSHH #14A was included in the winter monitoring program to address similar bacteria loading to Hempstead Harbor from the powerhouse drain subwatershed. The data from earlier monitoring of the sites has established a benchmark for comparison.

3.8.4 Comparing Bacteria Data

Variability in bacteria concentrations from samples collected at individual beaches on a particular day is presented in the data contained in *Appendix B.* Although rainfall can increase bacteria in a water body, it is difficult to see clear and consistent influences from rainfall when rainfall dates are plotted against coliform counts. It is also 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. For example, the method used for enterococci analysis by the NCDH laboratory changed from the 2004 to 2005 monitoring seasons, making comparisons between data from the two years difficult.

In 2018, monthly average bacteria results for enterococci at area beaches ranged from 1.37 CFU (colony forming units)/100 ml at Morgan Memorial Beach in April to 124.67 CFU/100 ml at North Hempstead Beach Park (N), formerly Hempstead Harbor Beach, in August. Overall, in 2018, North Hempstead Beach Park (N) had the highest average bacteria levels (not including Crescent Beach, which has been closed since 2009; see Section 3.8.2 above), whereas North Hempstead Beach Park (S) (the former Bar Beach) had the lowest (see *Table 3* below; see *Appendix D* comparing previous years).

The time series plots in *Appendix B* also 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, which are likely the largest source of bacteria to the harbor. These stations typically show lower bacteria levels than at other stations, and that pattern held true in 2018, with the exception of a single atypical reading at station #2 in September. The highest bacteria levels in 2018 were recorded at stations #10-13, all stations located within Glen Cove Creek.

For a few of the sampling events, concentrations of the two indicator organisms–fecal coliform and enterococci–were often noticeably different with low concentrations of one organism and high concentrations of the other (this has been noted in past monitoring seasons as well). Although this difference in the behavior of the two indicator organisms is counterintuitive because one would expect that all indicators of fecal pollution should behave similarly, it is not uncommon. Scientific studies have found that though fecal coliform and enterococci are both used as fecal indicator organisms, they are not highly correlated to each other. Both parameters indicate contamination, but the lack of correlation between the two may be related to bacteria source, the differing decay rates for the two species, and the possibility that they may have differing potential for regrowth in the watershed.

Table 3
Monthly Average for Beach Enterococci Data for 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**
April	Enterococci	3.64	27.47	4.20	39.76	27.64	1.37
May	Enterococci	8.31	8.93	1.94	2.68	5.04	1.58
June	Enterococci	4.93	12.64	25.29	19.16	10.51	25.90
July	Enterococci	51.91	51.63	7.76	12.65	14.03	37.43
August	Enterococci	42.17	124.67	14.36	11.79	19.89	13.75
September	Enterococci	--	--	--	--	--	--
*Season Averages**	*Enterococci*	*22.20*	*45.07*	*10.71*	*17.21*	*15.42*	*16.00*

**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.*

The Hempstead Harbor water-monitoring program has established levels of bacteria at various midharbor stations and stations in Glen Cove Creek during the regular season. The winter monitoring, which specifically targeted Scudder's Pond (CSHH #15A and #15B) and the powerhouse drain subwatershed (CSHH #14A), now has six years of data for comparison of bacteria levels.

The results of the analysis for winter water samples showed that the bacteria levels did not decline significantly solely as a result of the colder temperatures during the first winter season. Although there was some expectation that bacteria levels would decrease in the colder temperatures, there are factors that may have contributed to the continued higher numbers during the winter: lower temperatures and UV conditions during winter months promote slower decay and longer survival rates of the bacteria species. And while exceedances in bacterial levels generally remained high throughout both winter and summer seasons at the powerhouse subwatershed outfall (where no improvements have been undertaken), the data indicate that there was a considerable decline in the exceedances from the summer 2018 to winter 2018/2019 (from 65% to 17%). The data also indicate significant improvement in conditions at the Scudder's Pond outfall as a result of the restoration, especially in the most recent sampling year. See *Table 4* below and time series plots in *Appendix B.*

Table 4
Stations Exceeding Bacteria Standards–Summer and Winter Monitoring

CSHH Stations	#15A		#15B		#14A[1]	
% of CFU[2] Exceedances	FC[3]	EC[4]	FC	EC	FC	EC
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%	--[5]	--[5]
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%
Average–Summer Post-Restoration	9%	30%	12%	23%	41%	73%
Average–Winter Post-Restoration	11%	22%	15%	16%	55%	60%

[1] 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.
[2] CFU: colony-forming units
[3] FC: fecal coliform
[4] EC: enterococci
[5] Only one sample collected during this period.

3.8.5 Shellfish Pathogen TMDLs

Shellfish beds in most areas around western Long Island Sound have been restricted or closed to harvesting for between 40 and 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).

In August 2007, DEC announced the release of a report on "Shellfish Pathogen TMDLs for 27 303(d)-listed Waters." Under Section 303(d) of the federal Clean Water Act, states are required to develop plans to decrease the total maximum daily loads of all pollutants that cause violations of water-quality standards. The DEC had listed 71 "Class SA" water bodies as being pathogen impaired, which therefore made them impaired for shellfishing; 25 of these water bodies were included in a 2006 TMDL report, and 27, including Hempstead Harbor, were described in the 2007 report. Class SA is the highest classification given to marine and estuarine waters and is applied to waters that are considered to have ecological, social, scenic, economic, or recreational importance. Class SA waters are offered 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.

The TMDL report called for a 95% load reduction, which contradicted DEC test results that showed that a portion of the harbor's shellfish beds could be reopened. At an October 16, 2008 meeting, DEC stated that the ultimate objective of the TMDL is to open the harbor to shellfishing. 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, there may be a portion of the harbor's SA waters that will not be reopened–even in the long term. Therefore, efforts to reduce coliform will be required along with continued monitoring.

In December 2018, DEC created a pathogen TMDL workgroup to discuss formulation of new TMDLs and ways to prioritize the waterbodies around the state that would be addressed first in this new effort. CSHH and HHPC are members of this workgroup.

3.8.6 Monitoring Shellfish Growing Area

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; five stations were new to 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 FC/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.

3.8.7 Certified Shellfish Beds in Outer Harbor

June 1, 2011, was opening day for the newly certified shellfish beds in Hempstead Harbor. After five years of rigorous water-quality testing, as well as testing of samples of hard-shell clams from the area, DEC and the NYS Department of Health determined that 2,500 acres of the outer portion of Hempstead Harbor could be reopened for shellfish harvesting year-round. For the first time in more than 40 years, clams, oysters, mussels, and scallops can 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. Additionally, a small semicircular area around Crescent Beach is closed to shellfishing. (As mentioned previously, Crescent Beach has been closed for swimming since 2009 due to high bacteria levels caused by failing septic systems that drain into a stream that runs alongside of the beach and empties into the harbor.)

The DEC will continue to monitor the water quality of the newly reopened shellfish area and make necessary changes to the area's classification as conditions warrant. The DEC follows a protocol for temporarily closing shellfish beds after a threshold (3 inches) and duration of rainfall, similar to that used by NCDH for closing beaches, to protect against health risks associated with high bacteria levels caused by stormwater runoff. There were no closures in 2017.

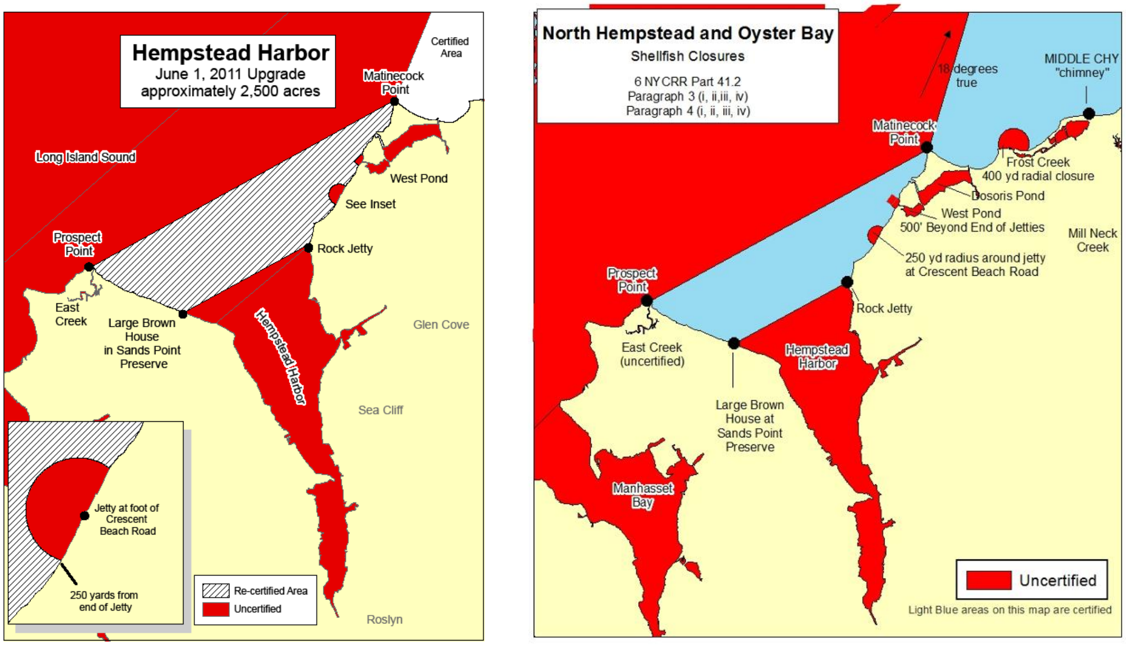
Since the opening of the shellfish beds in 2011, CSHH has visited the area during weekly water monitoring to record the number of boats harvesting clams throughout the season. Most of the commercial clammers work the area near Matinecock Point, and fewer are near Crescent Beach. In 2018, we observed about 10 clam boats on each monitoring date, although the number varies with weather conditions and water quality conditions in other bays further east; if shellfish beds in eastern bays are closed, we notice more clammers in Hempstead Harbor.

A recreational clammer in Hempstead Harbor who was happy with his haul of hard clams (photo by Carol DiPaolo, 9/14/18)

According to a DEC annual shellfish landings report, the 2014 haul of hard clams from Hempstead Harbor totaled 17,424 bushels. That represented the second largest harvest of hard clams for that year out of all of the harvest areas (30) around Long Island, with an economic value of over $1.36 million. For the following two years, the report has shown a decrease in the hard clam haul from Hempstead Harbor. In 2015, the haul for hard clams from the harbor had decreased to 9,421 bushels, with an economic value of nearly $860,000 (the fourth largest haul out of the 28 harvest areas). Over the next three years, the hard-clam haul for Hempstead Harbor was substantially less than it had been in 2014. In 2018, the NYS Shellfish Landing Annual Report showed a slight increase in the hard-clam haul for the harbor to 5,212 bushels, representing an economic value of $453,122; this put Hempstead Harbor in sixth place for the number of hard clams hauled from 30 growing areas around Long Island. The 2018 soft-clam haul (84 bushels) and oyster haul (48 bushels) from the harbor were down from 2017.

In May 2018, an area of approximately eight acres outside the mouth of West Creek, on the eastern shoreline of outer Hempstead Harbor, was reclassified as uncertified (closed) for the harvest of shellfish because of an increase in bacteria levels. See Figure 13 below.

Figure 13
NYS DEC's Maps of Hempstead Harbor Showing Recertified and Uncertified Shellfishing Areas in 2011 and 2018 and Aerial View of the Crescent Beach Closure Line



3.8.8 Bacteria Source Tracking

In March 2010, CSHH and HHPC developed a proposal to expand the water-monitoring program to include bacteria source tracking at midharbor stations as well as at specific outfalls that are suspected of contributing high levels of bacteria to Hempstead Harbor. The goal of the proposal was to determine whether most of the bacteria entering the harbor are primarily from human or nonhuman sources. The plan was to send water samples collected from Hempstead Harbor to a laboratory that does specialized genetic testing using a bacteroides marker. Unfortunately, funding was not available for the proposed 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, and there is a question as to whether the birds 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*).

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 (note that 25.4 mm is equivalent to approximately 1 inch). *Table 5* presents monthly total precipitation for June through October 1997 through 2018.

Total precipitation measured during the 2018 monitoring season (598.2 mm or 23.6 inches) was 24.0 mm (0.9 inches) or 3.9% lower than the average total precipitation during the previous 21 monitoring seasons (622.2 mm or 24.5 inches).Typically, the distribution of precipitation varies from month to month. In 2018, June was the driest month (76.0 mm), whereas September was the wettest month of the monitoring season (158.8 mm). There were eight precipitation events during the monitoring season that produced over 25mm (1 inch) of rain (26.7 mm or 1.05 inches on 6/28; 26.92 mm or 1.06 inches on 7/17; 25.65 mm or 1.01 inches on 7/27; 65.53 mm or 2.58 inches on 8/11; 28.70 mm or 1.13 inches on 9/10; 28.45 mm or 1.12 inches on 9/18; 30.23 mm or 1.19 inches on 10/11; and 34.29 mm or 1.35 inches on 10/27). Precipitation on these dates may have influenced water quality measurements occurring on or shortly after those days.

Links between precipitation and salinity are described above in Section 3.3. The strongest relationships between precipitation (indicated by previous day's rain) and bacteria were seen at stations CSHH #5, CSHH #7, CSHH #13, CSHH #14, and CSHH #15, where bacteria increased with increasing precipitation. All of these stations are near the shoreline, highlighting the influence of stormwater runoff on near-shore fecal indicator bacteria levels and overall water quality.

Table 5
Monthly Rainfall Totals for the 1997-2018 Monitoring Seasons, in mm

	June	July	August	September	October	Total
2018	75.95	103.89	147.32	158.75	112.27	598.2
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+

4 Observations

The 2018 water-monitoring season for Hempstead Harbor began on May 23 and extended through October 31 (monitoring for the Unified Water Study began on May 22 and extended through October 18); winter monitoring of shoreline outfalls ran from November 8, 2018, through April 25, 2019.

During all monitoring surveys, wildlife observations are noted. These observations along with information from local residents and formal fish surveys and reports help fill out the picture of the health of the harbor's habitat. Local residents help us by reporting what they see not only in and on the water, but also close to the harbor's shores. The section below offers an example of how our local fishing and wildlife reporters provide important information on conditions in Hempstead Harbor.

A 3-inch elver (juvenile eel) found in Scudder's Pond and a 15-inch black sea bass caught in an outer section of Hempstead Harbor (photo by Carol DiPaolo, 3/16/16, and Paul Boehm, 5/2/16, respectively)

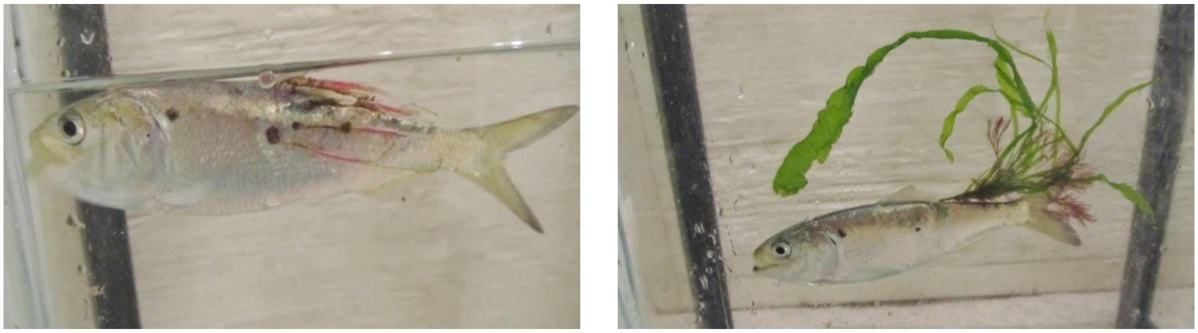
4.1 'Saladbacks'–A Local Phenomenon

In 2016, unusual conditions occurred early in the year with the large Atlantic menhaden (bunker) population. The mild temperatures of the preceding autumn seemed to have kept the large population of bunker in the harbor much later than usual, and it was thought that some schools may have stayed the winter in Long Island Sound.

In mid-December 2015, local resident and aquatic conservation biologist John Waldman first observed bunker having parasitic copepods streaming off of them along with red algae and ulva that seemed to be directly attached to the parasites. He referred to these fish as "saladbacks," and they were seen again in the same area on December 24, despite the drop in the temperature.

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 NYSDEC 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.



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

John Waldman netted about a hundred juvenile bunker over the course of two weeks from mid-December 2015 to January 2016. Below is his description of these fish.

> *Some of the specimens appeared normal. Others had one or more, red, tubular creatures attached to their bodies, heads, and even their mouths; a commonly seen parasite known as anchor worms. What was remarkable was that many had masses of algae growing off of the parasites' bodies.*
>
> *Back in my lab at Queens College, I found that two-thirds of the menhaden displayed anchor worms (some fish with as many as three parasites on them) and, of these, 69% had visible trailing algae, as long as twice the fish's body length. The seaweed was mainly of two kinds, a red algae that puffed out, and a green algae that trailed like a ribbon. This occurrence appears never to have been noted, based on the reactions from a number of marine scientists I showed photos to..... The fish "loses" both from the parasite feeding on it and the substantial water drag imposed by the algae; the parasite gains from feeding on the fish but is neutral concerning its serving as an algal attachment site; and the algae gains from obtaining an attachment site and, possibly, from being carried by a surface-dwelling fish that affords it sunlight for photosynthesis.*
>
> *I don't know exactly why this phenomenon occurred or if we'll ever see it again–but I can speculate. The year 2015 was unusual in two ways that may have interacted. There was extraordinary reproduction of menhaden in the northeast, including in Hempstead Harbor...; this abundance would have allowed the parasite to flourish. Infections by this parasite are reported to peak in September, and juvenile menhaden normally leave our harbor by late November as waters cool, but it's known from elsewhere that heavily parasitized and other aberrant individuals may not migrate at*

> *all, suffering whatever consequences befall them. El Nino brought on an extremely warm November and December which kept water temperatures far above normal through New Year's Day, which may have promoted algal growth on the parasite of a fish species that normally would have migrated elsewhere."*

In 2016, the bunker started to return to Hempstead Harbor in April. A small number of the saladbacks were seen only in May at Tappen Marina and a few in Glen Cove Creek in early June.

In 2017, a large population of bunker was present throughout the harbor and stayed through November. A large school of juvenile menhaden (4-5 inches long) was observed in Glen Cove Creek on June 1; a few had algae attached to them. (This phenomenon was not observed in 2018.)

In November 2017, the story of the saladbacks was included in a prestigious journal, *Ecology*, published by the Ecological Society of America*;* see John Waldman's article "A Novel Three-Way Interaction Among a Fish, Algae, and a Parasitic Copepod" (Ecology, 98(12), 2017, pp. 3219–3220).

4.2 Fish-Survey Reports

4.2.1 Entrainment and Impingement Monitoring Report and Impact of Power Plant Substation Removal

In 2015, the old brick powerhouse building was demolished, following the dismantling of the adjacent Substation 3 (in 2013) at the Glenwood Landing power plant. 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 Hempstead Harbor.

The one-year biological monitoring program that KeySpan Generation LLC was required to conduct from January 14, 2004, to January 5, 2005, found that a staggering number of fish and invertebrates were drawn into the plant's water intake. The "once-through cooling water system" to cool steam electric-generating units in the plant drew in various species of marine life that would become either trapped in the system or impinged on the intake screen. **Thirty-four types of fish and several other marine animals** were found in the samples that were collected weekly March through September and biweekly during the rest of 2004.

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). The EIS projected that the demolition of the plant would provide water-quality improvements by virtue of the elimination of the thermal discharge from the plant and preservation of 11 to 18.5 million gallons annually of freshwater that no longer had to be pumped from on-site wells and the municipal system. Also, it was 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 the increase in fish populations noted over the last few years is a result of this change in Hempstead Harbor.

4.2.2 A Study of the Striped Bass in the Marine District of New York State

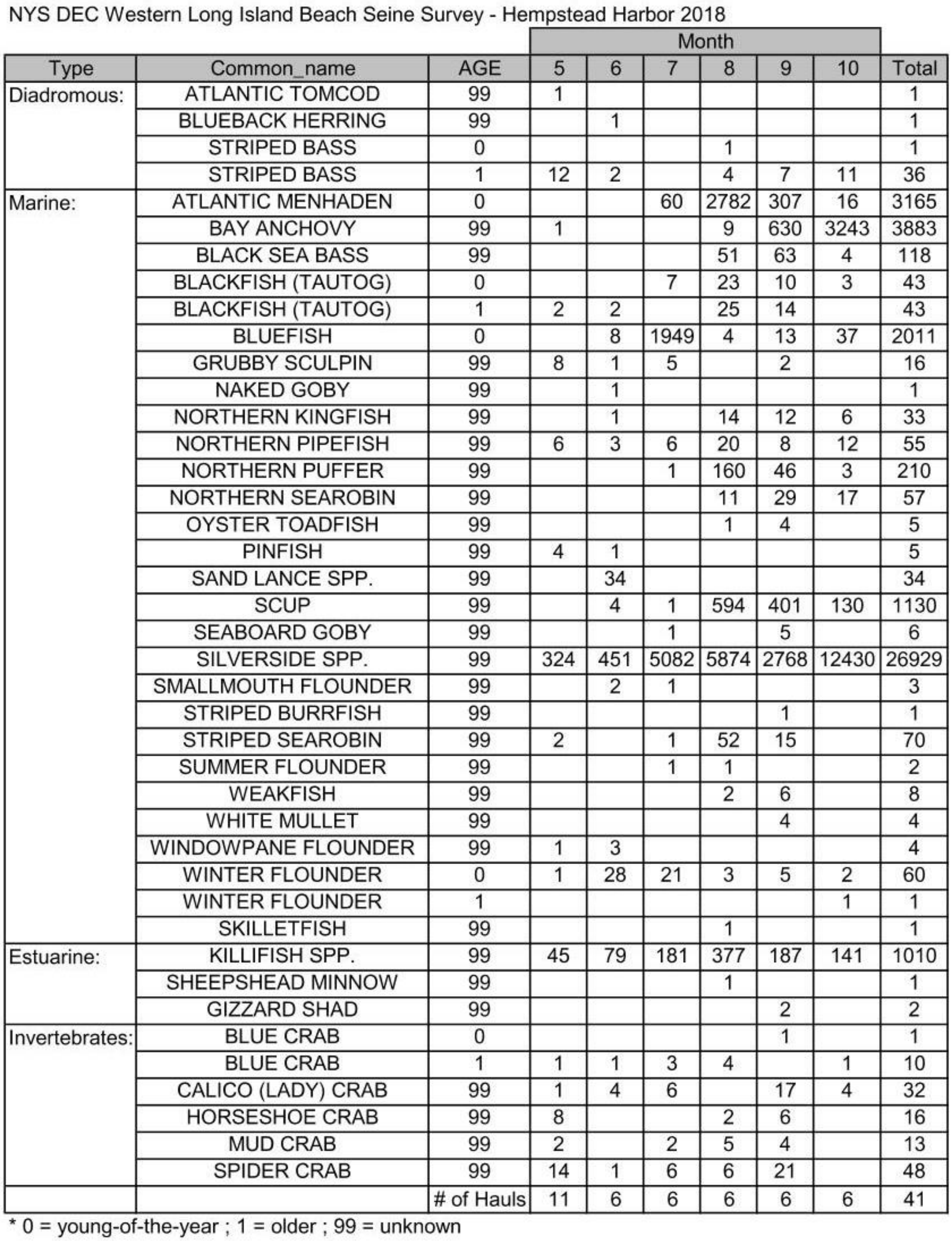
Seine surveys for the NYS DEC's striped-bass study have been conducted in western Long Island bays since 1984 and in the Hudson River since 1979. Every year, the DEC prepares a report on the previous season's surveys entitled "A Study of the Striped Bass in the Marine District of New York State," which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

The early years of the study found that striped bass generally spent their first year of life in the lower Hudson River, but 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 2018 catch totals for the harbor included in Table 6 were provided by Caitlin Craig, marine biologist at the NYS DEC Bureau of Marine Resources, Diadromous Fisheries Unit. The numbers for many of the fish caught in Hempstead Harbor were up from 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 catch, were up to a stunning count of 203,932 in 2015. In 2017 and 2018, the "bunker" totals were 12,086 and 3,165 respectively. Other significant catches in Hempstead Harbor for 2018 included those for bay anchovies (3,883, up from 268 in 2017) and bluefish (2,011, up from 488 in 2017). Although not reflected in the seine hauls, fishing reporters have observed an increase in sea robins and dogfish.

Table 6
NYS DEC Western Long Island Beach-Seine Survey–Hempstead Harbor 2018



NYS DEC Western Long Island Beach Seine Survey - Hempstead Harbor 2018

			Month						
Type	Common_name	AGE	5	6	7	8	9	10	Total
Diadromous:	ATLANTIC TOMCOD	99	1						1
	BLUEBACK HERRING	99		1					1
	STRIPED BASS	0				1			1
	STRIPED BASS	1	12	2		4	7	11	36
Marine:	ATLANTIC MENHADEN	0			60	2782	307	16	3165
	BAY ANCHOVY	99	1			9	630	3243	3883
	BLACK SEA BASS	99				51	63	4	118
	BLACKFISH (TAUTOG)	0			7	23	10	3	43
	BLACKFISH (TAUTOG)	1	2	2		25	14		43
	BLUEFISH	0		8	1949	4	13	37	2011
	GRUBBY SCULPIN	99	8	1	5		2		16
	NAKED GOBY	99		1					1
	NORTHERN KINGFISH	99		1		14	12	6	33
	NORTHERN PIPEFISH	99	6	3	6	20	8	12	55
	NORTHERN PUFFER	99			1	160	46	3	210
	NORTHERN SEAROBIN	99				11	29	17	57
	OYSTER TOADFISH	99				1	4		5
	PINFISH	99	4	1					5
	SAND LANCE SPP.	99		34					34
	SCUP	99		4	1	594	401	130	1130
	SEABOARD GOBY	99			1		5		6
	SILVERSIDE SPP.	99	324	451	5082	5874	2768	12430	26929
	SMALLMOUTH FLOUNDER	99		2	1				3
	STRIPED BURRFISH	99					1		1
	STRIPED SEAROBIN	99	2		1	52	15		70
	SUMMER FLOUNDER	99			1	1			2
	WEAKFISH	99				2	6		8
	WHITE MULLET	99					4		4
	WINDOWPANE FLOUNDER	99	1	3					4
	WINTER FLOUNDER	0	1	28	21	3	5	2	60
	WINTER FLOUNDER	1						1	1
	SKILLETFISH	99				1			1
Estuarine:	KILLIFISH SPP.	99	45	79	181	377	187	141	1010
	SHEEPSHEAD MINNOW	99				1			1
	GIZZARD SHAD	99					2		2
Invertebrates:	BLUE CRAB	0					1		1
	BLUE CRAB	1	1	1	3	4		1	10
	CALICO (LADY) CRAB	99	1	4	6		17	4	32
	HORSESHOE CRAB	99	8			2	6		16
	MUD CRAB	99	2		2	5	4		13
	SPIDER CRAB	99	14	1	6	6	21		48
		# of Hauls	11	6	6	6	6	6	41

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

4.3 Field Observations and Recreational-Fishing Reports

Even before our regular monitoring season begins, we receive reports about observations around the harbor. On January 18, Sanjay Jain described the adult and juvenile bald eagles he had seen near the eastern shore of the lower harbor. The next day, a mature bald eagle was seen flying above Shore Road near the Tappen Beach entrance as we were collecting water samples for the winter monitoring program. Minutes later, a very large red-tailed hawk flew over Tappen Beach, and another mature bald eagle flew over the north end of the Engineers Country Club. On February 9, Sebastian Li reported seeing an adult bald eagle perched in a maple tree along the eastern shore of the harbor near Bay Avenue.

Immature bald eagles on ice in lower harbor (l) and adult eagle in tree (r) along shore near Bay Avenue in upper harbor (photos by Sanjay Jain, 1/18/18. and Sebastian Li, 2/9/18, respectively)

March

In early March, a 2½-inch rainstorm and a post-storm high tide (on March 3) inundated areas around Hempstead Harbor and pushed water back to shore with such pressure that water spouted up through a manhole cover on Shore Road near the Tappen Beach Pool and caused the Glen Cove breakwater (the rock jetty just past Hempstead Harbour Club and off of Morgan Beach) to disappear from sight. On March 5, a dead goldfish (or other type of carp) was seen below the outfall north of Tappen Beach, probably pushed out of Scudder's Pond or a neighboring pond as the tide receded.

A post-storm high tide inundated areas around Hempstead Harbor, causing water to push up through a manhole cover on Shore Road (l) and the Glen Cove breakwater to disappear from sight (r) (photos by Carol DiPaolo, 3/3/18)

There were numerous bird observations reported by our regular fish and wildlife reporters. On March 10, Michael Schweiger reported seeing an adult bald eagle flying over the Engineers Country Club. Carole Berglie reported seeing a rough-legged hawk on March 11 and described the scene when on the same afternoon an immature bald eagle flew to a wire near Sea Cliff Beach:

> *He didn't mind everyone looking at him, photographing him, and admiring him…. He's a mix of first- and second-year markings, and he flew right by my balcony to exit the scene…. Amazing thing about size, of course, is that he didn't look all that big up close; more like a red-tailed size. But it was unmistakable, with that characteristic bill.*

On March 15, Carole was excited to report seeing a black vulture:

> *I just had a black vulture cruise by and circle the harbor a couple of times. Black vultures are southern vultures. They have been seen here, but are not all that common this far north. I know them well because of my time in FL. The total back body and black head, smaller size, and only faint dihedral wing pattern (i.e., mostly flat wings when cruising and gliding).*

On March 27, Carole reported seeing two pairs of long-tailed ducks (pintails) off of Sea Cliff Beach.

By mid-March, we received several reports that the ospreys had returned to some nearby bays, and on March 30 a pair of ospreys were seen looking over their reconstructed nest in the navigational light (Beacon 11) across from Tappen Marina; on March 31, an osprey was seen building up the nest on the platform on Shore Road by the power plant.

There also were unusual sightings on land, away from the harbor. On March 23, a deer was seen running across Route 107, between Northern Blvd and Wheatley Rd. And during the last week of March, white squirrel ran up a tree on Dubois Avenue in Sea Cliff. Evidently, gray squirrels have a gene that could cause them in rare cases to have all-white fur. There are areas along the east coast that have higher numbers of white squirrels, but Sea Cliff isn't one of them.

April

The month began with a surprise snow storm (about 7.5 inches of snow) on April 2. On April 4, one of our fish and wildlife reporters, Sanjay Jain, described what he was seeing near the lower harbor:

> …*a nest of bald eagles* [is] *nearby and suspect that eggs may have already hatched (based on behavior of adults, although have not seen hatchlings). Saw a juvenile bald eagle hover around the nest…chased by one of the adults…saw loons wading in the harbor a few days ago (think they were nonbreeding common loons as they were grey and white). Have not seen the species before… have frequently seen lesser scaups floating and fishing in big groups (often see buffleheads with them)…a few ospreys returned and actually were chasing a bald eagle from their territory….*

On April 4, John Waldman reported:

> *With the osprey back here in March but the sound still too cold for bunker, the birds are improvising, hitting stocked trout. This morning I was fishing Twin Pond in Huntington, and an osprey surprised me (I didn't see it coming) with a successful splashy grab of a rainbow trout just 30 feet away from me. And they were searching Mill Pond in Oyster Bay too.*

On April 5, Corin Basilion reported seeing what seemed to be a merlin scouting out a birdfeeder, and on April 6, Sanjay Jain saw a bald eagle on a nest in a tree along the shore of the lower harbor. The eagles continued to be active throughout the rest of the month, and we received reports of bald eagle sightings all along the eastern shore of Hempstead Harbor and even inland near Glen Cove Road in Glen Head. On April 30, John Grucci reported seeing an eagle flying near the Webb Institute being chased by an osprey.

April observations included a merlin sighted in Glen Cove (l), a bald eagle in a nest in Roslyn Harbor (r) (photos by Nick Basilion,4/5/19, and Sanjay Jain, 4/6/19, respectively)

Over the last couple of weeks in April, a number of people were fishing off of Tappen Beach, the rocks near Tappen Beach Pool, and the shore just south of Rum Point. A run of striped bass attracted all the attention; one person who had been fishing during this time said he caught a 30-inch long bass. On April 28, lion's mane jellyfish were seen near Brewer's Marina in Glen Cove Creek; these jellyfish were also seen in April 2017.

May

Weekly surveys for the season began in May (May 23 and 30 for the core program). We saw a variety of birds that are typically seen throughout the harbor: cormorants, great egrets (19 in the lower harbor on May 23), snowy egrets, Canada geese (and four goslings), mallards, mute swans, and ospreys. On May 23, we saw ospreys on the usual nests on pilings, a platform, and on Beacon 11—the navigational light between Tappen Marina and the former Bar Beach. A new osprey nest had been built on a recently moored boat near Mott's Cove, and a bald eagle perched on a nearby tree. On May 29, Sanjay Jain sent a photo of an adult eagle in the nest with one chick visible—he wasn't sure whether there was a second chick.

An adult bald eagle with chick in nest (l) and a pair of mergansers (r)
(photos by Sanjay Jain, 5/28/18)

Schools of baitfish were observed in Mott's Cove. One comb jelly (a sea walnut), the first of the season, was seen near Beacon 11. We saw very few during the entire season and only on four monitoring dates (August 29, September 5, and September 14, and October 10). Since 2013, the presence of comb jellies has been decreasing in the harbor, possibly as a result of the increasing menhaden population since that time.

On May 1, Paul Boehm caught two striped bass in Hempstead Harbor—one 33 inches long and the other 28 inches. On May 4, Paul reported the following:

> *Water is still cold so bass are not that aggressive, tend to pick up and drop baits. I believe there are schools of bunker in the harbor, not at surface, but I see schools on the fish finder which I believe are bunker. I think they're not on surface because no predators are "on" them yet.*

Striped bass caught by Paul Boehm (l) and lion's mane jellyfish (r) (photos by Rich Boehm, 5/1/18, and Karen Papasergiou, 4/28/18, respectively)

On May 6, Sebastian Li reported:

> *Though I haven't seen any obvious schools of bunker, I have spotted ospreys dive bombing and pulling out fish the last few days, while others have flown past the deck at eye level with bunker sized fish in talon. Many people fishing from shore and boat….One guy said that there are a lot of fluke in the area, which makes sense since the winter storms moved a lot of sand into the area* [off of Bay Avenue in Sea Cliff] *giving…a wider swath of sandy bottom…which is where fluke like to hang out.*

By mid-May, we received numerous reports that bunker were in the harbor and near the surface, and the ospreys were diving for their meals. We also had had reports of lion's mane jellyfish in large numbers at Tappen Marina and elsewhere in the harbor. The group of lion's mane jellies observed were orange rather than the maroon color that is often seen. There were also several reports of brown water and pollen streaks throughout the harbor, which are common in spring.

On May 18, Paul Boehm reported:

> *An OK but not great year for stripers. Largest fish I've caught was 36" 20 lbs; also caught 6 others ranging in size from 27" to 33." Bellies of all the fish I've kept were full of mantis shrimp. Schools of large bunker around as of this week, they are as big as I've ever seen.*

Other wildlife reports to be seen around the harbor during May included a rabbit on Glenlawn Avenue in Sea Cliff and a pheasant on Albin Street in Glen Cove.

June

During the four water-monitoring surveys in June (June 6, 13, 20, and 27), many of the usual birds were observed: cormorants, mallards, blue herons, great and snowy egrets, Canada geese, ospreys, and mute swans. Two bald eagles were spotted throughout the month. On June 13, a red-winged blackbird was observed as well as an adult bald eagle perched in a tree in the lower harbor. Geese and swans increased in numbers near Tappen Beach, and geese peace dogs were used to chase them away. A black-crowned night heron was seen on a dock in Glen Cove Creek on June 27.

On June 3, John Waldman witnessed part of the springtime horseshoe crab mating ritual taking place at Tappen Beach. Male crabs grab on to larger female crabs, as females travel further up the sand to dig shallow holes to lay eggs that are then fertilized by the male(s).

(photos by John Waldman, 6/3/19)

A report was received during the last week of June that five large turkey vultures were flying over Shore Road and Safe Harbor Marina (formerly Brewer Marina).

Baitfish and bunker were also observed throughout the month. On June 6, we saw evidence of the presence of striped bass, as we watch seagulls on a sandbar in Glen Cove Creek picking at a large filleted carcass of a striped bass. On June 8, Paul Boehm reported:

> *Harbor has a lot of life swimming around in it at the moment. Been catching a lot of stripers, the biggest one I've caught was 40," 28lbs; there have been many reports of bigger fish, some over 40 lbs. I've also caught a few black sea bass, a clearnosed skate (28" long by 18" wide, 6 lbs), about 100,000 sea robins, and multiple spider crabs. Bunker pods are all over the harbor. Rich caught a few bluefish (small). I have not seen any big blues and the bunker pods seem very happy and relaxed so I suspect they haven't arrived yet. Some fluke reported, but I haven't tried for them.*

A clearnosed skate caught on May 24 in the outer harbor and a cormorant with a stretched neck after swallowing a whole bunker (photos by Paul Boehm, 5/24/18, and Carol DiPaolo, 6/12/18, respectively)

Water color during monitoring dates in June was judged to be a normal brown to dark green. As was the case in May, June was a rainy month, which may have added to the appearance of increased turbidity in the harbor that was observed during monitoring dates. On June 6 and 20, a heavier flow from CSHH #10 (the large outfall west of the STP) was observed; on June 20, the flow included a white, milky discharge, which has been observed and reported previously over several years. Also, on June 20, the stream that runs along Crescent Beach to the harbor seemed to be flowing more rapidly than usual.

July

Weekly monitoring surveys were conducted on July 3, 11, and 17 (boat availability and weather conditions prevented monitoring during the fourth week of July). The usual birds seen in the harbor at this time of year were observed on July monitoring dates, including cormorants, mallards, egrets (great and snowy), Canada geese, blue herons, ospreys, swans, and terns. On July 11, ten ospreys were observed in nests throughout the harbor, including the nest on a broken-down boat moored in the lower harbor. On July 16, Paul Boehm saw a black skimmer fishing at night in Tappen Marina:

> *I saw a skimmer… repeatedly flying back and forth the length of dock D. He would come in low to the water with lower beak in the water as he flew and then immediately circle back, obviously feeding on the small baitfish in the marina. He must have been doing pretty well with it as I watched him for about 10 minutes during which time he never rested.*

On July monitoring dates, we observed bunker breaking the surface, but we had not yet seen them finning in large numbers as we had in recent years. However, our fish and wildlife reporters had another view. On July 6, Paul Boehm reported:

> *The harbor continues to have a lot of life. Bunker pods all over, very relaxed, which means to me that big blues have not showed up. New arrivals since my last report to you have been fluke, some of them pretty big--I have caught fish up to 27" 6.5 lbs. There are porgies all over the place. At times the bottom seems coated with smooth dogfish and sea robins. The spring striper run is still on but petering out at this point. So at this point I have personally caught porgies, fluke, black sea bass, striped bass, sea robins, dogfish, and a skate. I have also seen a butterfish snagged. As well, I have dragged at least 20 big spider crabs off the bottom as well as some other species of crabs I could not identify. All in all, the harbor seems healthy….*

On July 11, while at CSHH #1 (Beacon 11), we observed what we thought was a crustacean hatch of some sort. We were able to collect some and photograph them. Thanks to John Waldman and Edward (Jim) Rice, we were given a likely identification of caprellid amphipods. On July 12, Jim reported that they are pretty common between Florida and Cape Cod and further stated:

> …[they]*don't usually show up in open water plankton tows unless they get swept off their substrate. They are ambush predators that usually like to cling to a surface. I've seen them a couple of times in dock tows when some macroalgae they're clinging to makes its way into my net.*

Caprellid amphipods (l) (photo by Carol DiPaolo, 7/11/19)

On July 11, a pilot whale was seen in Oyster Bay, but there were no reports that it made its way to Hempstead Harbor.

On July 25, Paul Boehm reported:

> *Fishing update remains positive from my observations. I have continued to get stripers with fish of 41lbs on July 16 and 23lbs on July 19. Lot of bunker pods around, fluke (eating mantis shrimp) are around as I continue to pick up a few keeper fish (>19"). Large schools of smooth dogfish remain. Lots of sea robins. Huge spider crabs…. I still have not seen any big blues and have had no evidence of bites from them (chopped monofilament/fluorocarbon leaders, when they are around you have to use wire leaders). Also, bunker are not in panic mode yet, although in tighter schools than before--I assume because there are some big stripers below them.*

On July 27, Carole Berglie reported seeing fishermen catching lots of porgies off of Sea Cliff Beach. The results for the July 18 DEC striped-bass survey in Hempstead Harbor included a catch of 1,949 young-of-the-year bluefish, primarily from one seine.

On all three monitoring dates in July, the water in the harbor had been judged to be a normal green color. However, on July 3 and 17, a milky-white discharge was seen from CSHH #10, the large outfall west of the STP. On July 11, while testing at stations within Glen Cove Creek, we happened to be present when something seemed to burst from the bulkhead on the north side of the creek, near the old pumping station. A noticeable odor of sewage filled the air but, but the discharge was opaque green. Samples were collected for bacteria testing, and the results were low for both indicators—fecal coliform and enterococci. We later found out that the ultraviolet system used at the STP was being cleaned of algae buildup and possibly overwhelmed the pump station on the other side of the creek.

On July 17, another incident occurred in Glen Cove Creek, the cause of which remained unresolved. We noticed a large sediment flow from a pipe on the east end of the ferry terminal on the north side of Glen Cove Creek that discolored the area of the creek around the flow. A project manager for the Garvies Point development notice the flow as well and directed crew members to shut off all water lines from the project, but the flow seemed to be from a source upland of the development. Also on July 17, the stream by Crescent Beach seem to a more rapid flow than usual, and the large outfall west of the STP on the south side of Glen Cove Creek had a faint white flow.

A failure at the pump station on the north side of Glen Cove Creek (l) and a brown sediment discharge from a pipe on the east end of the ferry terminal (r) (photos by Carol DiPaolo, 7/11 and 7/17, respectively)

August
During the five monitoring surveys in August (August 2, 8, 15, 23, and 29), we saw the usual birds of Hempstead Harbor: cormorants, mallards, great egrets, snowy egrets, Canada geese, blue herons, ospreys, and mute swans. Dozens of Canada geese were observed throughout the harbor on most monitoring dates, and 22 swans were observed in the lower harbor on August 8. Terns were observed in the area of Crescent Beach on August 2, and a bald eagle was spotted in the lower harbor on August 8. Black-headed gulls were seen in the lower harbor on August 23.

On August 3, Sebastian Li reported on the numbers of geese and swans he had seen during May through July:

> *…there have been at any given time 50-150 geese along the shoreline along with 4 pairs of mute swans. At low tide, they like to congregate along the beach close to the Tappen jetty with their droppings covering the beach. At night I can hear them honking on the beach below, so they seem to be somewhat active then too.*

Swans north of rocks at Tappen Beach Pool (photo by Carol DiPaolo, 8/6/18)

On all monitoring survey dates, large schools of bunker were seen breaking the surface throughout the harbor. On August 15, flashes of bunker were seen rolling around near the surface seemingly with larger prey under them. Bunker observations on monitoring dates corresponded with the DEC's August striped-bass survey in Hempstead Harbor, for which 2,782 young-of-the-year Atlantic menhaden were hauled in the seines. We received reports that numerous blue-claw crabs were in local marinas at the end of July and early August. On August 15, five crabs were observed on the south bulkhead of Glen Cove Creek between The Cove restaurant and Safe Harbor Marina (formerly Brewer Marina). Five more blue-claw crabs were observed at Tappen Marina and one at Safe Harbor Marina on August 29.

On August 26, Paul Boehm reported:

> …. *I've been out twice in last three weeks without hooking any blues or stripers. From my observations, the big blues never showed up this summer. Got some fluke, but none of them keepers--very small fish on the order of 12-15". Sea robins, smooth dogfish are still there. The dominant game fish at this time is porgies. Over the last*

> *few years, they seem to take over the entire area in the warm water of August, and this year is no exception. Bait all over the place--Tappen Marina is full of silversides and small shrimp. Plenty of pods of big, healthy looking bunker in the harbor and sound. I have not seen any parasites on them this year and have not seen them inside the marina. There are a lot of blue-claws in the marina. Beautiful crabs, some of them quite large. A lot of spider crabs and some rock crabs out deeper.*

On August 29, the small variety of comb jellies were observed (sea gooseberries) near the navigational light off of Tappen Marina. This was only the second time during the season that any comb jellies were noted during monitoring surveys.

Baitfish and a small blue-claw crab in a net trap (l) and blue heron on remains of an old bulkhead (r) (photos by Carol DiPaolo, 8/29/18, and Michelle Lapinel McAllister, 8/21/19, respectively)

On all August monitoring dates, water color was judged to be normal and in the brown to green range but very brown on August 8. On August 29, the Gobler Laboratory of Stony Brook University's School of Marine and Atmospheric Sciences sent out an alert a rust tide was spreading from east to west in various areas around Long Island, including Long Island Sound. No reports or observations during monitoring survey dates indicated that a rust tide (an algal bloom that can cause widespread fish kills) had reached Hempstead Harbor.

Following a storm in early August, the disabled boat that had been moored in the lower harbor sank, and with it went the osprey nest that was built soon after the boat arrived.

A disabled boat moored in the lower harbor became a nesting place for ospreys (photos by Carol DiPaolo, 7/11/18)

Boat that sank in lower harbor after storm was then lifted and placed in Mott's Cove and sank a second time (photos by Carol DiPaolo, 8/8/18)

On our August 8 monitoring survey, we saw the sunken boat and an osprey land on the top of the small portions that were visible above the surface. The boat was lifted with a small crane, towed to the entrance of Mott's Cove, and sank again after another storm; it remains in Mott's Cove with two other boats (or pieces of boats) that have sunk over the years and that can be seen during a particularly low tide.

Although Hempstead Harbor has relatively little floating debris, trash collects in some pockets in Glen Cove Creek and Mott's Cove and along the shoreline and beaches, particularly following a high tide or stormy weather. A severe storm with heavy rain on August 11 and more rain on days following caused noticeable amounts of trash to run off onto the shoreline and into the harbor. On our August 15 monitoring date, we noted a large amount of floating trash and grabbed a large bucket that was floating by. The torrential downpours over the preceding weekend sent trash-laden rivers of water (as well as large amounts of rocks and sediment) into storm drains and into the harbor and the sound. The wind during our monitoring survey was coming from the north with the incoming tide (one of the higher tides), which left lots of trash on the shoreline as the tide receded.

Sebastian Li reported what he saw while kayaking on the same day, August 15:

> *I noticed a huge mass of plastic garbage comingled with seaweed from* [the area below Bay Avenue] *to Sea Cliff Beach. I'm sure it was larger, but that's where I happened to be fishing. I collected what I could… but there was so much of it and not just on the surface, you could see things floating at deeper levels. There were also vast amounts of microplastics and single Styrofoam cells everywhere…. Obviously, this is a direct result of the recent downpours and flash floods coupled with shifts in a N-NE wind pattern. The small amount I gathered included straws, wrappers, caps, drug bags, a used condom, broken bits. I also saw 3 full bags of dog poop. The whole scene made me queasy it was so disgusting. There is an interesting correlation between how plastics seem to form a bond with organic matter to form these large masses.*

On August 16, the Sea Cliff Beach manager reported that the beach was covered with straws, bottles, plastic bags, Styrofoam cups, etc. (about one large garbage bag full of debris was collected from the beach), and that the crew saw it floating on the surface of the harbor the day before.

September

During the four monitoring surveys for the month—September 5, 14, 19, and 2—cormorants, ducks, great egrets, snowy egrets, Canada geese, blue herons, ospreys, and swans were observed. On September 5, 147 cormorants were counted—the most that had been observed all season on any one monitoring date.

Cormorants on a boom at the southern end of Town of North Hempstead Beach Park (photo by Carol DiPaolo, 9/5/18)

Baitfish, blue fish, and Atlantic menhaden (bunker) were noted on survey dates throughout the month. On September 5, snappers were observed in Mott's Cove, and a large school of peanut bunker were observed in Glen Cove Creek. Six blue-claw crabs were on the south bulkhead of Glen Cove Creek, and one blue crab hitched a ride on the meter platform during testing at CSHH #1 (the navigational light off of Tappen Marina). A few comb jellies (the sea walnut variety) were observed on September 5—three at CSHH #1 and two at CSHH #2 (near the red bell buoy in the outer harbor).

On September 3, fish and wildlife reporter Sebastian Li forwarded his observations:

> *Bunker reappeared today. Noticed bright green striations in the water while kayaking so pretty sure there is an algae bloom under way. Tons of snapper by Rum Point. Caught 37 and 2 sea robins at low tide. Lots of spearing and peanut bunker close to shore from Sea Cliff Beach to Tappen.*

Large schools of peanut bunker (l) and a blue-claw crab (r) in Glen Cove Creek
(photos by Carol DiPaolo, 9/5/19, and Michelle Lapinel McAllister, 9/19/19, respectively)

A brown algal bloom was noted on September 5 near CSHH #1 and at the head of Glen Cove Creek, but a green bloom was noted midharbor. On other monitoring dates, the water was judged to be a normal green color. Also, on September 5, a limited kill of peanut bunker was observed at the head of Glen Cove Creek—about four dozen small bunker floated at the surface on the outgoing tide. High temperatures, larger predators, and/or the algal bloom (higher the usual DO readings pointed to a bloom in progress) could have contributed to the kill. However, a large school of seemingly healthy peanut bunker were observed in the western portion of the creek.

A milky-white discharge was note at CSHH #10 on September 14; Nassau County DPW requested that water samples be collected from the flow and delivered to Pace Analytical Services for analysis. Results for the samples collected showed high levels of magnesium, caclcium, total water hardness. On September 19, a brown discharge was noted from CSHH #9, adjacent to the STP discharge to the west. Test results for water samples collected from the pipe showed high levels of bacteria, for both fecal coliform and enterococci. Both disharges—on September 14 and September 19—were reported to the appropriate parties. The sources of the discharges were not resolved.

October

During October, there were five monitoring surveys: October 2, 10, 17, 24, and 31. The usual variety of birds was observed during monitoring dates: cormorants, ducks, great egrets, snowy egrets, Canada geese, blue herons, ospreys, and swans. The highest numbers number of birds were observed on October 10, with most counted in the lower harbor. The totals for that date included 138 cormorants (126 were in the lower harbor); 39 swans plus 2 cygnets; about a hundred Canada geese, 36 egrets. A bald eagle and two kingfishers were also observed on October 10. Individual eagles were seen on two different trips. On October 24, a large number of gulls worked the water off of the Town of North Hempstead Beach Park along with more than eight dozen terns.

Flooding below Bay Avenue (l) and along Sea Cliff shoreline looking north (r) duing October 27 nor'easter (photos by Sebastian Li, 10/27/19)

On October 27, a nor'easter brought in 1.35 inches of rain and caused local flooding. On the final monitoring date for the season, October 31, the air temperature at the start was just over 5ºC under cloudy skies with ice having formed overnight on the boat used for water monitoring and marina ramp. Because of the tidal cycle, only an upper harbor survey was conducted. The usual variety of birds was observed, although in fewer numbers overall: cormorants, ducks, Canada geese (about 6 dozen at the south end of the Town of North Hempstead Beach Park), blue herons, belted kingfishers (2), and an osprey with a bunker catch. At the end of the survey, we traveled beyond our Hempstead Harbor monitoring stations to Execution Rocks Lighthouse in Long Island Sound and saw cormorants perched on top of the lighthouse, creating a gothic scene. On the approach to Sands Point, an injured loon was swimming in wide circles on the surface of the water near Sands Point.

During weekly surveys in October, we observed more diverse fish activity than previously during the season. Baitfish, blue fish, bunker, striped bass, and small shrimp were seen. On October 31, comb jellies (sea gooseberries) were too numerous to count near CSHH #1—that was only the fourth time during the season that comb jellies were observed on monitoring dates.

October 31 also included an unusual sighting of a dead opossum floating by on a noticeably fast running outgoing tide. We had received reports of two other dead opossum that were observed along the shoreline during the season.

Water color on all monitoring dates in October was judged to be a normal green and very clear on October 31, with Secchi depths over 3 m at three stations. Also on October 31, a milky white discharge was noted from CSHH #10. High wind and waves prevented full surveys on October 17 and 24.

Cormorants on the lookout at Execution Rocks Lighthouse
(photo by Carol DiPaolo, 10/31/19)

November – December
Although our weekly water-monitoring surveys ended October 31, our fish and wildlife reporters keep us informed throughout the year with their harbor observations. On December 14, Sebastian Li offered a final report for 2018:

> *I was out on the water this morning fishing for herring, which are popping up all over (just not on my line!), and a harbor seal surfaced about 100' from my kayak in front of the Tilley stairs. I think it's a good indicator of the amount of herring that must be around. I'm pretty sure there must be stripers passing through too, on the tail end of their migration.*
>
> *At the end of October and into November there were tons of gulls and terns working the water following large schools of bass close to shore near the barges, Bar Beach, and Tappen, going after peanut bunker. The one 28" keeper that I landed had a belly full of peanut bunker and shrimp. I also hooked hickory shad… not very common around here anymore… spotted a bald eagle from the beach to the right of Rum Point around Thanksgiving. Lots of interesting black & white water fowl and gannets passing through, too.*

4.4 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 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 some are swimmers, like the blue-claw crabs, which have back legs that are shaped like paddles. 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 may be pushing out native species.

Lady/calico crab (l), blue-claw crab (m), and spider crabs (r) (photos by Michelle Lapinel McAllister, 7/27/17, Carol DiPaolo, 7/15/17, and by Paul Boehm, 5/2/16, respectively)

Although **blue-claw crabs** have always been present in Hempstead Harbor, particularly in the lower harbor, they appeared in remarkable numbers in 2007. We didn't see blue crabs in 2008 or 2009, and the 2009 DEC seines recorded only two blue crabs–one in July and one in October. Blue crabs returned in large numbers in 2010, but the population did not match the quantity recorded in 2007. No blue crabs were observed during the 2011-2012 monitoring dates, but the DEC seine crew for the striped-bass survey caught four in 2011 and seven in 2012. In 2013 we saw one blue-claw crab, and the DEC seine catch for Hempstead Harbor included two–one in May and one in July. In 2014-2016, no blue crabs were noted on monitoring dates, but two were caught in the 2015 Hempstead Harbor seine hauls by DEC. In 2017 and 2018, blue claws were present in greater numbers and were seen in local marinas and on bulkheads and beaches. In 2018, blue crabs were in caught in DEC seines for every May-August and again in October.

Horseshoe crabs mating (photo by John Waldman, 6/3/18)

Although **horseshoe crabs** are included in the group of crustaceans seen around the harbor, they are not true crabs but more closely related to spiders. They are noted most 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 in 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. We saw one many years ago during a low DO event that drove mantis shrimp and other bottom-dwelling creatures to the surface for air. In 2007, four small mantis shrimp were raked from the bottom during a shellfish survey, and a large one was brought up from a November 2013 shellfish survey. Increasingly, mantis shrimp have been found in the bellies of striped bass caught by local fishermen. Paul Boehm noted on June 30, 2014:

> *The bass' stomachs are always full of mantis shrimp early in the season. In addition, I've caught fluke full of mantis shrimp, and one of the black sea bass I caught hit a plastic mantis shrimp. So the shrimp are a major, perhaps the major, forage species in the area.*

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.

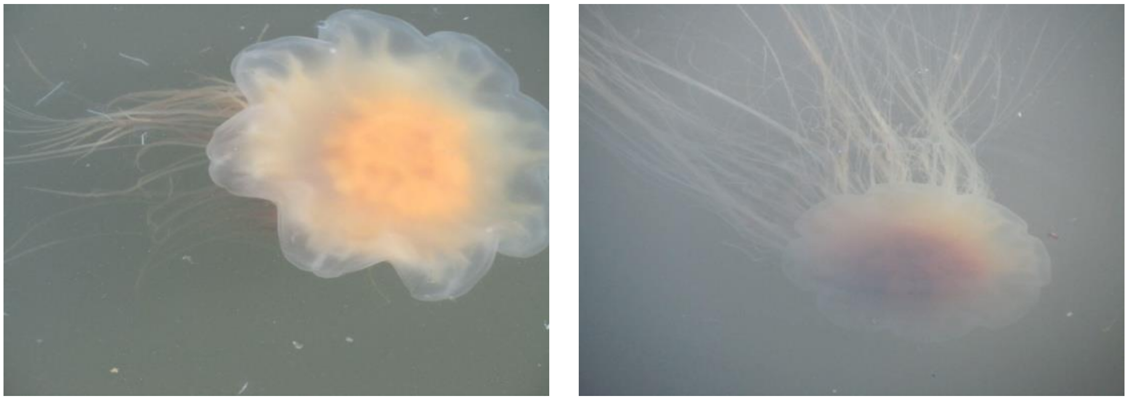
Long-claw porcelain crab (photo by Michelle Lapinel McAllister, 8/24/16)

4.5 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 tail-like appendage that can be seen when they are up close to the surface. Comb jellies do not sting.

Comb jellies had usually appeared in large numbers in Hempstead Harbor in late June and through mid-October. In 2011, they were noted a little earlier in the season (in May) and were seen during monitoring dates for the last time on October 6. In 2012, we observed only a few comb jellies on only two monitoring dates. The comb jellies were noted throughout the entire season in 2013 and from July through September in 2014. In 2015, no comb jellies were observed on monitoring dates, and only a few were observed on a few monitoring dates in 2016-2018. The decrease in comb jellies observed in Hempstead Harbor and Long Island Sound seems 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 purple-brown **lion's mane jellyfish**, with long tentacles that sting, and the round, bell-shaped **moon jellyfish** that has short tentacles around its rim that do not produce a stinging sensation**.** Moon jellies are easily identified by the four, whitish, horseshoe-shaped gonads on the top of the bell. Both types of jellyfish are usually observed earlier in the season in Hempstead Harbor. In 2013, we saw both lion’s mane jellyfish and moon jellies in Hempstead Harbor, but the lion’s mane had an orange coloring to them. Mixed among these, we saw hundreds of unfamiliar jellies that were identified as **salps**. No lion’s mane or moon jellyfish were observed on monitoring dates in 2016; in 2017, only one moon jelly was seen by the STP in Glen Cove Creek. In 2018, however, we received numerous reports of lion’s mane jellies in the harbor early in the season—in April and early May—with large numbers congregating in Tappen and Safe Harbor Marinas. All of these were relatively small and orange-colored.



Lion's mane jellyfish seen in Tappen Marina; the thin white lines visible at left are the internal structures in barrel-shaped salps (photos by Carol DiPaolo, 5/22/13)

4.6 Shellfish

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 beds is important not only because this area is now productive for both commercial and recreational harvesting, but also because this is the best indicator of the incredible water-quality improvements that have been made in Hempstead Harbor.

Baymen with full bags of clams (l) from Hempstead Harbor and sorted clams on board (r) (photos by Carol DiPaolo, 6/1/11)

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. In May 2018, approximately eight acres outside the mouth of West Creek, which connects West Pond to Hempstead Harbor, was reclassified and closed to shellfish harvesting because of an increase in bacteria levels. East Creek on the west shore near Prospect Point also remains closed. (See the map at *Section 3.8.7.*)

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, 10/31/18)

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 harvesting clams in Hempstead Harbor and then transporting them 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.

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.

4.6.1 Shellfish Landings

Just three years after the opening of the Hempstead Harbor shellfish beds, NYSDEC reported that, for 2014, Hempstead Harbor took in the second largest number of hard clams (17,424 bushels) out of all of the shellfishing areas (26) around Long Island, providing an economic benefit valued at over $1.36 million. In 2015 and 2016, the number of hard clams taken commercially from Hempstead Harbor decreased significantly—down to 4,446 bushels in 2016, with an economic value of $379,371. The 2017 state landings report indicated an increase in the number of shellfish taken from Hempstead Harbor; not only had the haul for hard clams increased (to 5,134 bushels), but also the hauls for soft clams (236 bushels) and oysters (379 bushels) increased. In 2017, Hempstead Harbor produced the seventh largest haul of hard clams out of 30 growing areas around Long Island. In 2018, Hempstead Harbor was in sixth place for hard clams produced (5,212 bushels) out of all growing areas around Long Island, with an economic value of $453,122 (slightly more that the 2017 value). However, the hauls of softshell clams and oysters were down significantly from 2017. (See also http://www.dec.ny.gov/outdoor/36800.html for shellfish areas.)

4.6.2 Monitoring and Enforcement for Hempstead Harbor Recertified Shellfish Beds

In the first few weeks after the 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; they were loaded with large mesh bags of clams. CSHH began incorporating a trip to the area during weekly monitoring surveys to count the number of boats in the area.

Concerns began to surface regarding the potential for overharvesting the area, the public's confusion over what area of the harbor had been recertified (some thought all of Hempstead Harbor had been recertified), and the difficulty of determining, from the water, exactly what area around Crescent Beach was closed to shellfishing. On June 20, 2011, a meeting coordinated by the HHPC brought all agency, municipal, and environmental representatives together to discuss, among other things:

- Jurisdiction–who can or should enforce?
- Area boundaries of shellfish beds (whether there is a need for markers)

- Regulations (hours, catch, equipment, permits, etc.) and measures that could ensure sustainability
- Communications (re: closures, etc.)
- Public education
- Interagency coordination and assistance

As a result of the meeting, signs were prepared to post along the shoreline in areas that remain uncertified, and buoy markers were placed outside of Crescent Beach to delineate the 250-yard radius around the beach that remained closed to shellfishing.

One of three buoys marking the closed area around Crescent Beach (l) and a posting for the area closed to shellfishing at Tappen Marina (r) (photos by Jim Moriarty and Carol DiPaolo, 6/15/11 and 9/21/11, respectively)

NYS DEC issues temporary closures of the shellfish beds (generally precautionary, following rain events of three inches or more) and releases that information through a recorded message available by phoning 631-444-0480, on its website (http://www.dec.ny.gov/outdoor/7765. html), and through press releases to local media outlets. In 2014, the shellfish beds were closed twice–in May and December–following heavy rain. In 2015 and 2016, there were no temporary closures for Hempstead Harbor shellfish beds. However, in 2017, following over 4 inches of rain on October 30-31, Hempstead Harbor shellfish beds were closed until November 9. There were no temporary closures of certified shellfish beds in Hempstead Harbor in 2018.

4.6.3 Shellfish-Seeding Projects

The first shellfish-seeding project for Hempstead Harbor was conducted on October 9, 2007, as a joint initiative that included Nassau County, the TNH, TOBAY, Cornell Cooperative Extension, Frank M. Flower & Sons Oyster Company, as well as HHPC and CSHH, and was intended to add biomass to the harbor using a resource that could help improve water quality–each clam and oyster can filter 1 to 2.5 gallons of water per hour, with daily estimates (for oysters) of 30 to 60 gallons.

The shellfish stock for the seeding project came from Cornell Cooperative Extension and Frank M. Flower & Sons Oyster Company, and included more than 1.3 million seeds, consisting of two types of hard-shell clams (*Mercenaria mercenaria* and *M. mercenaria notata*) and oysters. (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.

Following the opening of the shellfish beds in Hempstead Harbor in 2011, the prospect of reseeding the beds was raised as a measure of sustainability, but finding the necessary funding for such a project is problematic.

4.6.4 Surveys to Assess Survival of Seed Clams and Oysters

In late summer 2008, CSHH requested a permit from DEC to conduct a shellfish-density survey in the area of the 2007 seeding project in Hempstead Harbor to gauge the survival rate of the seeds. We selected seven of the GPS points previously recorded for raking. The area seeded in 2007 included a transition from thick, muddy bottom to a harder, sandier bottom.

In the areas of thick, black mud (the deeper-water stations), we did not find hard-shelled clams and oysters; instead, we found an abundance of the very small surf clams referred to as “duck feed.” As the bottom transitioned to sand closer to shore, we found a variety of clam sizes, from littlenecks to chowder, and the largest number in one raking included 10 clams. We also found a variety of other clams, some crabs, 4 small mantis shrimp, small snails, oyster drills, and broken shells of oysters, clams, and crepidula (slipper shells). A few seed clams of both types of clams used in the seeding project–*Mercenaria mercenaria* and *M. mercenaria notate*–were found, but they seemed to be naturally occurring because they were too small to have been from the 2007 seeding project.

In autumn 2008, the Town of Oyster Bay and the HHPC coordinated a broader shellfish population density survey, including 61 stations in Hempstead Harbor.

In preparation for Nassau County’s 2009 shellfish seeding in Hempstead Harbor, Cornell Cooperative Extension, Marine Division, staffers Matthew Sclafani, Neal Stark, and Gregg Rivara completed a Sediment Suitability Assessment of Hempstead Harbor for Nassau County's Shellfish Restoration Program (October 14, 2009). The assessment helped determine suitable sites to plant seed clams and oysters in the area off of Morgan Park. The team 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.

During the sediment assessment, a natural population of predominately hard clams (*Mercenaria mercenaria*) was observed in the central and southern area of the survey. They were also present in the northern survey area but not as frequently. (The report stated that these observations validate the effort to enhance shellfish in this area because the area currently supports shellfish.)

Also during the sediment assessment, the team observed and collected clam shells of the *notata* variety, which they felt were most likely from the 2007 seed plantings and originated from Frank M. Flower's and Son shellfish stock. *Notata* clams are not common in the area (typically < 1% frequency) and are easy to distinguish from the white clam variety by the dark zig-zag striped patterns on the shell. The average size of the 10 *notata* shells the Cornell team found was 27 mm. (The *notata* were between 8-12 mm at the time of the 2007 planting.)

In October 2013, a shellfish-density survey was conducted by the Town of Oyster Bay over a two-week period and replicated the 2008 survey. The survey involved collecting 120 bottom grab samples at the same 61 stations used in the 2008 survey. The findings in the survey report (July 9, 2014) included 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 is 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 decline over several consecutive years could indicate an overall decline in the resource. Further studies would be needed to determine whether the 2013 seed-clam decline was an anomaly or part of an ongoing condition.

4.6.5 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 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.

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 on the western shore below the Bar Beach sand spit.

Ribbed-mussel colonies on the eastern shore of Hempstead Harbor (l) and close-up of mussels around spartina roots in cove south of Bar Beacb (r) (photos by Carol DiPaolo, 3/30/12 and 7/15/17)

4.7 Birds

Over the last 20 years or so, we have seen a variety of birds that have become residents of or regular visitors to Hempstead Harbor. **Belted kingfishers, blue herons, cormorants, gulls, mallards, Canada geese, snowy and great egrets, ospreys, swans,** and **terns** 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. On monitoring dates in 2014-2018, red-winged blackbirds were noticed occasionally around the edges of Scudder's Pond and grassy areas on top of the bulkhead near the head of Glen Cove Creek.

Black-crowned night heron on Glen Cove Creek dock (photo by Carol DiPaolo, 6/24/15)

Barn swallows are so common and in such large numbers around the shore and marina bulkheads that we don't report sightings of them. In 2014-2018, barn swallows seemed to be increasing along Glen Cove Creek.

Barn swallows at Tappen Marina on the railing of the monitoring boat (l) and on a nest under the marina bulkhead (r) (photos by Jim Moriarty, 5/16/12)

Each year we see new, young members of the harbor's duck, Canada goose, and swan populations. Although the adult Canada goose population remains high, we have seen fewer numbers of young birds over the last few years. And while it seemed that the swan population was decreasing from the numbers noted in 2010 (approximately 30 swans and 11 cygnets noted on one monitoring date in August and 55 swans noted in the lower harbor on an October monitoring date), the swan population rebounded in 2018. On September 19, 2018, 50 swans were counted throughout the harbor, with most sighted in the lower harbor.

Observed less frequently during monitoring are **brants**, **green herons, black-crowned night herons, plover-type birds,** and **hawks** or **falcons**. Sightings of these are included on weekly data sheets and also noted in the monthly field observations at *Section 4.3*.

A pair of Foster terns on an old piling (l) in the lower harbor and one of four sanderlings at Sea Isle (r) (photos by Jim Moriarty, 5/16/12)

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 (to 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 for more than 20 years. Since 2010, there have been some changes and increases in nesting sites. By

May 2017, seven osprey nests were within easy view from monitoring stations around the harbor: (1) at Beacon 11, (2) on a recently erected platform on Shore Road by the power plant, (3) on a cell tower behind the power plant, (4) on old pilings on the west shore near the cove of the former Bar Beach, (5) on a nesting platform on the western shore, (6) on another set of old pilings on the western shore, south of the platform, and (7) a private dock on the eastern shore of the lower harbor. We have also seen temporary osprey nests built on duck blinds, boats, and cranes. In 2018, a pair of ospreys selected a disabled boat moored in the lower harbor as a nesting site; the boat sank after a storm, and the ospreys lost their nest.

Since about 2004, **peregrine falcons**, a protected species, have been sighted at the Glenwood Landing power plant. On October 28, 2009, we saw a pair of falcons flying to and from a high ledge at the power plant. We did not see the falcons in 2010 or 2011 during monitoring dates, but we saw one flying by the power plant on October 10, 2012. In 2013, a special **nesting box** had been erected south of the Glenwood Landing power plant, to try to attract the falcons away from the top of the brick building that was slated for demolition, but it has not been occupied. In May 2014, the falcons decided to build a nest in one of the white stacks on top of the brick building at the power plant, despite the noise and demolition work that was going on. In July 2016, a peregrine falcon was seen near the site of the old power plant.

Nesting box along the shoreline south of the powerplant and peregrine falcon on ledge of power plant building (photos by Carol DiPaolo, 4/28/14 and 7/23/14, respectively)

Although **red-tailed hawks** are seen often in wooded areas around Hempstead Harbor, we don't usually see them during water sampling. However, on November 3, 2010, three red-tailed hawks with striking coloration circled over the head of Glen Cove Creek and were seen in that location again on June 4 and 8, 2014. On a winter monitoring date (January 19, 2018), a red-tailed hawk made an appearance over the Tappen Beach parking lot—along with an adult bald eagle.



Red-tailed hawk flying over Glen Cove Creek (l) (11/3/10) and osprey in flight (c) (9/11/10) (photos by Jim Moriarty; turkey-vulture photo (r) posted at en.wikipedia.org/wiki/Turkey_Vulture, retrieved 6/17/12, showing the bird's distinctive two-tone feather pattern underneath its wings)

In May 2008, we had our first sighting of a **turkey vulture** 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, and Sea Cliff. In 2015, we saw turkey vultures flying over the harbor on monitoring dates in August and September; on September 25, we were amazed to see nine turkey vultures flying near the western shore of the lower harbor near CSHH #6. In August 2016, we saw three turkey vultures flying over the lower harbor. None were seen on survey dates in 2017. During the last week of June 2018, five large turkey vultures were seen flying over Shore Road and Safe Harbor Marina (formerly Brewer Marina).

There have been some unusual visitors over the years as well, such as a **great horned owl** that was rescued from the water at the Glen Cove Marina in Glen Cove Creek on August 9, 2009. During 2011, there were also some unexpected visitors: on April 9, two **northern gannets** were seen on Tappen Beach; on August 28, a **south polar skua** (a dark, gull-like bird), showed up on Sea Cliff Beach, brought in with the hurricane winds; and in mid-December, a **brown pelican** was seen off of Sands Point at the Execution Rock lighthouse. 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. Also in 2018, we received our first report of a **black vulture** (a southern variety) flying off of Sea Cliff Beach and two pairs of ducks **long-tailed ducks** swimming near the same area in the harbor.


Black skimmers (l) were seen off of the sandbar at the former Bar Beach (6/7/17) and an immature green heron (r) was photographed by Kenny Neice on a dock at Safe Harbor Marina in Glen Cove.

Bald eagles have been moving west over recent years, and we started receiving regular reports of them around Hempstead Harbor in 2015 during the monitoring season. A Roslyn Harbor resident saw an immature bald eagle perched in a tree on his property in December 2015 and also in April 2017 (it takes about four years for bald eagles to mature into their distinctive white and dark, brown-black coloration). A mature pair of bald eagles was seen in this area on February 20, 2017. In 2018 it was confirmed that there was a pair of bald eagles nesting in a large tree along the shoreline in Roslyn harbor and at least one chick was in the nest on May 28, 2018.

Bald eagle in a tree along lower harbor shoreline (photo by Carol DiPaolo, 6/13/18)

4.8 Diamondback Terrapins

Diamondback terrapins are the only turtle found in estuarine waters and generally grow up to 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 of 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 Safe Harbor Marina (formerly Brewer Marina) and the Sea Isle sand spit.

A diamondback terrapin below the outfall north of Tappen Beach Pool (photos by Carol DiPaolo, 6/27/12)

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 bar at the southern end of the North Hempstead Beach Park. On July 11 and August 19, 2009, a diamondback turtle was seen in Brewer's Marina. In 2010, a large (about a foot long) diamondback was seen swimming in Safe Harbor Marina (formerly Brewer Marina), 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. The last report received of a diamondback terrapin sighting in Hempstead Harbor was at Safe Harbor Marina on June 17, 2014.

Occasionally, large sea turtles have made their way into Long Island Sound and have been spotted in local bays. On August 2, 2011, a large sea turtle was seen at the Shelter Bay Yacht Club in Manhasset Bay. 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 large sea turtle, which he identified from photos as being a **Kemps ridley turtle.** On August 13, 2015, a large sea turtle was seen in Long Island Sound near Hempstead Harbor.

4.9 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. Algae absorb more light and are present in greater quantities than other particulate material 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.

In 2018, the range of Secchi depths was 0.5 m to 3.25 m, somewhat improved from 2017, but less than the range of 0.75 m to 3.8 m in 2016.

As mentioned previously in the monthly observations, in most instances during the 2018 monitoring dates the water color was judged to be normal in the brown to green range. However, there were instances of pollen slicks, which are commonly seen on the harbor's surface in spring. The slicks are usually lighter in color when first formed and then as the organic matter within the slick decays, it turns brown. It may also be mixed with algal cells.

On May 7, 2018, pollen slicks were reported throughout different parts of the harbor, and a few days later (on May 11), these slicks had turned brown and mixed with a probable algal bloom to produce brown, frothy mats on the surface of the harbor. Sebastian Li reported both phases, which he saw off of Bay Avenue, Sea Cliff:

> *Water was quite soupy yesterday leaving a thick residue on the beach.*
> *Today still some bands of pollen but far less scummy and water less brown.*

Pollen slicks off Bay Ave, Sea Cliff, on May 7 and turning brown on May 11
(photo by Sebastian Li, 5/7 and 5/11/18)

A more widespread pollen slick and algal bloom mix occurred in May 2015. The decaying pollen mixed with algae cells created a mat on the water surface that prompted some local residents to report the appearance as “sludge” or sewage. This occurred in many areas around Long Island Sound. On May 7, 2015, one of our regular-season monitoring dates, we observed these conditions in Hempstead Harbor and collected a water sample for bacteria analysis, and the results confirmed that no sewage was mixed in the mat that had formed on the water surface.

Pollen slicks–not sludge–in Hempstead Harbor (photos by Carol DiPaolo, 5/7/15)

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, moving from side to side as the wind changes.

Duckweed on surface of Scudder's Pond (l) and brown algal bloom in Tappen Marina (r) (photos by Michelle Lapinel McAllister, 9/19/18, and Carol DiPaolo, 6/24/16, respectively)

There have been instances in previous seasons as well when algal blooms have caused unusual coloration or conditions in parts of Hempstead Harbor. In 2010, unusual red-brown water color was observed on three occasions in Hempstead Harbor. On August 31, 2010, the water in sections of Tappen Marina had turned red; a water sample we collected and that was analyzed by the NCDH contained a mix of dinoflagellates, some that could cause red coloration along with other types of algae, none of which were toxin producers. The most dominant species was *Prorocentrum micans*, followed by *Prorocentrum triestinum*, *Gyrodinium* sp., and *Scripsiella trochoidea*.

Excess amounts of nitrogen released from failing septic systems, over fertilization 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.

Coalition to Save Hempstead Harbor

Water-Monitoring Data Sheet, Core Program

Collection Date: ☐ Wed. ☐ other ______________ ___/___ /2018 **Time:** ______________

GPS Land Reference: ____ **BP:** _________ **Depth:** _________

Monitor Name: Carol DiPaolo, Mark Ring, Michelle Lapinel, Tony Alfieri, John Bundas ____________________

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)

		Date	Amount
Rainfall:	Previous 24 hrs accumulation _____.__mm	_________	_________
	Previous 48 hrs accumulation _____.__mm	_________	_________
	Previous week's accumulation _____.__mm	_________	_________

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 ☐ dead fish ☐ dead crabs ☐ algal bloom
☐ odors ☐ sea weed ☐ bubbles ☐ foam
☐ oil slick ☐ floatables ☐ ice ☐ turbidity (suspended particles)
☐ other____

Comments____

____

____

____

Plankton count ________ type ________ sample taken: ☐ surface ☐ ______ below surface

Human Activities

☐ Barges/tugs, Pt. W. gravel op. _________________ Gladsky _________________ Raison ___________________
DiNapoli __________________ Global/fuel ______________ other ___________________

☐ 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 ______other______

☐ Styrofoam, cups _______pieces ______ ☐ Wood, boards ______ pieces ___________ other______________

☐ Other ____

Coalition to Save Hempstead Harbor

Water-Monitoring Data Sheet

Date: ____________

Station: ____________________ GPS: 40. ____________ 073. ____________ Time: ____________ NH3 (ppm): ____________

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH (ppm)	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: ____________________ GPS: 40. ____________ 073. ____________ Time: ____________ NH3 (ppm): ____________

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH (ppm)	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: ____________________ GPS: 40. ____________ 073. ____________ Time: ____________ NH3 (ppm): ____________

	Sample Depth (m)	Temp (°C)	Salinity (ppt)	DO		pH (ppm)	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								

Water-Monitoring Data Sheet

Wildlife Observations

Date ____________

BIRDS

	Upper Harbor	Lower Harbor
☐ Cormorants	____	____
☐ Ducks, mallards	____ ducklings ____	____ ducklings ____
☐ Egrets, great	____	____
snowy	____	____
☐ Geese, Canada	____ goslings ____	____ goslings ____
brandts	____	____
☐ Gulls, hooded	____	____
☐ Herons, blue	____	____
night, green	____	____
☐ Kingfisher, belted	____	____
☐ Ospreys	____	____ chicks ____
☐ Plover-type, killdeer	____	____
☐ Swans, mute	____ cygnets ____	____ cygnets ____
☐ Other	____	____

JELLIES/JELLYFISH

☐ Comb, sea walnuts: CSHH stations ☐#1____ ☐#2____ ☐#3____ ☐#4____ ☐#5____ ☐#6____ ☐#7____

☐#8-10____ ☐#11____ ☐#12____ ☐#13____

sea gooseberries: CSHH stations ☐#1____ ☐#2____ ☐#3____ ☐#4____ ☐#5____ ☐#6____ ☐#7____

☐#8-10____ ☐#11____ ☐#12____ ☐#13____

☐ Lion's mane: CSHH stations ☐#1____ ☐#2____ ☐#3____ ☐#4____ ☐#5____ ☐#6____ ☐#7____

☐ Moon: CSHH stations ☐#1____ ☐#2____ ☐#3____ ☐#4____ ☐#5____ ☐#6____ ☐#7____

FISH

☐ Baitfish ____________

☐ Blue ____________

☐ Bunker ____________

☐ Striped bass ____________

☐ Small shrimp ____________

CRABS

☐ Asian shore ____________

☐ Blue-claw ____________

☐ Horseshoe ____________

OTHER ____________

____

____

Hempstead Harbor Core Program
Sonde Calibration Datasheet 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			
Lot Number			
Expiration			

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 Datasheet

Eureka Manta+ 35

♦COMPLETE **BEFORE** SAMPLING♦

5a. Calibrate **pH STANDARD • 2-Point Calibration**

Pre-Calibration Reading

➔ **1st Cal Value: pH_____ •••**

➔ **2nd Cal Value: pH_____ •••**

Post-Calibration Reading

➔ **1st Cal Value: pH_____ •••**

➔ **2nd Cal Vaue: pH_____ •••**

SRF •••

♦COMPLETE **AFTER** SAMPLING♦

Post-Readings

3a. Fill cup with **pH STANDARD**

➔ **1st Cal Value: pH_____ •••**

➔ **2nd Cal Value: pH_____ •••**

	pH 7 Standard	**pH 10 Standard**
Manufacturer		
Lot Number		
Expiration		

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

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	Rev: 2
	Date: 4/8/2011	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
THOMAS EDWARDS, LEAD TECHNICAL DIRECTOR; CONNIE IANNUCCI, 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 No.	**Area No.**	**Point No.**	**Sample Type**	**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	10		5	BEACON ELEVEN										
CSHH-2	10		5	BELL BUOY 6										
CSHH-3	10		5	RED MARKER GLEN COVER CREEK										
CSHH-4	10		5	BAR BEACH SPIT										
CSHH-5	10		5	MOTT'S COVE										
CSHH-6	10		5	EAST OF FORMER TNH INCINERATOR										
CSHH-7	10		5	BRYANT LANDING										
CSHH-8	10		5	GLEN COVE STP										
CSHH-9			5	FIRST PIPE WEST OF STP OUTFALL										
CSHH-10			5	PIPE AT CORNER OF SEAWALL WEST OF STP OUTFALL										
CSHH-11			5	50 YARDS EAST OF STP OUTFALL										
CSHH-12			5	EAST OF STP OUTFALL BY BEND IN SEAWALL										
CSHH-13			5	60 FEET WEST OF MILL POND WEIR										

COMMENTS/REMARKS

***ESTIMATED COUNT**

REPORT TO: **RECREATIONAL FACILITIES**
200 COUNTY SEAT DRIVE
MINEOLA, NY 11501

TNTC = "TOO NUMEROUS TO COUNT"

DATA ENTRY PROOFED

TEST	**TECHNOLOGY**	**METHOD**
Fecal Coliform CFU/100 ml.	MF-QN	SM 9222 D-2006
Enterococci CFU/100 ml	MF-QN	EPA 1600

TEMP CONTROL:

TIME RECEIVED:

DATE ANALYZED:

DATE RECEIVED:

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 reproced except in full without the written approval of the laboratory. Current New York State laboratory certification status is maintained under ELAP ID #10339. **Page 1 of 2**

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: 4/8/2011	Rev: 2 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
THOMAS EDWARDS, LEAD TECHNICAL DIRECTOR; CONNIE IANNUCCI, 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 No.	**Area No.**	**Point No.**	**Sample Type**	**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-14	10		5	NW CORNER OF POWER PLANT ~ 50 YARDS FROM CEMENT OUTFALL										
CSHH-14A	10		5	CEMENT OUTFALL ADJACENT TO POWER PLANT										
CSHH-15	10		5	NW CORNER OF TAPPEN POOL										
CSHH-15A	10		5	SCUDDER'S POND OUTFALL @ SEAWALL N. OF TAPPEN POOL										
CSHH-15B	10		5	SCUDDER'S POND WEIR										
CSHH-16	10		5	OUTER HARBOR MIDWAY BETWEEN EAST/WEST SHORE										
CSHH-17	10		5	OUTSIDE RESTRICTED AREA OF CRESCENT BCH ACROSS FROM WHITE BLDG										
CSHH-17A	10		5	INSIDE RESTRICTED AREA OF CRESCENT BCH ACROSS FROM WH BLDG & STREAM										
TRIP BLANK														

COMMENTS/REMARKS

REPORT TO: **RECREATIONAL FACILITIES**
200 COUNTY SEAT DRIVE
MINEOLA, NY 11501

***ESTIMATED COUNT**

TNTC = "TOO NUMEROUS TO COUNT"

24hr rain: **48hr rain:**

DATA ENTRY PROOFED

TEST	**TECHNOLOGY**	**METHOD**
Fecal Coliform CFU/100 ml.	MF-QN	SM 9222 D-2006
Enterococci CFU/100 ml	MF-QN	EPA 1600

TEMP CONTROL:

TIME RECEIVED:

DATE ANALYZED:

DATE RECEIVED:

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** 2

Section A
Required Client Information:

Company: Coalition to Save Hempstead Harbor
Address: 80 Ransom Ave.
Sea Cliff, NY 11579
Email: cdeditor@optonline.net
Phone: (516)676-4574 Fax:
Requested Due Date:

Section B
Required Project Information:

Report To: Carol DiPaolo
Copy To:
Purchase Order #:
Project Name: HARBOR MONITORING
Project #:

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote:
Pace Project Manager: betty.harrison@pacelabs.com,
Pace Profile #: 7288

Regulatory Agency

State / Location
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

Requested Analysis Filtered (Y/N)

ITEM #	**SAMPLE ID** **One Character per box.** **(A-Z, 0-9 / , -)** **Sample Ids must be unique**	MATRIX CODE (see valid codes to	SAMPLE TYPE (G=GRAB C=CO	COLLECTED				SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives								**Y/N**														
				START DATE	START TIME	END DATE	END TIME			Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	**Analyses Test**	No2/NO3,	NO2	NH3										Residual Chlorine (Y/N	
1	CSHH #1	WT	G																X	X	X											
2	CSHH #2	WT	G																X	X	X											
3	CSHH #3	WT	G																X	X	X											
4	CSHH #4	WT	G																X	X	X											
5	CSHH #5	WT	G																X	X	X											
6	CSHH #6	WT	G																X	X	X											
7	CSHH #7	WT	G																X	X	X											
8	CSHH #8	WT	G																X	X	X											
8	CSHH #9	WT	G																X	X	X											
9	CSHH #10	WT	G																X	X	X											
9	CSHH #11	WT	G																X	X	X											
10	CSHH #12	WT	G																X	X	X											
11	CSHH #13	WT	G																X	X	X											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
CLIENT WILL ADD AMMONIA ANALYSIS WHEN NEEDED										
							TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: **DATE Signed:**

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 2 **Of** 2

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:	80 Ransom Avenue	Copy To:		Company Name:	
Sea Cliff, NY 11579				Address:	
Email:	cdeditor@optonline.net	Purchase Order #:		Pace Quote:	
Phone:	(516)676-4574 Fax:	Project Name:	HARBOR MONITORING	Pace Project Manager:	betty.harrison@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	7288

Regulatory Agency
State / Location
NY

Requested Analysis Filtered (Y/N)

SAMPLE ID
One Character per box.□
(A-Z, 0-9 / , -)□
Sample Ids must be unique

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

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	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										Residual Chlorine (Y/N)	
12	CSHH #14	WT	G																X	X	X											
13	CSHH #14A	WT	G																X	X	X											
14	CSHH #15	WT	G																X	X	X											
15	CSHH #15A	WT	G																X	X	X											
16	CSHH #15B	WT	G																X	X	X											
17	CSHH #16	WT	G																X	X	X											
18	CSHH #17	WT	G																X	X	X											
21	CSHH #17A	WT	G																X	X	X											
22																																
23																																
24																																

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
CLIENT WILL ADD AMMONIA ANALYSIS WHEN NEEDED										
							TEMP in C	Received on Ice□ (Y/N)	Custody Sealed□ Cooler□ (Y/N)	Samples Intact□ (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: **DATE Signed:**

UWS Field Datasheet

EMBAYMENT NAME(S): Hempstead Harbor **SAMPLE DATE:** ____________________

PEOPLE: ____ **TIME:** __________________________

• Tides nearest time of sampling, use NOAA Tide Tables •

Low Tide: ________________ **High Tide:** _______________

APPROX. EXPECTED RANGE	
Salinity (ppt/PSS)	5 – 30 ppt/PSS
Dissolved Oxygen (mg/L)	0 – 14 mg/L
Dissolved Oxygen (% Sat.)	0 – 120 %
Chlorophyll *a* (µg/L)	0 – 30 µg/L
Turbidity (NTU)	0 – 30 NTU

WEATHER CONDITIONS

• 24 hours preceding time of sampling •

High Air Temperature (˚C)	
Low Air Temperature (˚C)	

Cloud Cover (%)	
Precipitation State (mist, drizzle, rain, etc.)	
Wind at Embayment (use Beafort scale)	

Daily Precipitation	
Date	**Inches**

NOTES: ____

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Embayment Name	Hempstead Harbor
Sample Date	- -
People	

GPS units (circle one):
[✓ decimal degree (40.772240°)]
degree minutes (40° 46.334')
degree min. sec. (40° 46' 20.06")

Station ID	HEM-M-01 / CSHH #1			HEM-M-02			HEM-M-03 / CSHH #3		
Time									
add 0.5 m **Station Depth (m)**									
GPS N	40.			40.			40.		
GPS W	073.			073.			073.		
	bottom (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)
Sample Depth (m) add 0.13 m									
Temperature (°C)									
Salinity (ppt)									
Dissolved Oxygen (%)									
Dissolved Oxygen (mg/L)									
Fluroescence (RFU)									
Chl-a (µg/L)									
Turbidity (NTU)									

Enter additional field notes on back of sheet

If using a different method than usual, make a note!

At 1 station per embayment,do a second profile (usually at last station).

If total depth < 1.5m, do only mid-depth.

data entry ______________ person checking ______________

Embayment Name	Hempstead Harbor	**GPS units (circle one):**
Sample Date	- - 19	[✓ decimal degree (40.772240°)] degree minutes (40° 46.334') degree min. sec. (40° 46' 20.06")
People	M. L. McAllister, M. Ring, E. Neice	

Station ID	HEM-O-04 / CSHH #2			HEM-O-05 / CSHH #16			HEM-O-06 / CSHH #17		Replicate	
Time										
Station Depth (m) add 0.5 m										
GPS N	40.			40.			40.		40.	
GPS W	073.			073.			073.		073.	
	bottom (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)	**bottom** (0.5 m off bottom)	**mid-depth** (if total depth > 10m)	**surface** (0.5m below surface)	**bottom** (0.5 m off bottom)	**surface** (0.5 m below surface)	**bottom** (0.5 m off bottom)	**surface** (0.5 m below surface)
Sample Depth (m) add 0.13 m										
Temperature (°C)										
Salinity (ppt)										
Dissolved Oxygen (%)										
Dissolved Oxygen (mg/L)										
Fluroescence (RFU)										
Chl-a (µg/L)										
Turbidity (NTU)										

Enter additional field notes on back of sheet

If using a different method than usual, make a note!

At 1 station per embayment,do a second profile (usually at last station).

If total depth < 1.5m, do only mid-depth.

Chlorophyll Reference Check in Bucket (do once per day per embayment)

date & time	Vol Filt.	Vol Filt.	Vol. Filt.	Vol Filt.	**sonde reading** RFU
	ID HEM-DA	ID HEM-DB	ID HEM-DC	ID HEM-DD	ug/L

data entry ______________ person checking ______________

Appendix A

2018 CSHH Field-Monitoring Data
2018 Weekly Graphs for Water-Quality Parameters
2018 Turbidity and Secchi-Disk Transparency Graphs
1996-2018 Dissolved Oxygen Graphs

2018 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 replicate survey using YSI Pro Plus.

*Sonde surface levels are taken at a half meter below the surface.
** Sonde bottom levels are taken at 0.3 m off the harbor floor.
*** Total depth includes the 0.3 m distance between the sonde depth sensor and the harbor floor.

Date	**Water Temp (°C)**		**Salinity (ppt)**		**DO (ppm)**		**pH (ppm)**		**Air Temp**	**Secchi**	**Chlor a (mg/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																
10/31/18	12.02	12.23	24.55	24.7	8.20	8.25	7.68	7.70	5.5	2.2	7.19	7.28	1.59	2.01	3.38	8:05
10/31/18	12.13	12.24	24.62	24.69	8.28	8.25	7.70	7.71			6.04	7.86	1.6	4.76	3.33	
10/31/18	12.0	12.3	24.36	24.54	8.24	8.30	8.23	8.10							3.75	8:10
10/31/18	12.1	12.3	24.46	24.53	8.33	8.25	8.08	8.04							3.75	8:20
10/24/18	12.80	12.84	21.65	21.71	8.29	8.29	7.60	7.63	8.4	2.0	8.74	9.95	2.11	4.62	3.53	7:55
10/24/18	12.82	12.85	21.78	21.82	8.35	8.28	7.64	7.66			11.18	11.96	6.75	10.35	3.63	8:00
10/24/18	12.7	12.9	23.72	23.85	8.04	8.02	7.40	7.57							3.90	8:05
10/17/18	16.69	17.36	22.19	22.36	7.75	6.84	7.22	7.56	10.8	1.5	12.16	17.51	2.97	3.45	4.51	7:50
10/17/18	16.74	17.39	22.22	22.36	6.87	6.83	7.57	7.57			11.99	13.74	2.72	4.12	4.50	7:57
10/10/18	20.83	20.88	24.88	25.19	6.44	5.72	7.35	7.41	21.2	1.75	10.52	8.81	3.14	5.16	3.24	8:01
10/10/18	20.86	20.89	25.02	25.34	5.28	5.25	7.40	7.42			10.57	9.02	2.96	4.57	3.22	8:06
10/3/18	20.91	21.06	25.49	25.96	7.79	7.27	7.34	7.55	20.3	1.4	26.77	27.00	2.38	2.92	4.23	7:50
10/3/18	20.86	21.07	25.30	25.82	7.44	7.17	7.58	7.53			21.45	26.56	2.67	5.11	4.34	
9/26/18	20.79	20.89	24.99	25.61	5.50	5.56	7.44	7.48	22.4	1.3	12.86	14.90	3.16	5.52	2.86	7:57
9/26/18	20.80	20.91	24.96	25.68	5.52	5.49	7.44	7.49			15.91	14.51	4.08	5.34	2.89	
9/19/18	23.09	23.17	25.42	25.90	5.89	5.64	7.44	7.46	23.5	1.5	19.76	15.85	3.16	3.56	5.03	9:11

2018 CSHH Field-Monitoring Data

9/14/18	22.51	22.52	25.28	25.40	4.72	2.98	7.02	7.16	21.7	1.25	22.35	17.29	3.90	3.52	2.98	8:05
9/14/18	22.52	22.52	25.44	25.46	5.57	3.20	7.19	7.18	21.6		19.77	18.96	3.95	4.02	2.92	8:07
9/5/18	25.79	24.65	26.33	26.78	8.30	4.51	7.82	7.31	25.8	1.0	89.01	33.87	4.43	2.47	5.26	7:55
9/5/18	25.81	24.70	26.25	26.74	7.98	4.98	7.87	7.35			84.02	32.53	3.61	2.16	5.21	
8/29/18	24.96	24.88	25.30	25.78	5.44	3.66	7.17	7.32	29.2	1.5	21.20	22.56	2.89	5.04	3.71	7:50
8/29/18	24.95	24.88	25.34	25.75	3.57	3.55	7.26	7.32			21.07	22.57	3.17	4.03	3.65	7:55
8/23/18	23.76	23.86	26.34	26.48	5.48	4.24	7.62	7.49	20.5	1.5	29.67	21.90	3.47	5.00	5.29	8:00
8/23/18	23.78	23.86	26.36	26.43	4.93	4.64	7.62	7.51			30.02	23.26	3.49	3.47	5.22	
8/15/18	23.21	23.21	25.96	26.01	4.02	2.17	7.06	7.09	23.7	1.75	16.97	16.56	3.28	3.29	3.81	7:55
8/15/18	23.21	23.21	25.95	26.01	4.84	2.23	7.12	7.10			17.43	13.62	2.35	2.86	3.94	
8/8/18	24.08	22.54	26.36	26.88	6.22	1.83	7.51	7.14	27.1	1.0	88.58	22.02	3.72	1.85	6.51	7:58
8/8/18	24.08	22.55	26.43	26.92	4.59	1.68	7.57	7.15			98.77	24.56	3.97	1.44	6.51	
8/2/18	23.68	23.23	25.61	26.05	4.44	3.03	7.13	7.22	26.0	1.5	10.91	13.07	3.4	4.11	4.25	7:55
7/17/18	21.07	21.02	25.51	25.64	3.58	3.45	7.29	7.29	25.6	1.25	17.31	24.39	4.03	4.30	2.33	8:05
7/17/18	21.11	20.99	25.46	25.63	3.38	3.36	7.27	7.28			19.93	26.81	4.02	7.47	2.76	8:10
7/11/18	21.48	19.39	25.83	26.14	8.35	4.33	7.91	7.40	24.0	1.0	27.21	48.52	3.56	8.92	4.74	7:55
7/3/18	22.01	20.44	25.20	25.68	3.99	3.56	7.24	7.25	25.3	1.4	33.65	41.21	3.04	3.69	2.52	7:58
6/27/18	20.22	19.36	25.08	25.60	6.39	4.80	7.51	7.42	22.0	1.25	41.92	21.91	3.90	6.50	2.64	7:50
6/27/18	20.19	19.13	25.12	25.67	7.06	5.16	7.53	7.43			42.91	19.84	4.25	6.33	2.86	8:00
6/20/18	19.87	18.90	24.80	25.18	7.30	6.68	7.71	7.69	19.6	1.1	30.89	45.13	4.66	4.56	4.36	8:00
6/20/18	19.74	18.70	24.89	25.21	6.85	6.63	7.72	7.66			27.50	40.99	4.37	4.79	4.27	8:05
6/13/18	17.39	17.02	24.72	24.99	7.42	6.39	7.73	7.64	20.0	1.0	37.32	35.76	4.50	6.08	3.26	8:00
6/13/18	17.38	17.09	24.73	25.00	6.94	6.73	7.73	7.66			32.38	40.40	4.28	7.19	3.36	
6/6/18	17.07	17.04	22.04	22.27	11.16	11.26	8.17	8.19	15.9	1.0	47.74	59.12	3.87	2.18	4.59	8:00
6/6/18	17.05	17.02	22.01	22.24	11.26	11.15	8.18	8.18			51.35	65.46	3.21	2.77	4.62	
5/30/18	15.86	15.52	24.29	24.60	7.62	7.06	7.54	7.64	17.8	1.2	25.26	16.76	13.64	2.98	1.92	7:50
5/30/18	15.71	15.49	24.51	24.68	6.94	6.94	7.63	7.64			19.79	16.41	3.79	3.86	2.06	8:05
5/23/18	14.75	14.42	24.49	24.69	6.52	6.59	7.70	7.74	20.6	1.25	5.45	7.24	0.06	0.48	3.96	9:45

2018 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/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																
10/31/18	12.94	13.46	25.84	25.96	9.03	8.70	7.84	7.84	8.9	3.25	8.25	7.19	0.83	3.76	7.14	8:46
10/24/18	No sampling due to high wind and waves.															
10/17/18	17.87	17.95	22.57	22.63	7.34	7.29	7.65	7.66	10.9	2.5	10.10	11.05	1.43	2.79	8.82	8:24
10/10/18	20.93	20.94	25.87	25.96	6.18	6.02	7.60	7.57	21.6	2.5	9.58	9.75	1.84	3.09	6.33	8:25
10/3/18	20.95	20.77	25.86	25.90	7.88	6.95	7.69	7.54	20.5	2.5	16.60	10.58	1.55	1.93	8.89	8:26
9/26/18	21.27	21.36	26.25	26.37	7.38	6.45	7.65	7.58	23.3	1.6	9.95	6.15	2.53	5.85	7.54	8:30
9/19/18	23.19	22.95	25.64	25.97	6.65	5.72	7.62	7.47	24.2	1.75	12.04	8.71	2.57	3.03	7.63	9:42
9/14/18	22.43	22.55	26.21	26.81	5.77	4.74	7.49	7.45	21.6	1.5	19.84	9.41	2.73	8.63	6.49	8:35
9/5/18	26.24	24.53	26.64	26.77	11.03	5.54	8.18	7.53	26.2	1.5	24.82	15.51	2.35	4.43	7.65	9:45
8/29/18	25.09	24.25	26.09	26.33	7.06	6.43	7.84	7.50	29.6	0.9	51.89	22.65	2.77	2.81	7.16	8:25
8/15/18	23.12	23.10	26.67	26.79	4.61	4.02	7.45	7.43	23.6	1.5	35.43	32.31	2.63	3.40	6.79	8:25
8/8/18	24.85	21.70	26.23	26.91	8.93	1.68	8.04	7.20	28.3	1.25	68.62	11.81	3.31	0.70	9.86	9:56
8/2/18	23.26	22.57	26.41	26.49	6.73	3.59	7.57	7.38	28.3	1.5	17.12	14.78	2.34	12.12	8.30	8:20
7/17/18	20.50	18.94	26.06	26.37	6.01	4.29	7.71	7.52	26.9	1.5	11.19	26.71	1.81	9.76	7.19	8:35
7/11/18	21.46	18.24	26.12	26.49	9.89	5.62	8.12	7.53	23.3	1.5	22.76	35.66	2.07	6.01	8.61	10:06
7/3/18	22.03	17.91	25.67	26.22	7.95	5.87	7.91	7.42	26.5	1.75	29.27	17.67	1.77	4.38	6.99	8:24
6/27/18	20.03	18.52	25.33	25.99	8.12	6.08	7.90	7.66	21.8	1.30	31.72	19.19	2.98	9.36	7.60	8:22
6/20/18	19.19	16.03	25.26	25.62	8.37	5.81	7.96	7.57	19.6	1.75	13.61	17.47	1.84	7.78	7.53	8:28
6/13/18	17.37	16.12	25.27	25.49	8.53	5.23	8.06	7.57	20.9	1.50	20.78	21.93	1.39	6.32	8.04	8:30
6/6/18	17.12	17.05	22.46	22.51	9.76	12.78	8.32	8.28	17.9	1.5	28.42	58.55	1.62	1.78	7.85	8:36
5/30/18	16.11	14.91	24.97	25.20	10.07	9.58	8.04	7.93	16.9	1.25	39.51	27.06	1.75	3.78	6.57	8:30
5/23/18	14.82	13.38	24.81	25.24	8.67	7.26	7.99	7.86	20.6	2.0	7.31	3.17	-2.27	-1.15	7.26	10:25

2018 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/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 E/W Shore and N/S Boundary of Shellfish Harvesting Area																
10/31/18	13.68	13.79	26.06	26.13	8.52	8.52	7.86	7.85	9.7	2.5	7.73	6.28	1.23	2.53	9.22	9:00
10/24/18	No sampling due to high wind and waves.															
10/17/18	Did not survey due to lost anchor - grab samples only.															
10/10/18	20.99	20.91	25.83	25.91	7.04	6.15	7.67	7.61	22.2	2.75	10.49	6.23	1.23	3.16	9.13	8:50
10/3/18	21.05	20.94	25.80	26.11	7.66	7.12	7.65	7.52	20.8	2.75	10.11	11.07	1.17	5.53	10.26	8:54
9/26/18	21.42	21.44	26.20	26.40	6.57	6.08	7.66	7.61	24.5	1.7	7.28	4.66	2.78	7.40	9.54	8:51
9/19/18	23.15	22.58	26.06	26.66	6.54	3.72	7.58	7.31	25.1	2.5	8.18	5.13	1.49	7.68	10.59	10:00
9/14/18	22.51	22.53	26.64	26.80	6.20	5.18	7.59	7.49	22.7	1.8	17.52	8.46	2.51	8.98	8.88	8:54
9/5/18	26.24	24.14	26.66	26.98	10.81	3.64	8.19	7.39	27.6	1.75	30.36	7.72	2.30	5.45	10.39	10:02
8/29/18	24.73	23.54	26.03	26.55	7.55	3.70	7.82	7.34	28.5	1.5	43.88	11.20	2.35	8.84	8.84	8:45
8/23/18	23.63	23.59	26.45	26.60	7.0	4.72	7.72	7.52	20.8	1.75	26.62	16.03	2.15	8.08	10.98	9:20
8/15/18	23.37	23.30	26.81	26.90	6.08	5.37	7.68	7.63	23.9	1.75	22.84	25.59	2.20	2.65	8.73	8:46
8/8/18	24.91	20.79	26.21	27.31	10.76	1.48	8.21	7.22	26.8	1.25	105.23	6.59	4.24	1.72	10.89	10:15
8/2/18	23.66	22.51	26.25	26.55	6.16	3.93	7.65	7.44	26.5	1.75	16.61	12.90	2.22	11.01	8.96	8:41
7/17/18	20.57	18.53	26.12	26.46	6.96	5.25	7.79	7.49	26.9	1.5	9.44	16.29	1.51	10.60	8.80	9:05
7/11/18	21.71	16.79	26.15	26.81	10.19	3.45	8.17	7.38	23.1	1.5	18.74	22.48	4.12	7.76	11.11	10:25
7/3/18	21.51	17.37	25.86	26.31	9.23	4.20	8.08	7.43	28.7	1.75	19.02	14.81	1.43	11.66	8.84	8:45
6/27/18	19.85	18.33	25.63	26.06	8.61	6.49	7.95	7.73	22.30	1.8	18.04	21.44	1.88	10.45	9.87	8:45
6/20/18	19.37	15.21	25.33	25.77	8.78	5.01	8.01	7.56	19.80	2.0	13.92	16.88	1.68	12.80	9.68	9:02
6/13/18	17.58	16.60	25.22	25.39	9.36	8.50	8.16	7.94	21.4	1.75	12.99	36.29	1.58	5.02	10.09	8:45
6/6/18	17.17	16.81	22.46	22.67	11.98	9.48	8.33	8.09	17.7	1.5	29.31	46.86	1.56	4.77	9.67	9:25
5/30/18	16.43	14.19	25.10	25.36	10.33	7.20	8.06	7.76	17.3	1.5	27.1	20.69	1.66	6.50	9.77	9:35
5/23/18	No survey on this day.															

2018 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/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, Just Outside Restricted Crescent Beach Boundary

10/31/18	13.21	13.22	25.90	25.90	8.68	8.74	7.86	7.86	11.1	3.25	7.12	7.56	6.06	2.20	6.24	9:18
10/24/18	No sampling due to high wind and waves.															
10/17/18	Did not survey due to lost anchor - grab samples only.															
10/10/18	21.01	20.96	25.77	25.84	6.61	6.30	7.66	7.62	23.0	2.4	10.57	6.58	1.56	2.95	6.93	9:10
10/3/18	21.07	21.06	25.77	25.81	8.16	7.90	7.76	7.7	21.1	2.05	21.38	25.74	1.93	1.74	7.23	9:18
9/26/18	21.50	21.43	26.10	26.12	6.55	6.32	7.67	7.64	23.4	1.75	7.96	5.17	2.80	5.17	7.63	9:14
9/19/18	23.21	22.99	25.97	26.33	6.86	5.31	7.66	7.45	25.7	2.0	10.69	7.58	1.79	5.76	8.28	10:23
9/14/18	22.45	22.45	26.84	26.94	5.70	4.70	7.49	7.45	22.9	1.5	7.63	4.63	4.91	8.60	6.81	9:21
9/5/18	25.87	24.12	26.72	27.07	8.84	3.19	8.02	7.33	26.6	1.5	28.78	6.36	2.59	6.02	7.94	10:25
8/29/18	25.77	24.70	26.09	26.26	8.58	7.40	8.13	7.74	29.8	1.5	35.96	21.21	2.60	4.80	6.27	9:02
8/23/18	23.87	23.86	26.65	26.69	6.28	5.70	7.69	7.64	21.5	1.25	22.01	17.57	3.05	6.95	7.55	8:48
8/15/18	23.48	23.36	26.76	26.77	6.21	5.48	7.69	7.60	24.6	1.25	43.83	35.69	3.48	4.18	6.07	9:10
8/8/18	24.61	20.54	26.38	27.43	8.68	1.70	8.09	7.23	26.8	1.5	45.25	3.84	3.26	3.33	7.91	10:33
8/2/18	23.46	23.24	26.35	26.41	6.88	6.12	7.72	7.61	26.7	1.75	25.90	16.42	2.61	9.73	6.24	8:58
7/17/18	21.10	18.67	26.01	26.49	7.03	4.14	7.83	7.49	27.5	1.5	19.62	18.09	2.01	9.56	6.51	9:26
7/11/18	21.16	16.56	26.26	26.87	8.74	3.14	8.13	7.36	25.4	1.5	15.00	17.63	2.16	13.82	9.08	10:45
7/3/18	23.09	18.29	25.71	26.11	8.95	4.08	8.04	7.42	26.5	1.70	19.29	19.52	1.67	4.65	6.72	9:05
6/27/18	20.04	19.21	25.67	25.85	8.30	7.31	7.95	7.79	21.9	1.75	13.14	24.65	1.86	10.87	7.62	9:05
6/20/18	19.13	16.36	25.34	25.65	8.57	6.57	7.99	7.63	20.0	2.0	10.78	10.80	1.72	5.51	6.58	9:35
6/13/18	17.76	17.36	25.23	25.28	8.43	9.52	8.08	8.11	20.4	1.5	24.59	35.26	2.72	5.04	8.15	9:08
6/6/18	17.27	16.81	22.54	22.64	11.67	10.27	8.35	8.17	17.6	1.5	23.30	48.43	1.70	2.73	6.81	10:00
5/30/18	16.10	14.84	25.15	25.35	9.91	9.04	8.05	7.94	18.4	1.5	31.77	33.88	1.74	3.69	7.89	10:00
5/23/18	14.68	12.91	25.03	25.55	7.96	7.47	7.94	7.89	21.2	2.0	4.36	3.37	-2.34	-0.10	6.54	10:51

2018 CSHH Field-Monitoring Data

CSHH #3 - Glen Cove Creek, Red Marker

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
10/31/18	12.54	13.22	25.17	25.81	8.88	8.65	7.84	7.86	12.2	3.15	8.03	8.47	1.11	1.01	3.22	10:35
10/24/18	No sampling due to high wind and waves.															
10/17/18	17.21	17.22	22.50	22.47	7.52	7.44	7.68	7.68	12.8	2.25	7.33	12.65	1.86	1.71	4.23	9:30
10/10/18	20.95	20.90	25.29	25.56	6.68	5.90	7.59	7.57	24.0	2.4	11.26	8.42	1.41	2.22	4.44	9:35
10/3/18	21.43	21.31	23.77	25.57	8.26	8.92	7.77	7.84	21.5	1.5	24.94	53.34	3.28	2.34	4.04	9:53
9/26/18	21.12	21.06	25.58	25.75	6.46	6.09	7.61	7.58	24.1	1.5	14.87	14.18	2.42	1.90	4.89	9:44
9/19/18	23.64	23.25	24.69	26.13	6.80	5.76	7.62	7.49	24.4	1.25	10.64	11.22	2.99	5.05	4.93	10:52
9/14/18	22.53	22.55	25.98	26.75	5.30	4.41	7.44	7.40	21.8	1.8	13.29	9.71	3.06	8.58	3.61	10:06
9/5/18	26.22	24.79	25.94	26.77	10.02	8.21	8.01	7.61	27.2	1.5	25.75	22.88	2.83	5.85	4.26	10:55
8/29/18	25.62	25.31	26.09	26.31	7.62	7.51	7.99	7.83	30.3	1.0	78.54	52.98	5.42	4.15	3.59	9:35
8/23/18	23.89	23.90	26.37	26.53	6.91	6.50	7.82	7.76	20.9	1.5	40.95	30.48	2.71	3.63	5.46	9:45
8/15/18	23.70	23.39	26.23	26.46	7.12	6.10	7.73	7.52	24.1	1.25	82.24	5.87	3.52	4.86	3.10	9:45
8/8/18	25.20	22.76	25.57	26.61	10.29	4.07	8.28	7.28	26.5	0.9	150.84	14.35	5.96	2.21	5.22	10:58
8/2/18	24.13	23.26	25.45	26.16	6.01	4.01	7.59	7.32	27.4	1.75	14.80	17.2	2.47	5.52	3.28	9:27
8/2/18	23.49	23.16	26.04	26.25	3.80	3.09	7.39	7.29			33.35	14.99	2.48	5.34	3.31	
7/17/18	21.72	20.56	25.63	25.98	6.86	5.30	7.77	7.59	26.9	1.0	27.81	35.63	3.26	3.29	3.33	9:56
7/11/18	21.23	18.59	25.92	26.39	8.31	4.27	7.93	7.42	25.7	1.25	19.28	35.11	2.49	13.40	5.73	11:15
7/3/18	23.25	20.30	25.35	25.80	8.76	8.47	7.98	7.55	26.7	1.4	29.12	36.56	2.19	2.72	3.24	9:35
7/3/18	23.30	20.21	25.49	25.88	8.13	7.70	7.99	7.58			26.94	33.72	2.32	3.01	3.19	
6/27/18	20.07	18.92	25.37	25.74	8.23	5.59	7.91	7.50	24.2	1.0	49.83	19.72	3.43	8.64	5.06	9:45
6/20/18	19.55	17.60	24.62	25.39	8.02	6.10	7.90	7.61	25.7	1.1	36.44	38.55	4.32	5.68	3.74	10:10
6/13/18	17.55	16.95	25.11	25.33	8.28	7.79	7.98	7.83	19.6	1.25	44.02	37.13	2.91	3.58	5.26	9:40
6/6/18	17.26	17.04	22.27	22.36	12.88	12.55	8.35	8.28	18.3	1.25	50.75	71.61	1.93	2.95	3.79	10:35
5/30/18	16.33	14.89	24.91	25.21	9.10	9.35	7.99	7.93	20.4	1.25	32.15	30.17	2.29	2.13	5.00	10:35

2018 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
5/23/18	15.22	14.32	23.88	25.07	7.72	7.63	7.80	7.91	20.7	1.0	6.06	10.49	-0.89	-1.49	3.57	11:20

CSHH #8 - Glen Cove Sewage Treatment Plant Outfall

10/31/18	13.16	12.96	24.91	25.37	8.02	8.03	7.76	7.80	13.6	1.25	8.44	9.11	5.15	6.03	1.89	11:05
10/24/18	13.95	14.08	19.58	22.06	9.26	8.40	7.70	7.73	8.7	2.0	11.16	11.35	3.71	2.51	3.30	8:50
10/24/18	14.8	14.1	18.01	24.17	8.65	7.73	7.71	7.82							3.6	8:55
10/17/18	15.51	17.30	16.68	22.13	8.61	6.28	7.62	7.50	12.6	1.2	6.60	9.38	3.92	7.90	2.88	9:47
10/10/18	21.02	21.00	23.97	25.16	6.35	5.67	7.50	7.52	23.6	1.7	10.01	9.61	3.57	3.37	3.30	9:55
10/03/18	21.39	21.31	21.8	25.34	8.61	7.50	7.74	7.57	21.0	1.25	46.16	31.53	4.33	7.71	2.66	10:21
09/26/18	21.31	21.18	21.01	25.74	6.46	5.40	7.53	7.47	24.3	1.25	12.78	10.38	3.56	4.02	3.82	10:18
09/19/18	23.71	23.32	24.37	25.74	6.77	5.64	7.62	7.47	25.8	1.0	37.53	15.19	6.57	4.32	3.32	11:22
09/14/18	22.55	22.56	25.51	26.44	3.55	3.13	7.33	7.29	22.6	1.5	19.28	10.14	8.78	8.99	2.34	10:50
09/05/18	26.04	25.89	25.22	26.34	7.87	8.39	7.86	7.88	29.0	1.25	41.74	30.64	6.43	5.29	2.15	11:25
8/29/18	25.75	25.49	23.43	25.98	7.44	6.05	7.91	7.59	31.0	1.25	42.70	38.43	6.71	6.24	2.76	10:15
8/23/18	24.97	24.09	24.36	26.59	6.88	5.31	7.74	7.60	20.9	1.25	46.89	25.5	2.96	2.79	4.24	10:11
8/15/18	23.88	23.78	24.65	26.00	6.57	5.65	7.65	7.35	24.3	1.25	85.56	31.09	4.06	5.0	2.02	10:15
8/8/18	25.47	24.48	25.81	26.06	7.57	6.44	7.85	7.47	29.4	1.0	125.80	34.37	8.02	3.10	2.30	11:25
8/2/18	24.31	24.02	20.63	25.71	10.06	7.51	7.86	7.52	26.7	1.0	68.57	17.78	4.8	7.06	2.23	10:10
7/17/18	22.69	21.67	19.18	25.64	7.06	6.27	7.62	7.56	28.8	1.0	26.83	33.18	6.08	7.76	1.96	10:30
7/11/18	21.72	20.65	25.09	26.07	6.47	6.36	7.68	7.70	26.6	0.75	24.93	28.58	7.04	12.83	4.35	11:35
7/3/18	23.04	21.16	25.03	25.72	8.66	7.05	7.83	7.43	27.9	1.1	64.28	16.99	3.62	4.99	2.23	10:15
6/27/18	20.75	20.11	21.62	25.20	9.25	8.08	7.76	7.78	23.9	1.1	48.43	42.25	3.77	5.12	4.05	10:20
6/20/18	19.09	19.24	24.12	24.83	6.20	6.15	7.64	7.67	23.3	0.75	33.59	38.13	7.96	4.45	2.22	11:08
6/13/18	18.60	17.97	24.05	24.84	8.15	8.51	8.03	7.96	20.4	1.0	62.38	60.08	4.01	4.90	4.09	10:05
6/6/18	18.31	17.04	21.18	22.24	14.17	12.92	8.55	8.15	19.8	1.0	47.50	62.22	3.18	4.10	2.47	11:15
5/30/18	16.79	15.85	21.66	24.85	8.69	8.78	7.77	7.84	24.2	1.25	26.28	32.15	2.86	11.42	3.94	11:00

2018 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
5/23/18	14.70	14.52	24.73	24.85	7.01	6.72	7.74	7.72	22.0	N/A	9.03	7.7	0.53	2.41	1.51	11:50

CSHH #13 - 60' West of the Mill Pond Weir

10/24/18	14.43	14.31	18.83	21.93	8.24	6.35	7.44	7.52	9.4	1.0	11.10	8.13	6.77	14.72	2.92	9:20
10/24/18	14.2	14.5	17.22	23.64	6.20	5.17	7.62	7.57							2.00	9:25
10/17/18	14.52	17.24	12.46	18.16	8.19	6.10	7.34	7.18	12.8	1.0	4.78	8.17	3.15	10.90	1.30	10:16
10/10/18	20.62	20.95	23.16	24.82	4.00	3.25	7.26	7.26	23.7	1.5	10.01	5.67	5.34	6.93	2.31	10:19
10/3/18	21.01	21.12	23.22	24.01	6.03	5.96	7.34	7.34	21.50	1.0 bottom	22.96	22.51	6.96	6.16	1.00	10:41
9/26/18	21.06	21.28	23.96	25.66	4.54	3.74	7.39	7.51	25.40	0.75	8.44	8.45	10.45	9.79	2.50	10:41
9/19/18	23.57	23.51	24.62	25.54	5.08	4.09	7.39	7.33	25.60	1.25	24.10	11.09	5.61	5.53	1.70	11:38
9/14/18	22.44	22.53	25.54	26.08	4.02	2.90	7.23	7.23	22.20	0.8	10.51	9.1	5.31	4.76	1.23	11:18
9/5/18	25.11	25.24	24.22	26.09	9.55	6.96	7.89	7.37	29.60	1.0	107.24	21.34	4.34	7.76	2.38	11:50
8/23/18	23.73	24.32	22.76	26.33	5.05	3.09	7.39	7.31	22.40	1.25	37.60	17.42	4.40	5.94	3.32	10:35
8/15/18	22.58	23.41	21.98	25.66	5.48	3.30	7.28	7.12	25.40	1.25 Bottom	21.57	16.63	6.03	9.89	1.38	10:35
8/8/18	24.97	24.30	23.81	26.12	6.36	4.41	7.50	7.41	30.5	1.25	40.03	35.21	4.34	3.08	3.26	11:40
8/2/18	22.89	23.70	19.20	24.88	5.16	4.12	7.29	7.16	27.5	0.85	29.03	12.33	5.93	7.67	1.37	10:30
7/17/18	21.47	21.97	19.77	25.11	4.48	3.62	7.24	7.19	30.5	0.5	16.98	12.232	19.56	13.11	1.14	10:55
7/11/18	No survey at this station.															
7/3/18	22.37	22.42	22.13	22.30	7.59	7.50	7.63	7.63	32.0	0.6	59.09	55.38	9.65	13.33	0.86	10:43
6/27/18	20.30	20.25	23.48	24.79	9.20	6.60	7.75	7.55	23.8	1.0	87.29	43.86	7.40	5.05	2.52	10:40
6/20/18	19.35	19.09	23.90	24.43	6.06	5.03	7.57	7.42	26.00	0.85	41.12	32.47	7.34	8.37	1.05	11:30
6/13/18	18.98	18.81	23.94	24.55	9.03	7.60	7.90	7.84	21.4	1.0	83.53	69.36	6.56	5.62	2.66	10:30
6/6/18	No vertical profile - picked up nitrogen and bacteria samples.															
5/30/18	15.94	15.59	23.21	24.38	6.33	5.68	7.48	7.57	23.5	1.0	24.03	25.19	5.38	6.29	2.47	11:20
5/23/18	No survey on this date.															

2018 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
CSHH #14 - 50 yds from Powerhouse Drain																
10/24/18	13.06	13.07	22.02	22.03	9.30	8.87	7.80	7.79	10.4	1.25	13.06	13.66	4.04	3.50	2.43	10:25
9/19/2018	22.97	23.09	25.26	25.59	5.33	4.75	7.33	7.34	23.2	1.25	11.35	13.73	3.55	3.60	2.21	8:53
9/5/2018	25.86	25.51	26.17	26.31	6.88	6.49	7.62	7.53	27.0	1.0	91.62	46.15	8.20	3.79	2.23	9:00
8/8/18	23.75	23.40	26.17	26.38	4.95	3.05	7.32	7.22	26.9	1.0	68.08	37.26	3.07	1.99	2.72	9:16
7/11/18	20.30	19.87	26.02	26.10	4.99	5.04	7.49	7.46	22.5	1.0	33.62	38.57	7.58	7.75	2.01	8:15
7/11/18	20.13	20.23	25.91	26.06	4.99	5.24	7.53	7.49			31.04	36.75	6.63	7.40	2.04	8:20
6/13/18	17.42	17.10	25.05	25.15	7.75	7.12	7.81	7.74	20.5	n/a	45.16	42.41	3.69	3.25	2.55	11:25
5/23/2018	14.87	14.66	24.23	24.40	6.96	6.36	7.65	7.65	20.4	1.25	4.46	6.92	0.21	-0.02	1.80	9:30
CSHH #15 - 50 yds from Scudder's Pond Outfall, North of Tappen Pool																
10/10/18	21.07	21.03	25.46	25.46	6.94	6.84	7.56	7.56	24.3	1.3	15.12	13.75	3.78	3.02	1.29	10:42
9/19/18	23.00	23.11	25.40	25.64	5.98	5.00	7.40	7.37	23.8	1.25	14.88	22.64	4.14	5.65	1.82	9:25
9/5/18	25.68	25.43	26.20	26.26	8.25	8.20	7.90	7.66	27.6	1.25	50.18	49.43	3.79	4.58	1.50	9:30
8/23/18	23.86	23.82	26.07	26.24	7.00	6.72	7.78	7.75	22.0	1.25	30.69	28.78	3.52	3.03	2.20	11:04
8/8/18	23.94	22.97	26.15	26.54	5.95	3.10	7.43	7.19	25.4	1.0	35.22	21.39	3.44	2.24	3.10	9:40
7/11/18	21.11	20.29	25.85	26.16	7.46	7.09	7.80	7.73	24.1	1.0	25.95	46.60	5.06	5.30	2.20	9:50
6/13/18	17.60	17.35	24.92	25.08	8.03	8.07	7.85	7.87	21.00	n/a	43.26	41.06	4.52	3.25	1.99	11:08
CSHH #4 - Bar Beach Spit																
10/24/18	13.01	13.23	21.90	22.12	9.15	8.77	7.75	7.79	9.6	1.7	10.05	14.17	3.75	2.04	8.07	9:55
10/24/18	12.9	13.3	23.82	24.18	8.77	8.67	7.79	7.90	couldn't complete because of wind - went to 8m depth							10:10
10/10/18	21.08	21.00	25.40	25.51	6.15	5.84	7.55	7.55	24.3	2.0	5.90	12.04	2.39	2.70	3.52	10:56
9/19/18	23.15	23.15	25.63	25.75	6.33	5.04	7.35	7.38	24.0	1.25	9.47	13.43	4.59	4.46	2.81	8:58
9/5/18	25.06	24.70	26.51	26.57	4.43	2.87	7.31	7.24	27.4	1.0	33.78	24.18	3.88	2.69	4.18	9:10

2018 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
8/8/18	24.09	23.42	26.22	26.40	6.39	4.18	7.52	7.25	26.1	1.0	122.92	35.67	4.67	2.46	2.70	9:25
7/11/18	20.91	20.34	25.88	26.04	6.13	5.87	7.56	7.52	22.7	1.0	36.46	45.61	4.55	6.03	2.09	8:28

CSHH #5 - Mott's Cove

10/24/18	12.64	12.69	21.59	21.71	9.13	8.38	7.72	7.68	10.7	1.0	6.95	7.75	6.38	9.47	2.18	10:35
9/19/18	23.06	23.10	25.28	25.55	3.95	3.92	7.21	7.21	23.3	1.5	15.05	5.68	3.61	2.67	2.07	8:38
9/5/18	25.32	25.08	25.87	26.06	4.77	3.57	7.22	7.14	26.3	1.5	70.18	23.10	4.27	7.43	2.08	8:47
8/23/18	23.97	23.96	25.86	26.02	6.23	4.94	7.54	7.47	21.8	2 .0 Bottom	9.71	8.56	1.38	1.06	1.99	11:55
8/8/18	23.72	23.44	25.92	26.27	4.20	3.04	7.19	7.15	27.5	n/a	26.18	4.95	1.99	5.33	2.22	9:03
7/11/18	21.02	20.78	25.53	25.85	5.88	5.58	7.45	7.46	24.80	1.0	31.67	28.57	5.31	5.04	2.11	8:44
5/23/18	14.60	14.47	24.27	24.47	6.79	6.55	7.61	7.66	19.4	1.25	4.81	9.03	-1.1	-0.14	1.66	9:10

CSHH #6 - East of Former Incinerator Site

10/24/18	12.67	12.66	21.71	21.72	8.32	8.27	7.69	7.68	10.1	2.0	5.66	11.44	3.48	5.67	2.70	10:50
10/10/18	21.26	21.01	24.95	25.05	5.43	5.14	7.45	7.44	24.9	1.75	11.48	5.87	4.01	5.67	2.55	11:14
8/23/18	24.16	24.13	25.76	25.70	4.50	3.76	7.33	7.33	22.8	1.75	14.43	14.33	3.24	7.20	2.34	11:43
8/8/18	24.41	24.12	25.89	26.02	4.25	2.55	7.22	7.11	25.5	n/a	36.47	10.66	3.84	6.18	2.51	8:48
7/11/18	21.63	21.29	25.65	25.72	5.47	5.37	7.32	7.36	24.0	1.0	21.55	15.62	4.29	3.44	2.44	9:05
05/23/18	15.11	14.51	24.29	24.60	6.68	6.37	7.63	7.69	18.9	1.25	6.15	8.18	1.02	7.71	3.07	8:55

CSHH #7 - West of Bryant Landing (formerly site of oil dock)

10/24/18	11.98	12.04	21.05	21.15	8.83	7.97	7.62	7.57	10.7	1.0	3.43	3.79	8.26	6.29	1.76	11:02
10/10/18	21.11	21.09	24.18	24.80	5.29	4.65	7.36	7.36	24.8	0.75	7.51	8.22	8.38	5.57	1.90	11:27
9/19/18	22.89	23.34	23.62	24.80	5.46	2.98	7.05	7.00	22.3	1.0	9.47	3.82	6.48	3.76	1.67	8:00
9/19/18	22.83	23.32	23.40	24.82	6.41	5.49	7.01	6.99			12.56	6.37	7.59	4.53	1.64	
8/23/18	23.65	23.77	24.52	24.79	5.38	3.69	7.34	7.26	22.3	1.0	15.17	16.35	6.54	12.22	1.61	11:30
8/8/18	24.18	24.42	24.44	25.86	2.60	1.90	7.00	7.06	26.6	1.5	7.78	9.69	6.89	2.23	1.87	8:35
7/11/18	21.79	21.75	25.47	25.51	4.46	4.18	7.14	7.15	24.7	1.25	25.18	25.15	4.38	10.62	1.77	9:20

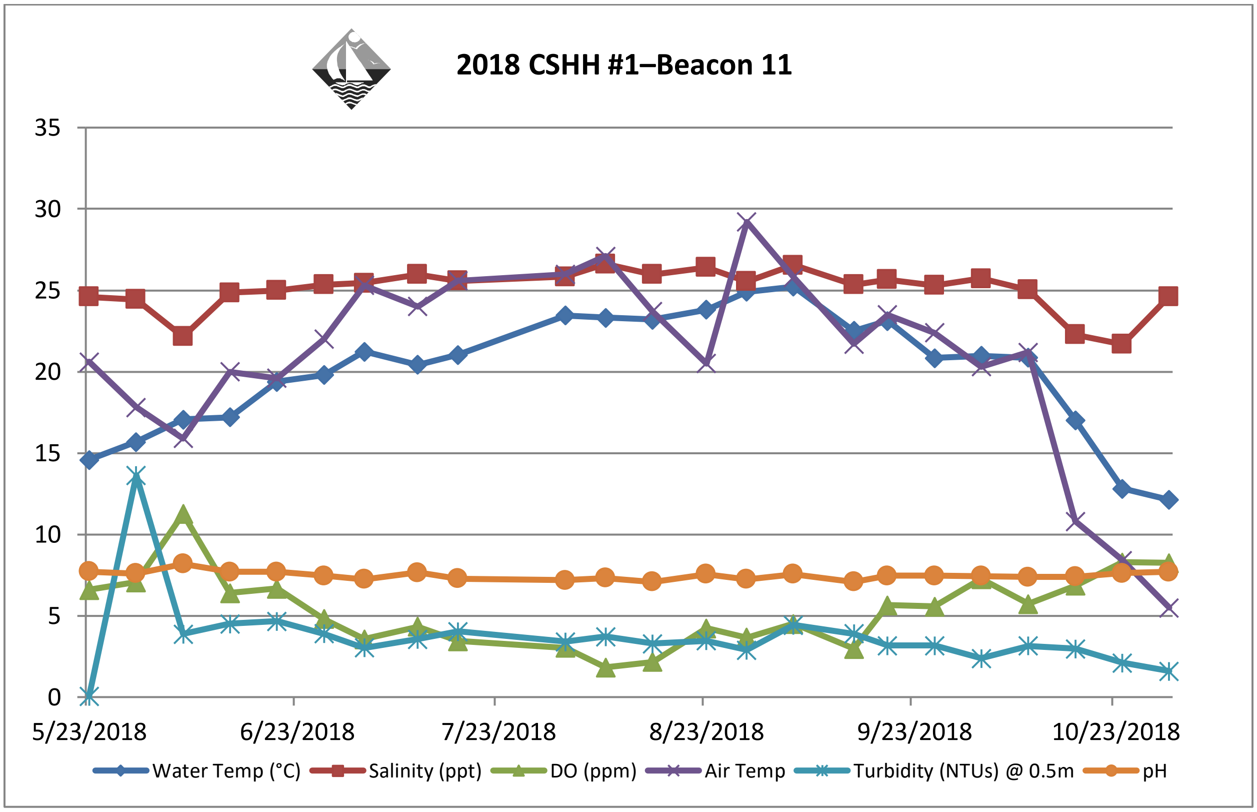
2018 CSHH Field-Monitoring Data

Date	Water Temp (°C)		Salinity (ppt)		DO (ppm)		pH (ppm)		Air Temp	Secchi	Chlor a (mg/l)		Turbidity (NTU)		Depth(m)	Time
	Surface*	Bottom**	Surface	Bottom	Surface	Bottom	Surface	Bottom	(°C)	(m)	Surface	Bottom	Surface	Bottom	(Total)***	(AM)
6/27/18	20.72	20.69	24.68	24.78	6.51	5.47	7.37	7.31	23.8	1.75	6.45	6.14	1.38	1.83	1.66	11:33
5/23/18	15.30	15.06	24.02	24.37	5.51	5.16	7.46	7.51	18.9	0.5	3.61	24.12	0.34	5.39	1.37	8:35

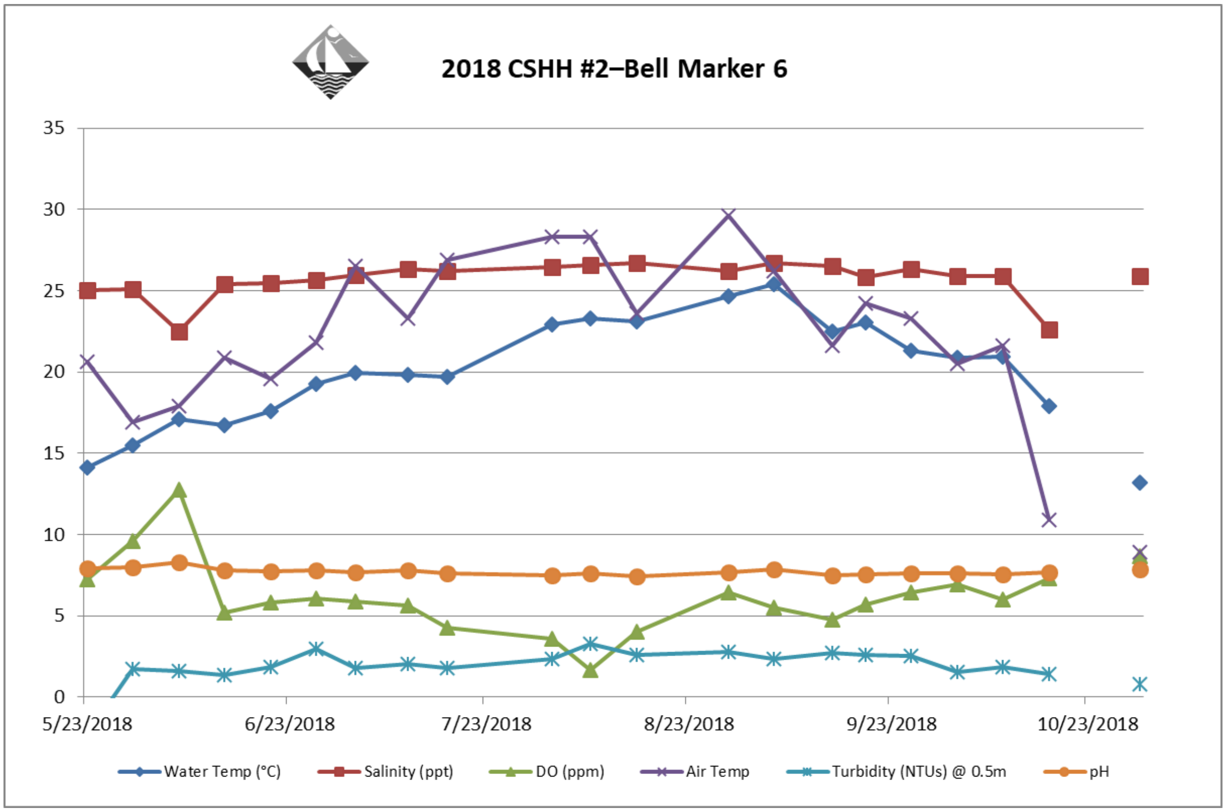
2018 Weekly Graphs for Water-Quality Parameters

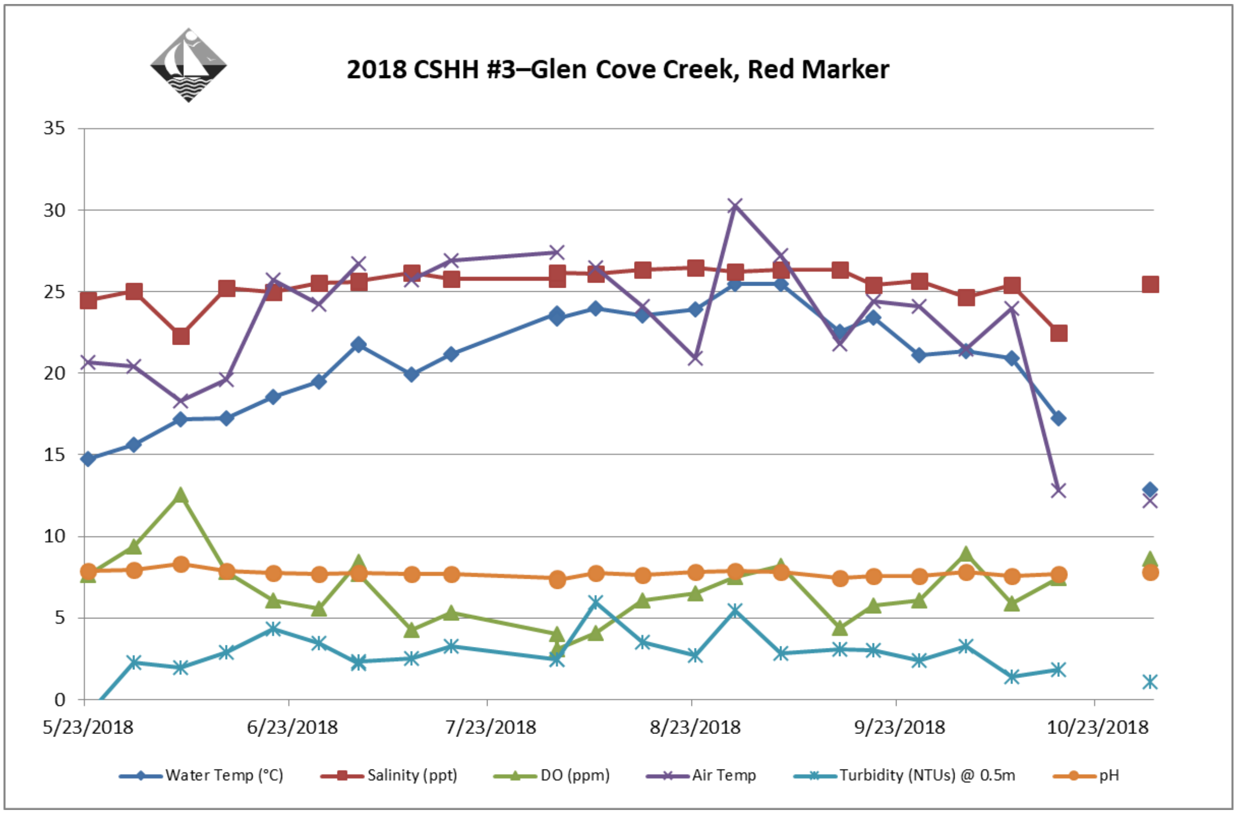
Note: The values graphed below are:

- Water Temperature: the average of the surface and bottom water temperature measurement for that sampling date
- Salinity: the average of the surface and bottom salinity measurement for that sampling date
- DO: the average of the surface and bottom dissolved oxygen measurement for that sampling date
- Air Temp: the measured air temperature at each of the stations on that sampling date
- Turbidity: the turbidity measured at 0.5 meter below the water surface on that sampling date
- pH: the average of the surface and bottom pH measurement for that sampling date

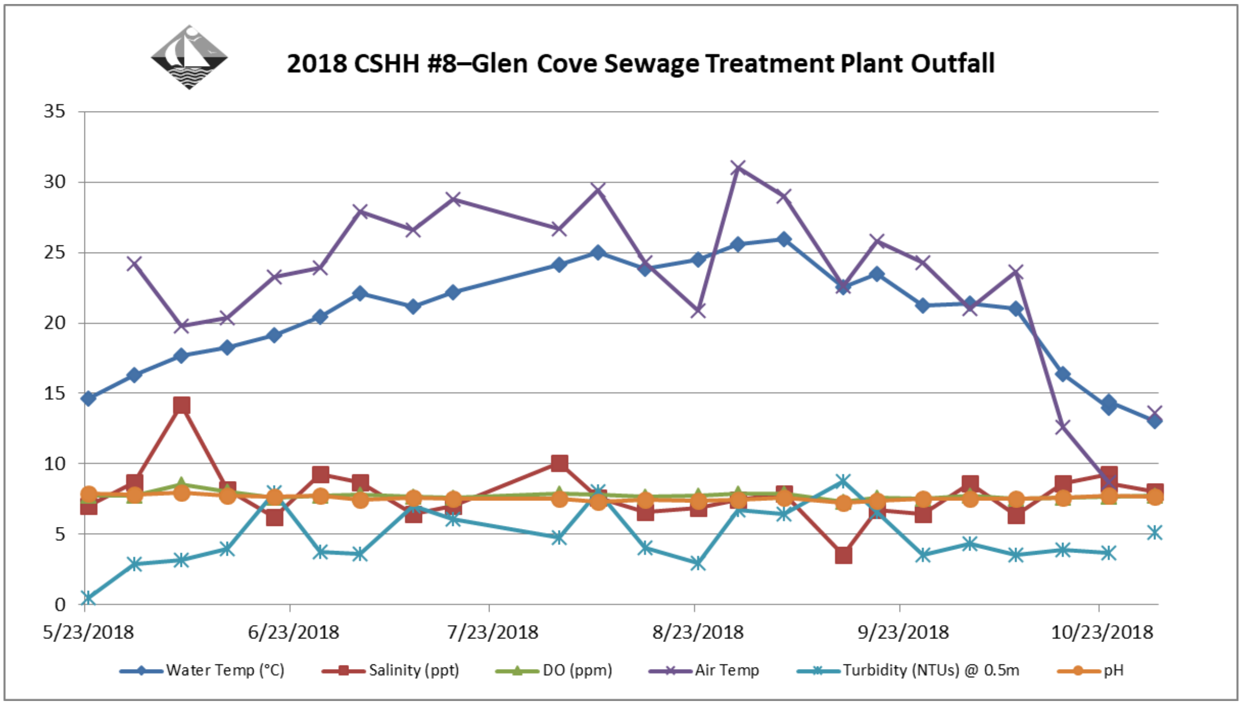


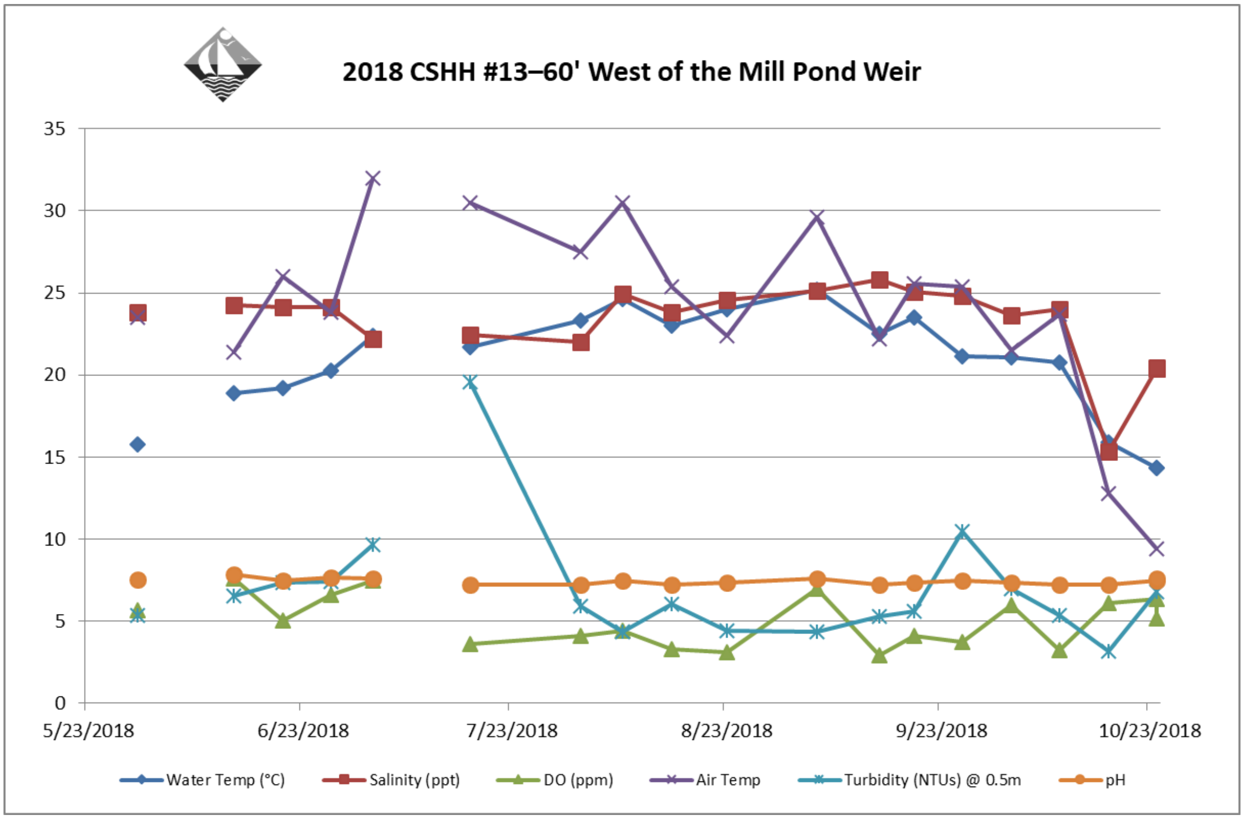
2018 Weekly Graphs for Water-Quality Parameters



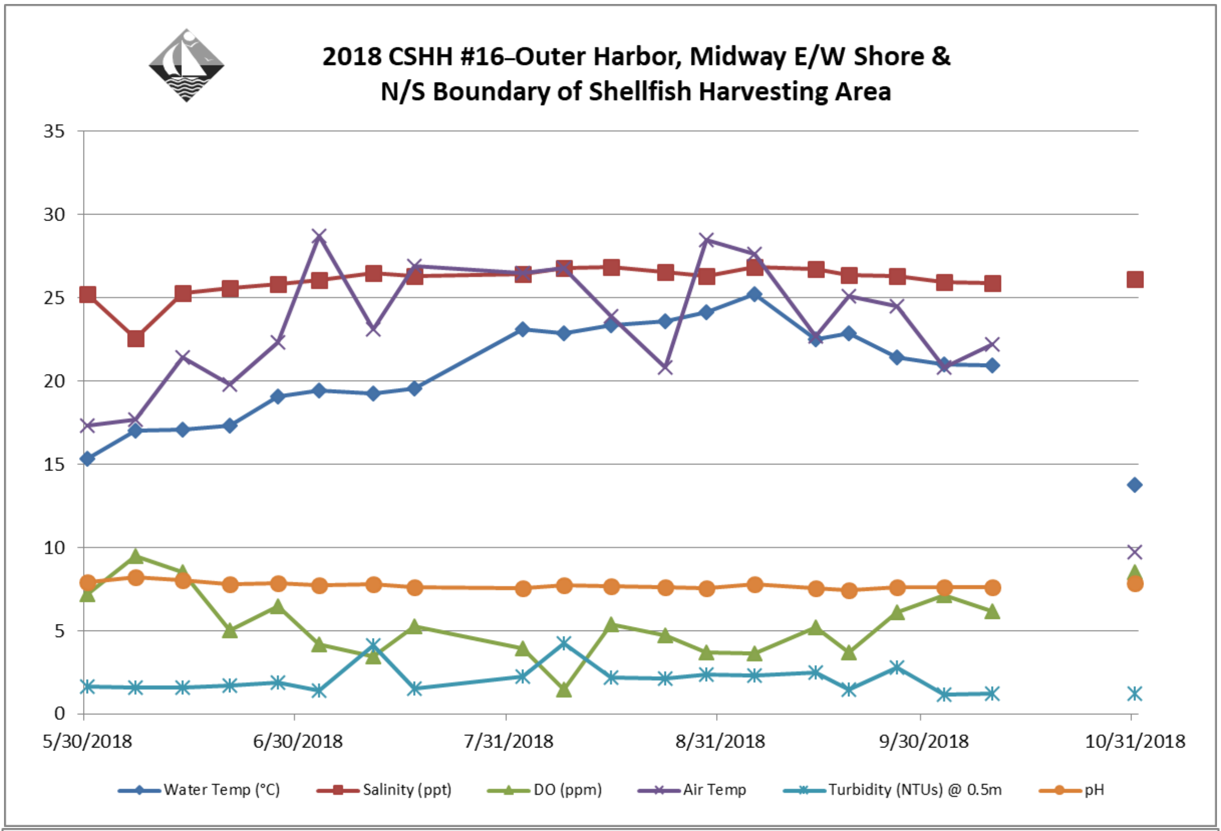


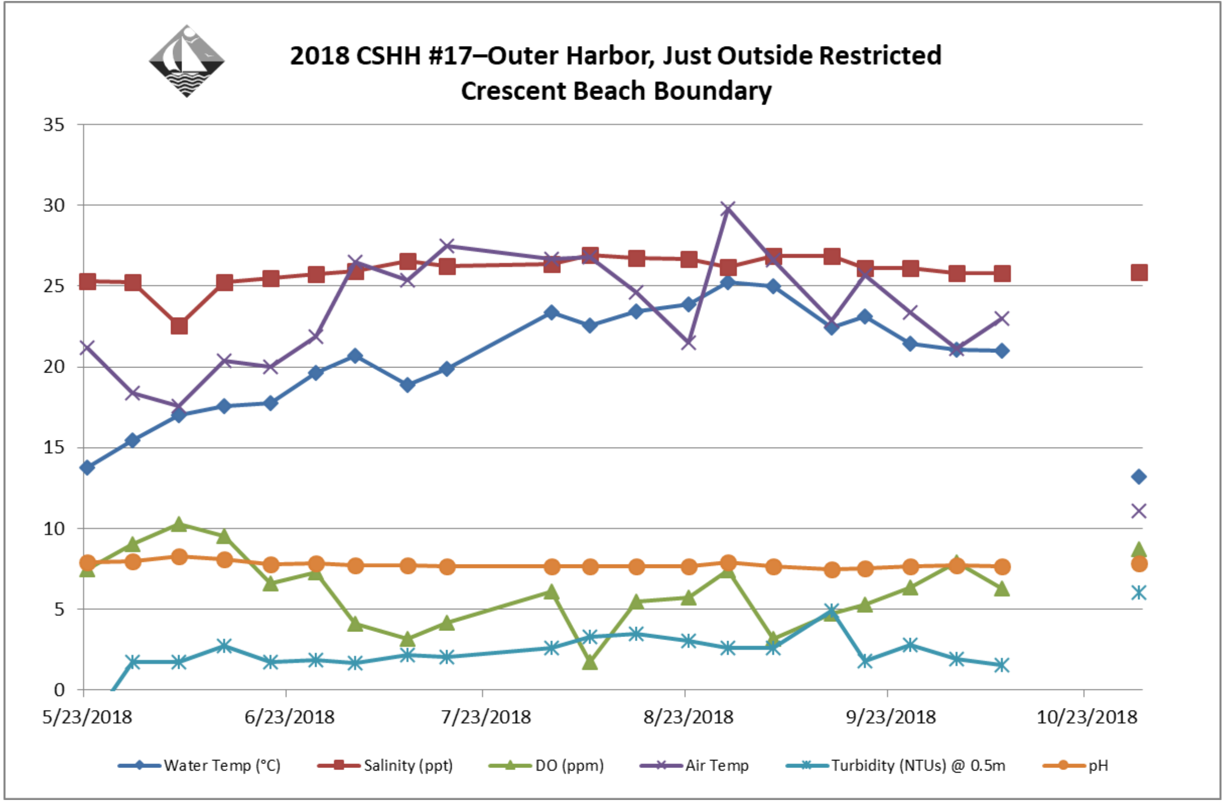
2018 Weekly Graphs for Water-Quality Parameters





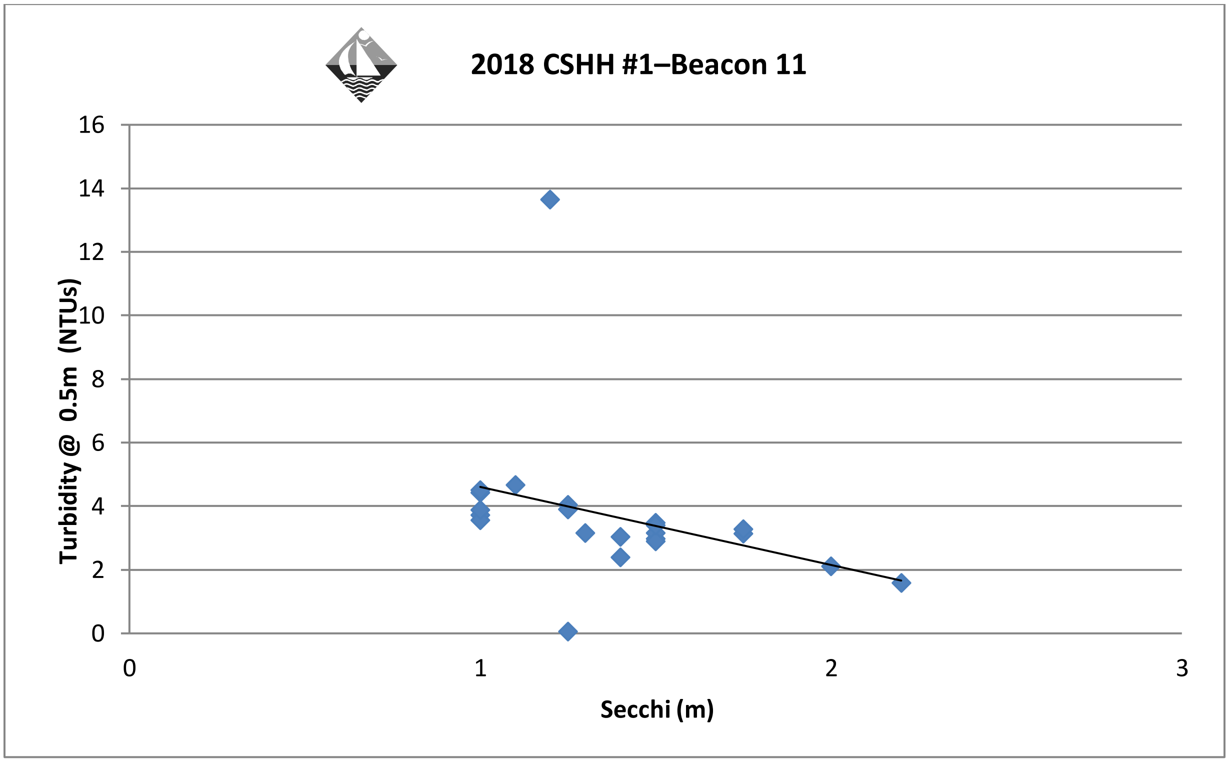
2018 Weekly Graphs for Water-Quality Parameters



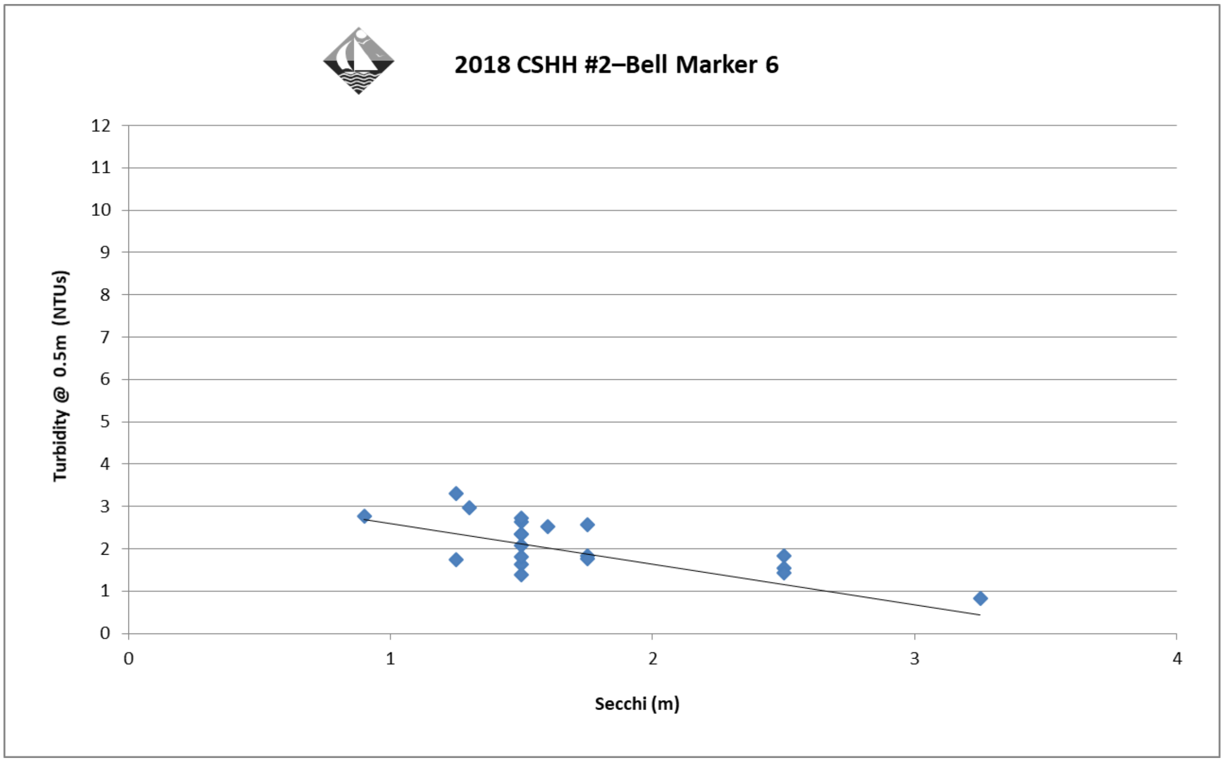


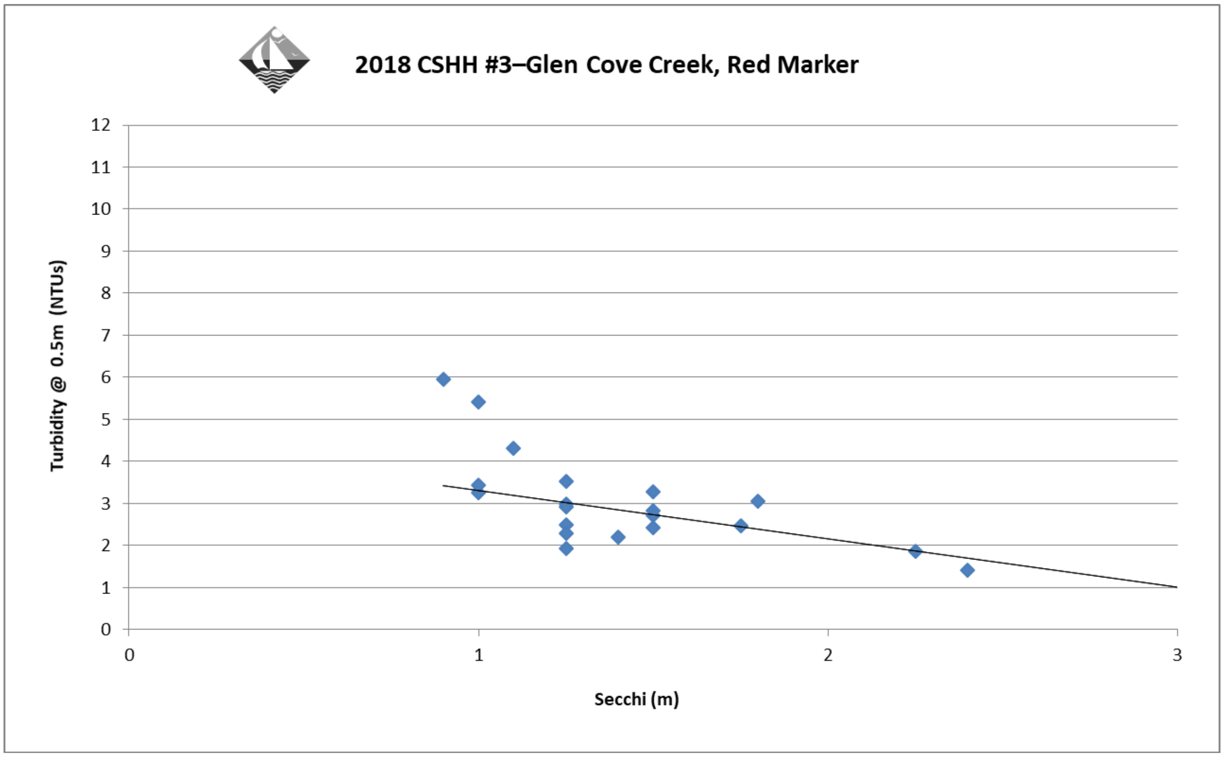
2018 Turbidity and Secchi Disk Transparency Graphs

A linear trendline, generated by Microsoft Excel, is shown for each of the following graphs in this section. This line shows the inverse relationship between Secchi-disk depth and turbidity levels (NTUs), with turbidity measured at 0.5 m below the surface. The Secchi disk is visible to a greater depth when turbidity is lower. Unusually high turbidity measurements may not show on the graph, but still affect the slope of the trendline.

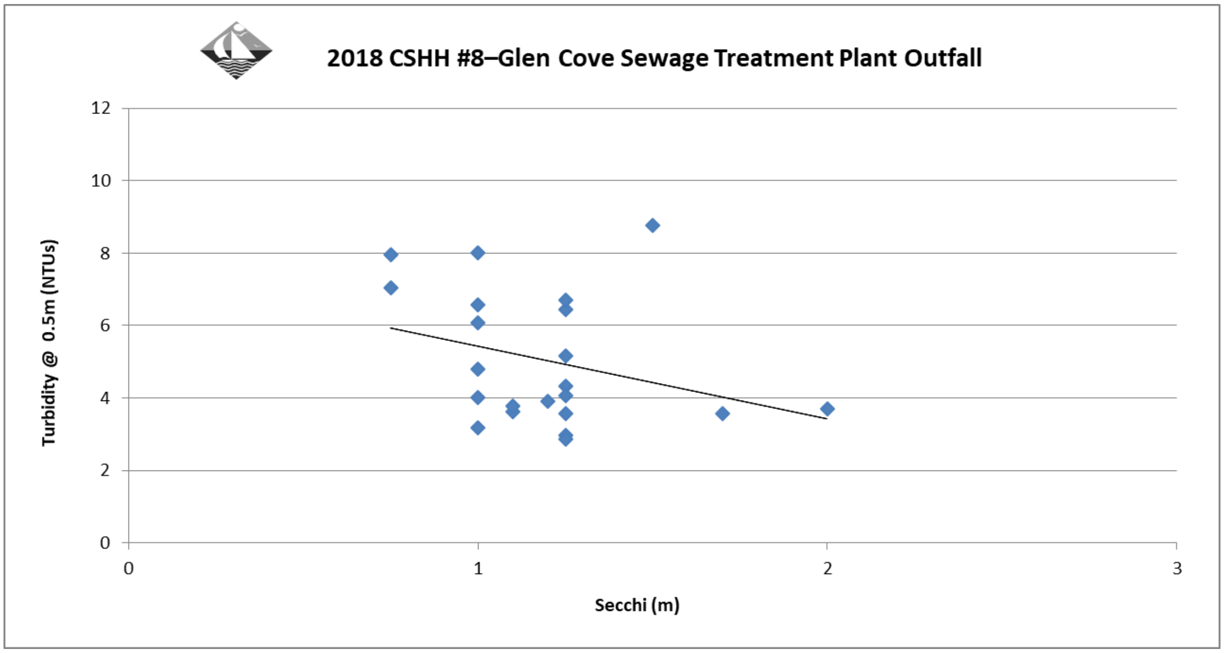


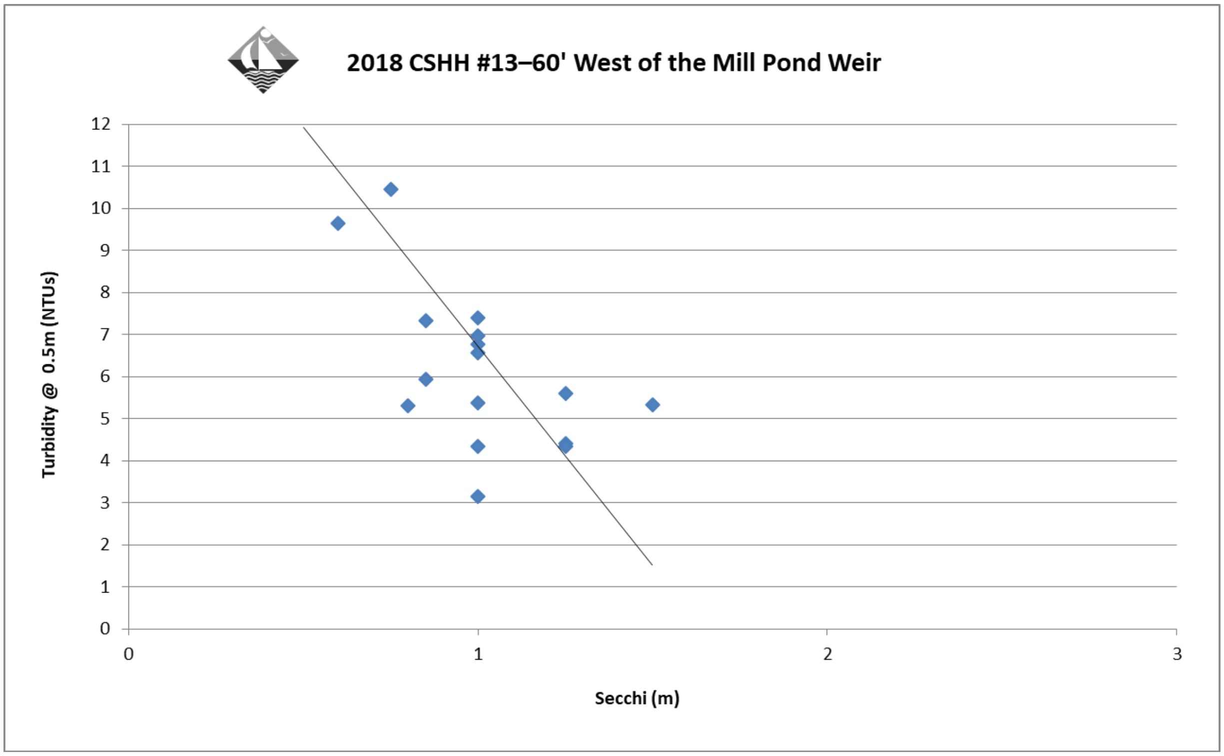
2018 Turbidity and Secchi Disk Transparency Graphs



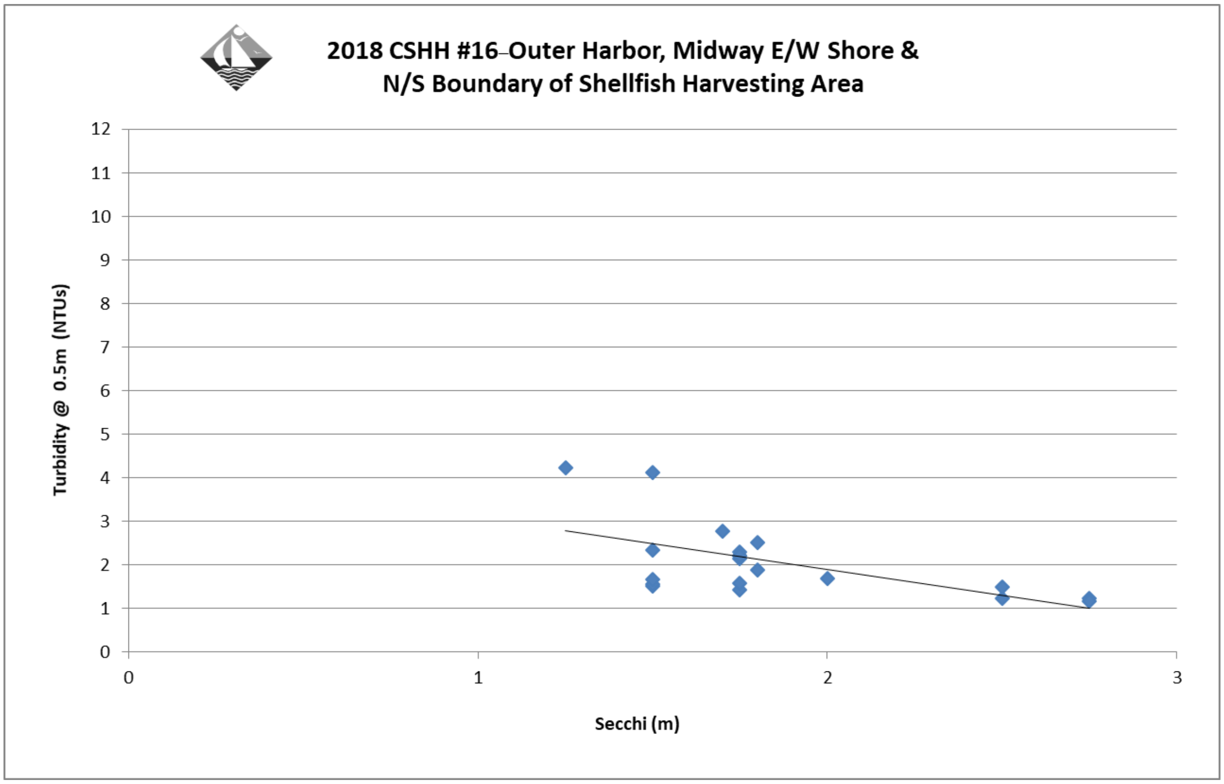


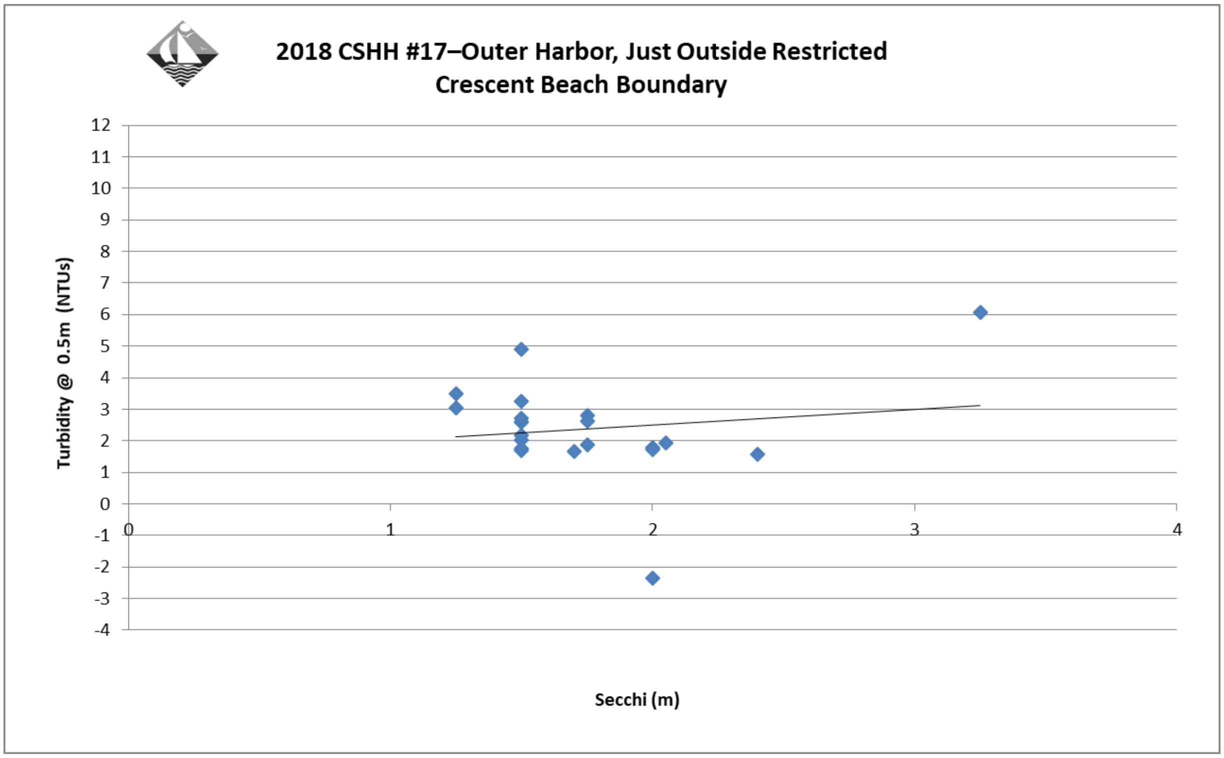
2018 Turbidity and Secchi Disk Transparency Graphs





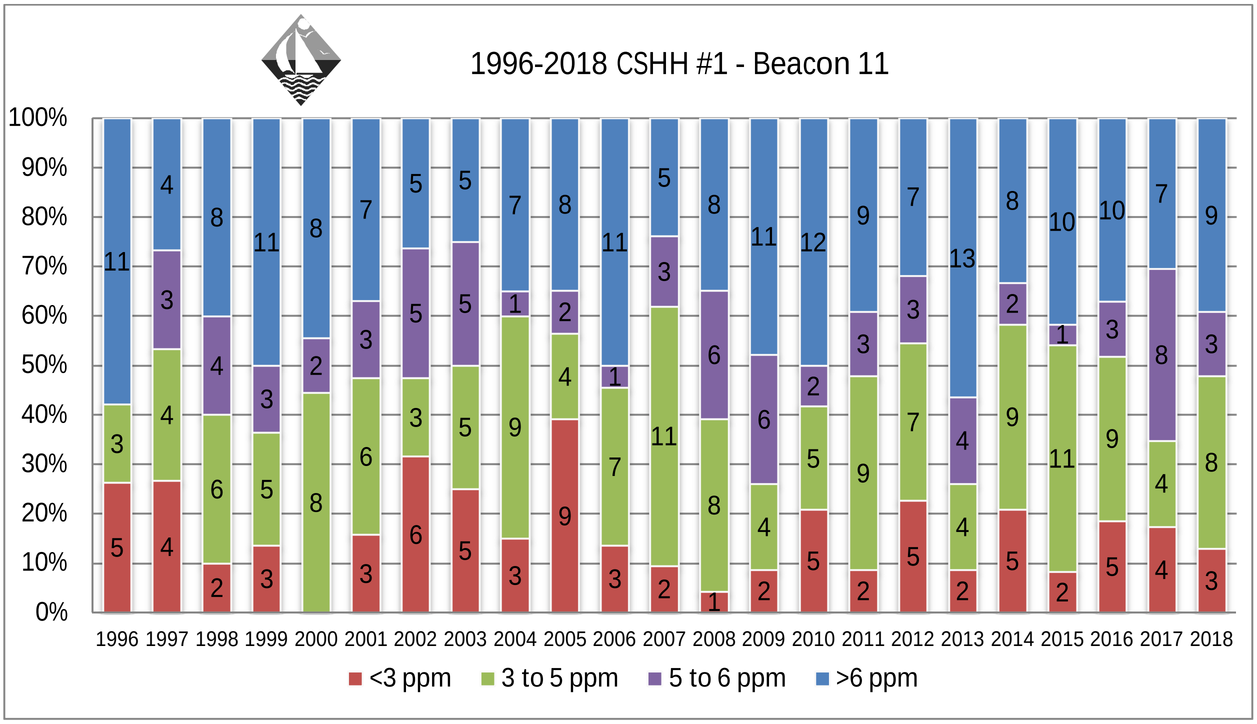
2018 Turbidity and Secchi Disk Transparency Graphs



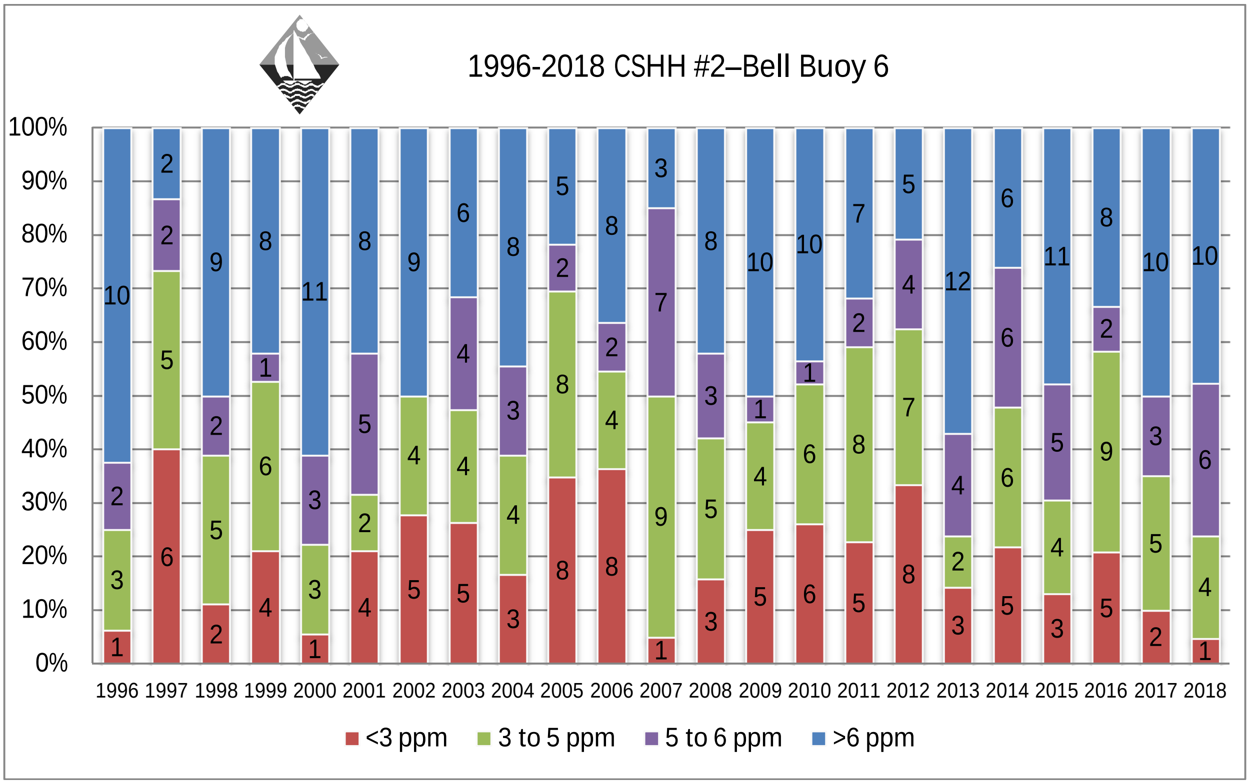


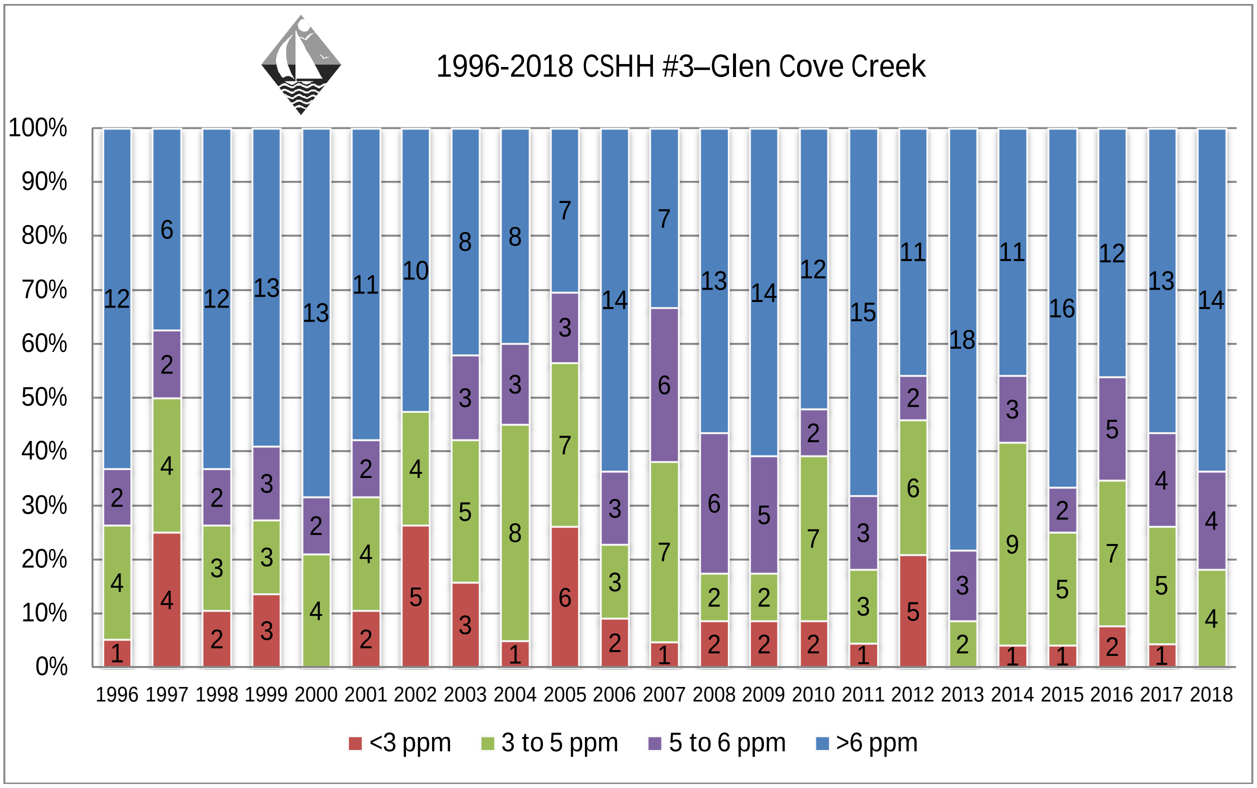
1996-2018 Dissolved Oxygen Graphs

Each vertical bar represents one of CSHH's monitoring sites. Colored bars indicate percentage of all samples taken at a location that fall into each of the four color-coded categories. Numbers inside the bars indicate the number of observations (sample size) within each bar segment. Red bars are representative of hypoxic conditions (DO below 3ppm); DO between 3 and 5 is considered marginal, and DO above 5 ppm is considered a healthy condition.

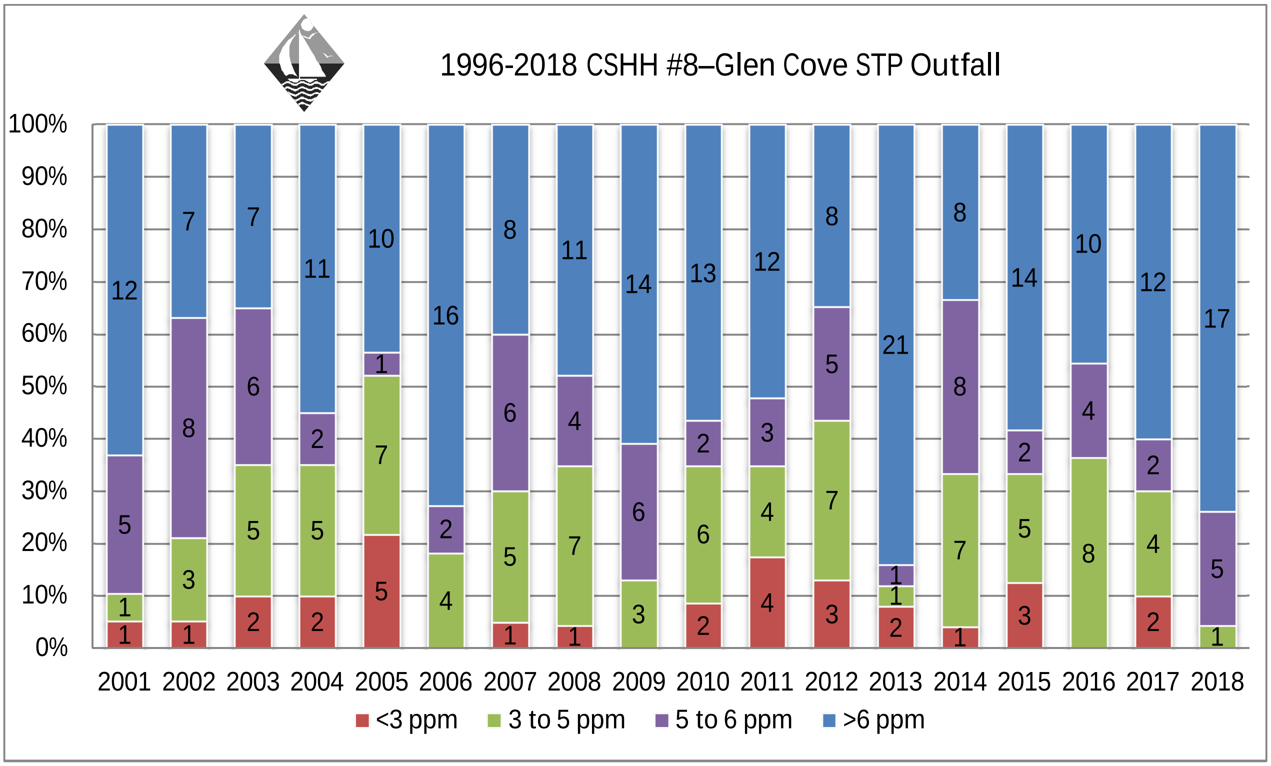


1996-2018 Dissolved Oxygen Graphs





1996-2018 Dissolved Oxygen Graphs



Appendix B

2018 In-Harbor Bacteria Data
2018 In-Harbor Bacteria Graphs
2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data
2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Graphs
2018-2019 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Data
2018 Beach-Monitoring Bacteria Data
2018 Sea Cliff Precipitation Data
2019 Partial Sea Cliff Precipitation Data
1997-2018 Monthly Precipitation

2018 In-Harbor Bacteria Data

CSHH #1 - Beacon 11

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	21.00	29.08	11.00	27.29
10/24/18	15.00	53.19	12.00	57.84
10/17/18	22.00	100.43	51.00	84.53
10/10/18	100.00	117.87	**150.00**	56.82
10/3/18	30.00	72.82	15.00	20.86
9/26/18	430.00	78.26	**470.00**	17.37
9/19/18	360.00	53.47	80.00	7.00
9/14/18	49.00	33.55	7.00	4.42
9/5/18	9.00	31.36	1.00	4.74
8/29/18	43.00	44.37	6.00	6.54
8/23/18	64.00	44.72	5.00	6.69
8/15/18	35.00	46.05	8.00	9.46
8/8/18	35.00	45.38	10.00	7.40
8/2/18	51.00	46.63	5.00	6.77
7/17/18	72.00	36.08	20.00	4.17
7/11/18	33.00	30.68	3.00	3.55
7/3/18	39.00	26.87	7.00	1.80
6/27/18	33.00	29.19	3.00	1.61
6/20/18	20.00	26.91	1.00	2.16
6/13/18	32.00	28.99	9.00	2.62
6/6/18	17.00	28.05	0.10	1.73
5/30/18	59.00	36.03	4.00	7.21
5/23/18	22.00	0.00	13.00	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #2 - Bell Marker 6

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	7.00	4.33	1.00	0.18
10/17/18	10.00	13.64	0.10	0.78
10/10/18	5.00	17.43	0.10	0.78
10/3/18	1.00	12.63	0.10	0.78
9/26/18	22.00	17.43	26.00	0.78
9/19/18	430.00	5.93	11.00	0.26
9/14/18	34.00	2.79	0.10	0.10
9/5/18	1.00	1.50	0.10	0.10
8/29/18	5.00	1.71	0.10	0.10
8/23/18	0.10	1.00	0.10	0.10
8/15/18	10.00	0.00	0.10	0.00
8/8/18	4.00	1.15	0.10	0.15
8/2/18	0.10	0.59	0.10	0.18
7/17/18	3.00	1.96	1.00	0.25
7/11/18	4.00	0.99	0.10	0.16
7/3/18	0.10	0.75	0.10	0.16
6/27/18	6.00	1.37	1.00	0.16
6/20/18	4.00	1.10	0.10	0.10
6/13/18	0.10	0.80	0.10	0.10
6/6/18	1.00	1.59	0.10	0.10
5/30/18	2.00	2.00	0.10	0.10
5/23/18	2.00	0.00	0.10	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #3 - Glen Cove Creek, Red Marker

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	15.00	41.58	5.00	5.00
10/17/18	9.00	126.91	0.10	11.43
10/10/18	82.00	180.23	24.00	27.45
10/3/18	270.00	154.54	52.00	9.17
9/26/18	280.00	90.89	**130.00**	2.63
9/19/18	590.00	18.58	12.00	0.63
9/14/18	52.00	11.68	8.00	0.24
9/5/18	38.00	22.89	0.10	0.23
8/29/18	19.00	27.20	0.10	0.23
8/23/18	0.10	29.75	0.10	0.29
8/15/18	58.00	121.68	0.10	0.51
8/8/18	**1500.00**	104.04	7.00	0.51
8/2/18	90.00	29.73	0.10	0.18
7/17/18	28.00	33.30	1.00	0.25
7/11/18	31.00	25.24	0.10	0.25
7/3/18	10.00	20.52	0.10	0.25
6/27/18	8.00	19.10	1.00	0.25
6/20/18	590.00	28.49	0.10	0.46
6/13/18	7.00	13.35	1.00	0.68
6/6/18	11.00	16.56	0.10	0.59
5/30/18	7.00	20.32	0.10	1.45
5/23/18	59.00	0.00	21.00	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #4 - East of North Hempstead Beach (S) (Former Bar Beach) Sand Spit

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/24/18	13.00	24.19	1.00	5.20
10/10/18	45.00	121.86	27.00	56.92
9/19/18	330.00	139.53	**120.00**	32.86
9/5/18	59.00	52.66	9.00	7.94
8/8/18	47.00	57.36	7.00	9.17
7/11/18	70.00	0.00	12.00	0.00
5/23/18	34.00	0.00	15.00	0.00

CSHH #5 - Mott's Cove

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/24/18	46.00	44.47	9.00	13.42
10/10/18	43.00	124.42	20.00	30.66
9/19/18	360.00	241.24	47.00	16.64
9/5/18	390.00	135.65	14.00	10.25
8/23/18	100.00	80.00	7.00	8.77
8/8/18	64.00	71.55	11.00	19.05
7/11/18	80.00	0.00	33.00	0.00
5/23/18	310.00	0.00	28.00	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #6 - East of the Former Incinerator Site

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/24/18	12.00	33.05	1.00	3.74
10/10/18	91.00	233.67	14.00	**144.91**
9/19/18	600.00	49.32	**1500.00**	11.82
9/5/18	50.00	24.44	11.00	2.49
8/23/18	4.00	17.09	0.10	1.18
8/8/18	73.00	53.36	14.00	11.22
7/11/18	39.00	22.52	9.00	5.20
6/27/18	13.00	0.00	3.00	0.00
5/23/18	52.00	0.00	16.00	0.00

CSHH #7 - West of Old Oil Dock

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/24/18	41.00	84.22	13.00	16.12
10/10/18	173.00	319.48	20.00	**148.32**
9/19/18	590.00	60.86	**1100.00**	29.78
9/5/18	191.00	33.68	12.00	7.56
8/23/18	2.00	14.14	2.00	6.00
8/8/18	100.00	40.00	18.00	19.90
7/11/18	16.00	46.32	22.00	11.97
6/27/18	27.00	78.80	3.00	8.83
6/13/18	230.00	365.24	26.00	33.05
5/23/18	580.00	0.00	42.00	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #11 - 50 Yards East of STP Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	49.00	619.79	38.00	**136.05**
10/24/18	360.00	**1615.77**	100.00	**341.75**
10/17/18	180.00	**2320.61**	47.00	**291.30**
10/10/18	**6001.00**	**2415.64**	**450.00**	**362.37**
10/3/18	**4800.00**	**1958.09**	**580.00**	67.38
9/26/18	**5900.00**	**1981.97**	**3800.00**	44.14
9/19/18	**2200.00**	**1939.91**	45.00	11.20
9/14/18	220.00	**2338.49**	**140.00**	16.37
9/5/18	**2100.00**	**4529.97**	0.10	13.53
8/29/18	**5100.00**	**3465.17**	70.00	47.44
8/23/18	**5300.00**	**3146.03**	4.0	43.05
8/15/18	**5600.00**	**1688.72**	**300.00**	61.81
8/8/18	**6001.00**	484.68	54.00	31.41
8/2/18	550.00	293.78	53.00	30.01
7/17/18	440.00	216.10	17.00	23.37
7/11/18	38.00	169.34	20.00	32.62
7/3/18	810.00	185.54	45.00	22.32
6/27/18	58.00	143.22	19.00	22.92
6/20/18	600.00	171.61	24.00	23.79
6/13/18	130.00	125.50	90.00	23.74
6/6/18	60.00	124.03	3.00	15.22
5/30/18	60.00	178.33	24.00	34.29
5/29/18	530.00	0.00	49.00	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #12 - Bend in Seawall East of STP Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	57.00	450.34	39.00	**142.93**
10/24/18	180.00	**1110.63**	**120.00**	**349.30**
10/17/18	90.00	**1936.40**	90.00	**313.60**
10/10/18	**3400.00**	**2051.08**	**240.00**	**248.29**
10/3/18	**5900.00**	**1495.22**	**590.00**	52.35
9/26/18	**5200.00**	**1306.05**	**3400.00**	34.18
9/19/18	**2900.00**	**1344.02**	70.00	9.92
9/14/18	120.00	**1370.74**	28.00	9.38
9/5/18	700.00	**2997.53**	0.10	10.74
8/29/18	**3000.00**	**2886.88**	70.00	37.93
8/23/18	**6001.00**	**2859.28**	7.00	32.55
8/15/18	**3200.00**	**1189.92**	53.00	31.32
8/8/18	**6001.00**	409.76	55.00	26.94
8/2/18	580.00	168.11	55.00	20.37
7/17/18	180.00	139.44	6.00	21.79
7/11/18	45.00	140.95	29.00	29.44
7/3/18	170.00	130.83	18.00	23.79
6/27/18	66.00	130.83	28.00	27.33
6/20/18	580.00	202.75	56.00	48.83
6/13/18	190.00	155.90	27.00	47.19
6/6/18	31.00	145.96	10.00	56.84
5/30/18	170.00	316.70	36.00	**135.50**
5/23/18	590.00	0.00	**510.00**	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #13 - 60 Feet Downstream of Mill Pond Weir

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/24/18	100.00	**1100.65**	**130.00**	**458.13**
10/17/18	390.00	**2187.37**	**140.00**	**806.64**
10/10/18	**2600.00**	**2230.51**	**480.00**	**838.58**
10/3/18	**2700.00**	**2521.49**	**550.00**	**475.04**
9/26/18	**5900.00**	**2478.74**	**4200.00**	**457.95**
9/19/18	**3100.00**	**1698.26**	**2200.00**	**156.31**
9/14/18	430.00	**1540.70**	**170.00**	75.54
9/5/18	**4800.00**	**2977.88**	28.00	83.18
8/23/18	**1300.00**	**1763.23**	57.00	**108.15**
8/15/18	**2100.00**	**1402.25**	**120.00**	**118.80**
8/8/18	**6001.00**	**1225.63**	**250.00**	**118.40**
8/2/18	590.00	479.79	80.00	84.23
7/17/18	520.00	279.18	83.00	72.90
7/3/18	360.00	139.24	90.00	16.94
6/27/18	59.00	138.46	63.00	18.76
6/20/18	550.00	171.37	60.00	13.86
6/13/18	140.00	116.18	0.10	8.50
6/6/18	32.00	105.83	41.00	78.42
5/30/18	350.00	0.00	**150.00**	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #14 - NW Corner of Power Plant, Approximately 50 Yards from Cement Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/24/18	16.00	27.13	15.00	7.75
10/10/18	46.00	164.74	4.00	22.80
9/19/18	590.00	242.90	**130.00**	22.80
9/5/18	100.00	75.50	4.00	6.93
8/8/18	57.00	50.65	12.00	36.82
7/11/18	45.00	28.46	**113.00**	3.36
6/13/18	18.00	24.37	0.10	1.22
5/23/18	33.00	0.00	15.00	0.00

CSHH #15 - NW Corner of Tappen Pool

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/10/18	24.00	117.98	5.00	18.71
9/19/18	580.00	193.03	70.00	16.82
9/5/18	40.00	74.24	17.00	6.48
8/23/18	310.00	101.14	4.00	4.00
8/8/18	33.00	44.50	4.00	3.46
7/11/18	60.00	41.46	3.00	6.16
6/27/18	27.00	34.47	6.00	8.83
6/13/18	44.00	33.17	13.00	8.83
5/23/18	25.00	0.00	6.00	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

CSHH #16 - Outer Harbor, Midway Between E/W Shore

	Fecal Coliform		***Enterococci***	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	--	--	0.10	0.18
10/17/18	14.00	2.57	0.10	0.57
10/10/18	4.00	2.61	1.00	0.57
10/3/18	0.10	1.97	0.10	0.36
9/26/18	20.00	3.13	6.00	0.36
9/19/18	1.00	1.08	1.00	0.16
9/14/18	15.00	1.08	0.10	0.18
9/5/18	1.00	1.00	0.10	0.18
8/29/18	1.00	1.32	0.10	0.18
8/23/18	0.10	1.41	0.10	0.21
8/15/18	1.00	3.31	2.00	0.21
8/8/18	10.00	3.31	0.10	0.10
8/2/18	4.00	2.45	0.10	0.10
7/17/18	3.00	0.98	0.10	0.16
7/11/18	1.00	0.90	0.10	0.16
7/3/18	3.00	0.57	0.10	0.16
6/27/18	1.00	0.29	1.00	0.16
6/20/18	0.10	0.21	0.10	0.10
6/13/18	2.00	0.27	0.10	0.10
6/6/18	0.10	0.10	0.10	0.10
5/30/18	0.10	0.00	0.10	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

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

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	--	--	1.00	0.53
10/17/18	11.00	17.11	0.10	0.70
10/10/18	5.00	15.63	0.10	1.38
10/3/18	32.00	14.94	8.00	1.38
9/26/18	32.00	9.86	21.00	0.58
9/19/18	26.00	6.80	0.10	0.36
9/14/18	7.00	3.55	3.00	0.36
9/5/18	4.00	2.76	0.10	0.18
8/29/18	4.00	2.76	0.10	0.18
8/23/18	5.00	2.51	2.00	0.21
8/15/18	1.00	2.63	0.10	0.18
8/8/18	2.00	2.63	0.10	0.18
8/2/18	4.00	2.21	0.10	0.18
7/17/18	6.00	1.43	1.00	0.25
7/11/18	1.00	1.25	0.10	0.25
7/3/18	1.00	0.79	0.10	0.40
6/27/18	1.00	1.37	1.00	0.90
6/20/18	1.00	1.57	0.10	0.90
6/13/18	3.00	1.76	1.00	1.57
6/6/18	0.10	1.47	1.00	1.82
5/30/18	16.00	5.66	6.00	2.45
5/23/18	2.00	0.00	1.00	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 In-Harbor Bacteria Data

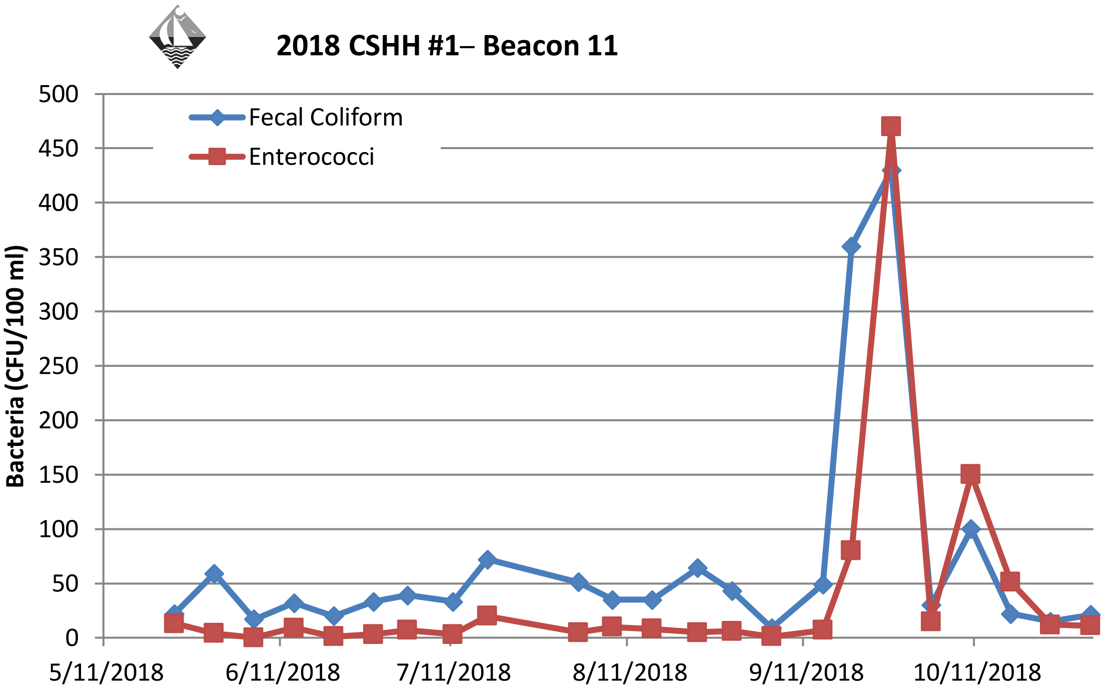
CSHH #17A - Within the Restricted Shellfishing Area

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	--	--	4.00	3.30
10/17/18	8.00	35.38	0.10	7.07
10/10/18	15.00	46.68	59.00	18.11
10/3/18	33.00	38.87	5.00	5.05
9/26/18	280.00	31.20	100.00	2.31
9/19/18	50.00	16.33	6.00	1.06
9/14/18	32.00	15.70	11.00	1.02
9/5/18	6.00	16.41	0.10	0.79
8/29/18	11.00	19.71	0.10	1.43
8/23/18	11.00	22.81	2.00	2.78
8/15/18	41.00	28.00	5.00	3.66
8/8/18	40.00	26.11	3.00	3.46
8/2/18	15.00	28.28	2.00	5.50
7/17/18	25.00	20.15	6.00	2.47
7/11/18	31.00	17.95	4.00	1.98
7/3/18	55.00	9.03	19.00	0.95
6/27/18	6.00	7.05	2.00	0.75
6/20/18	13.00	10.87	0.10	1.70
6/13/18	14.00	10.39	2.00	3.46
6/6/18	1.00	9.41	0.10	4.16
5/30/18	16.00	28.84	6.00	26.83
5/23/18	52.00	0.00	**120.00**	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

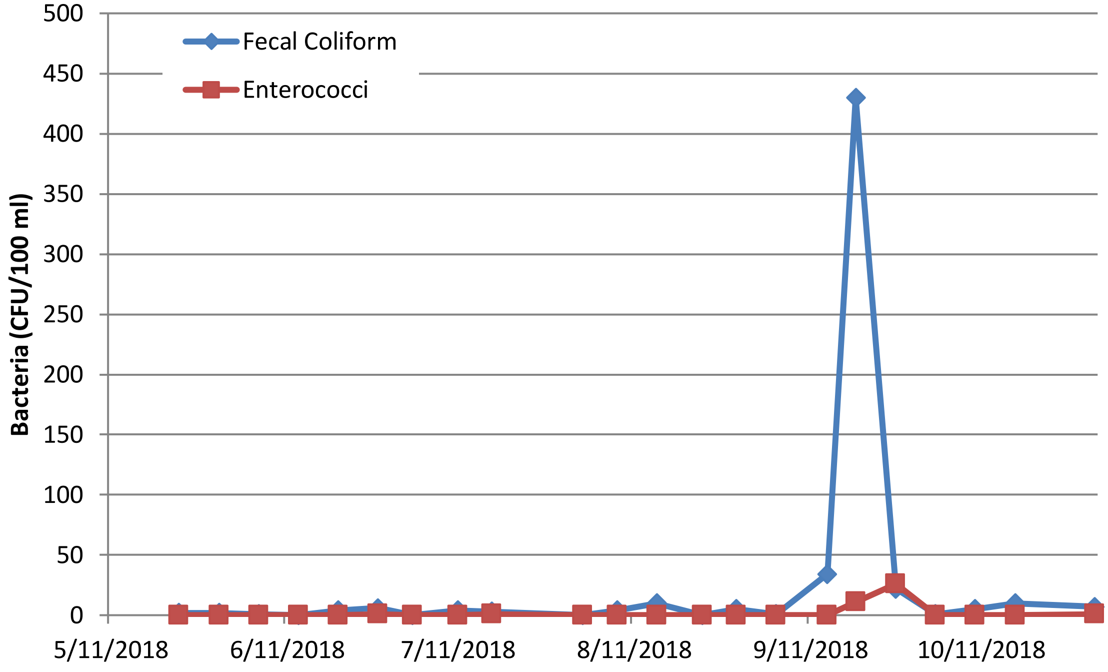
2018 In-Harbor Bacteria Graphs

For each of the following graphs in this section, note that the NYS shellfish bed closure standard uses fecal coliform as the indicator bacteria, which may not exceed 1,000 CFU/100 ml, and the NYS beach closure standard uses entercocci as an indicator bacteria, which may not exceed 104 CFU/100 ml.

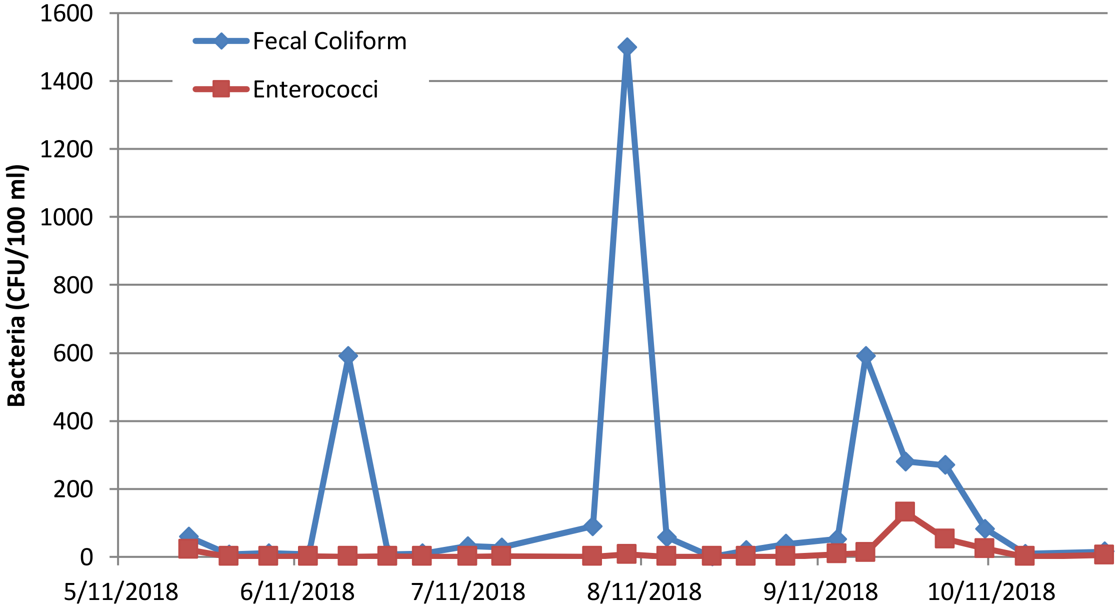


2018 In-Harbor Bacteria Graphs

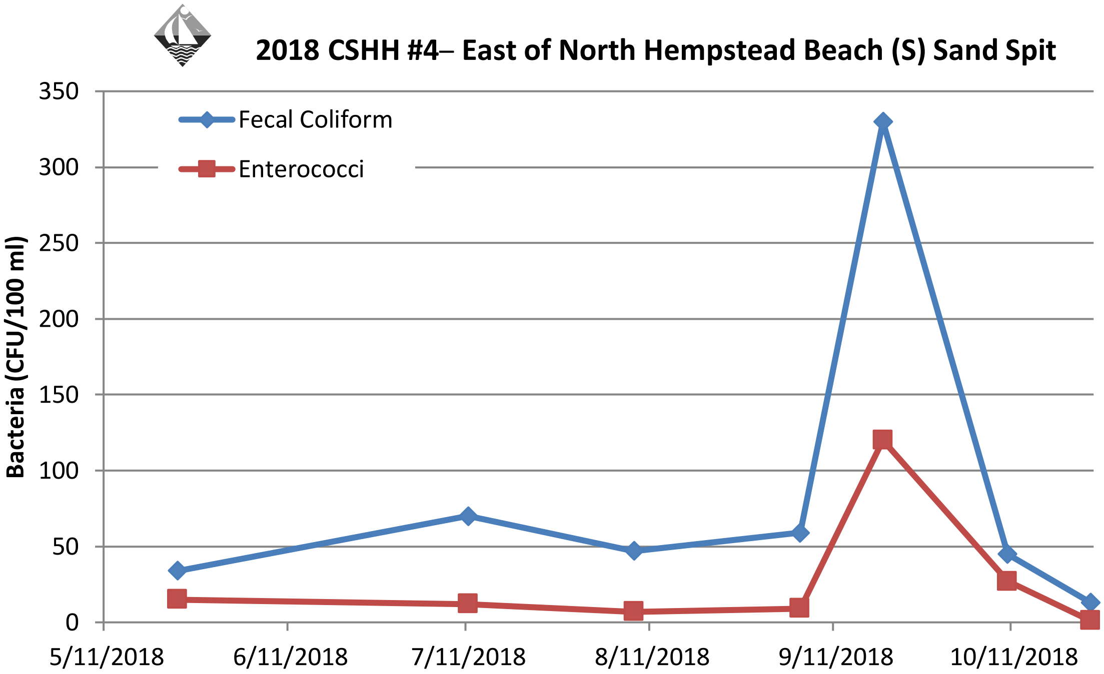
2018 CSHH #2– Bell Marker 6

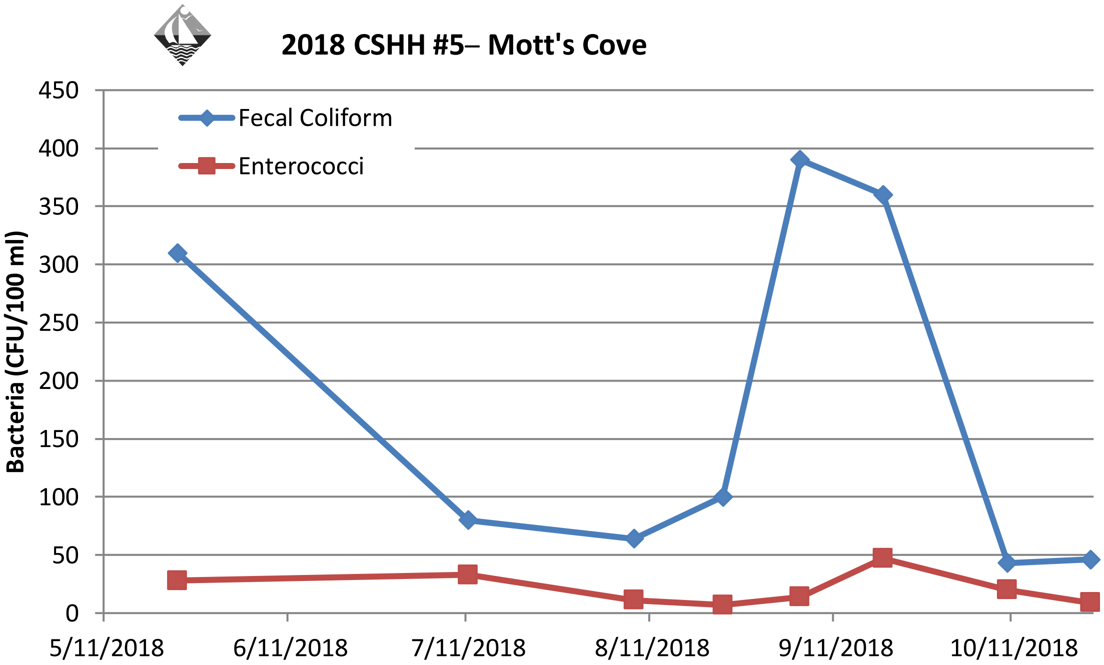


2018 CSHH #3– Glen Cove Creek, Red Marker

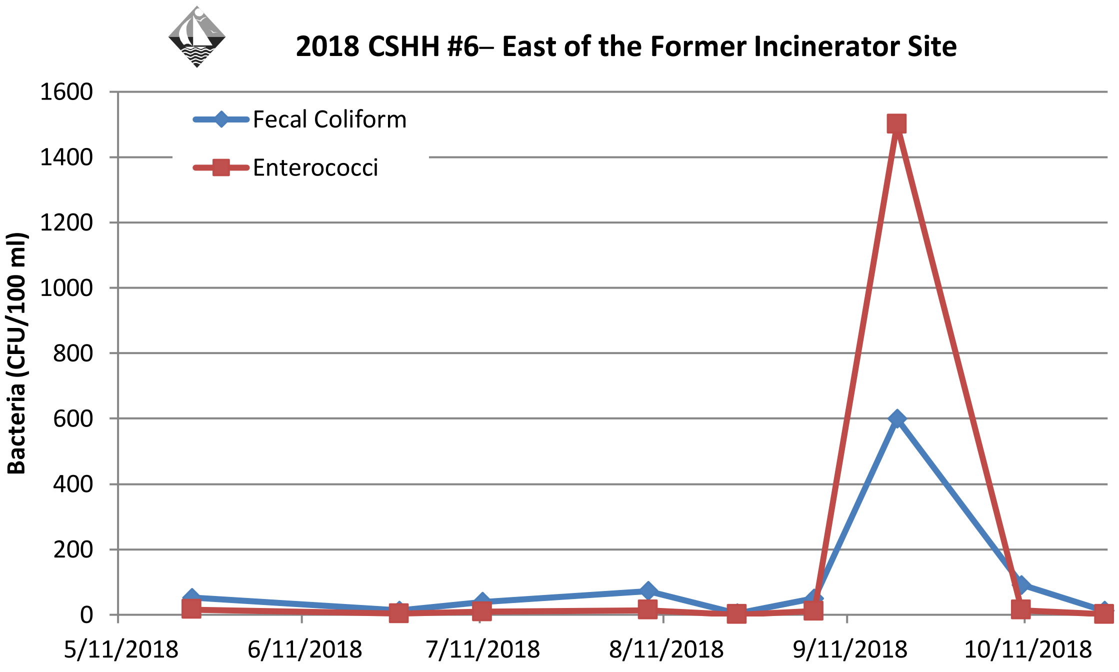


2018 In-Harbor Bacteria Graphs

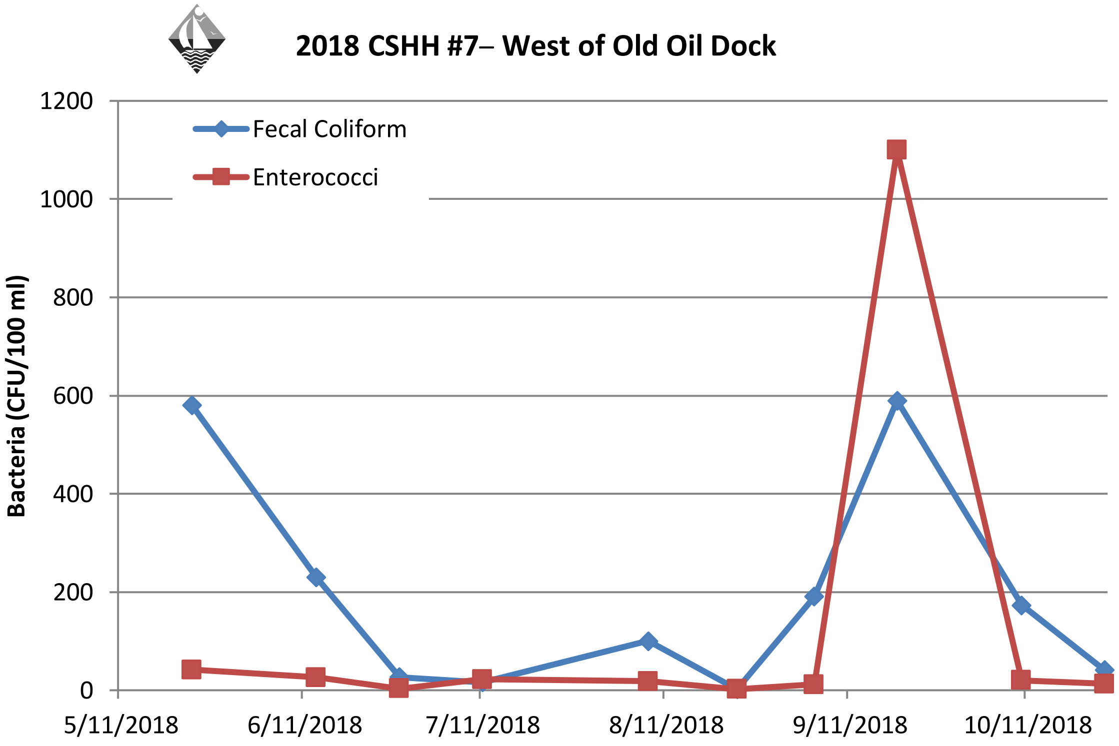




2018 In-Harbor Bacteria Graphs

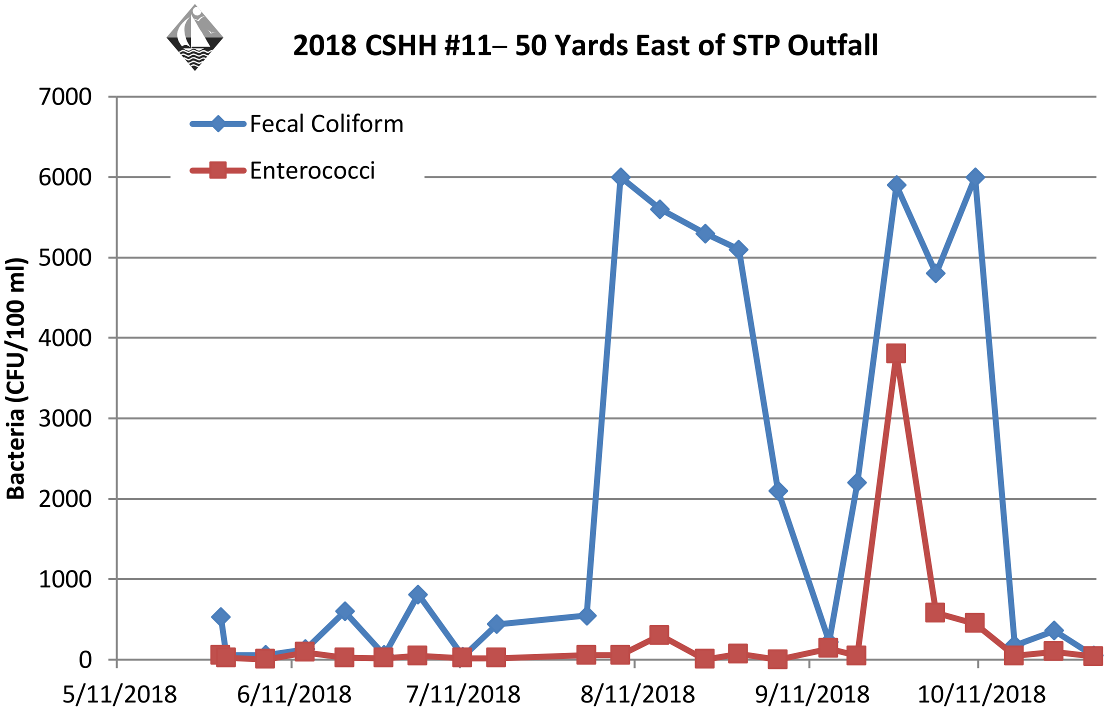


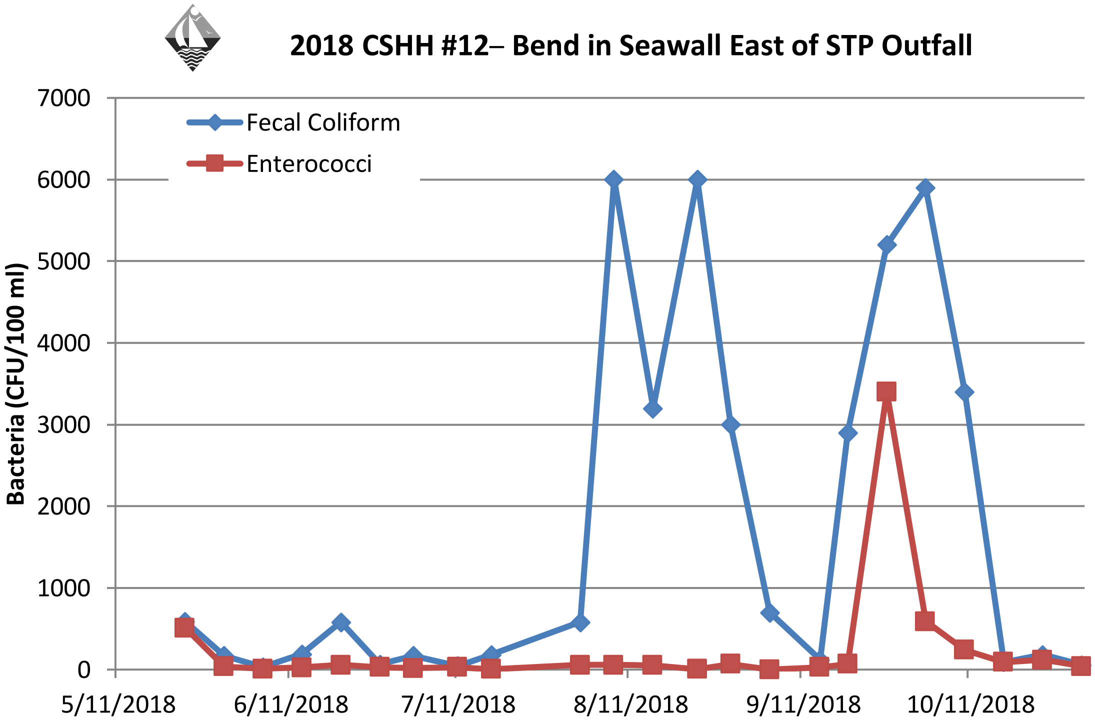
2018 CSHH #6– East of the Former Incinerator Site



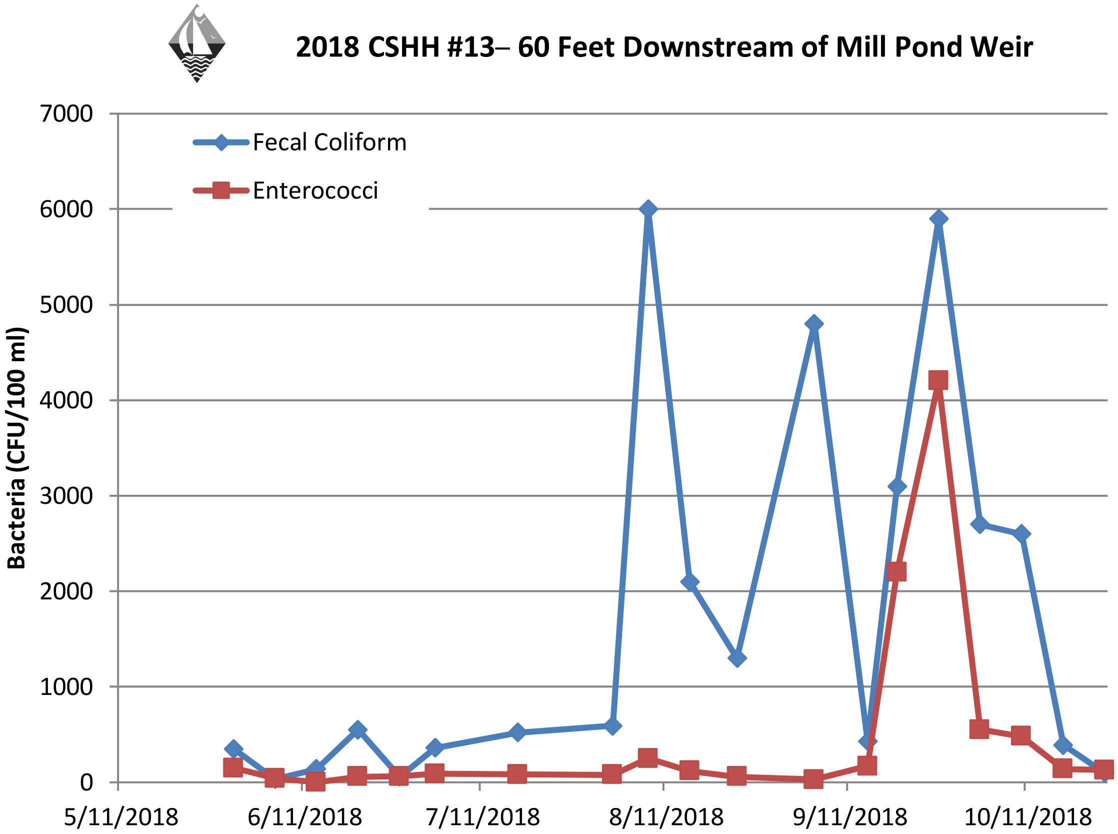
2018 CSHH #7– West of Old Oil Dock

2018 In-Harbor Bacteria Graphs



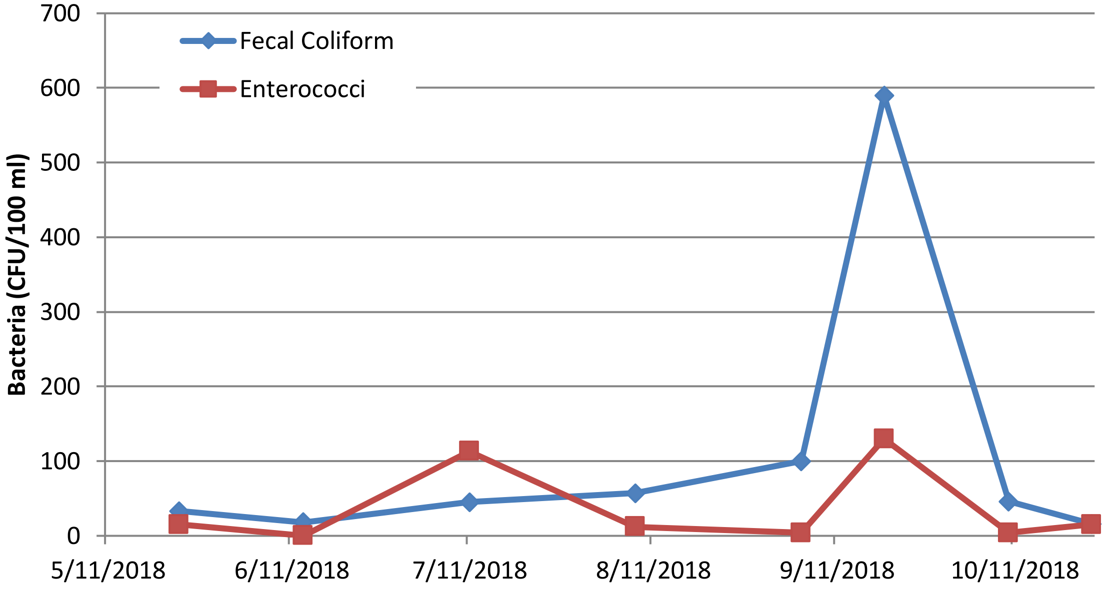


2018 In-Harbor Bacteria Graphs

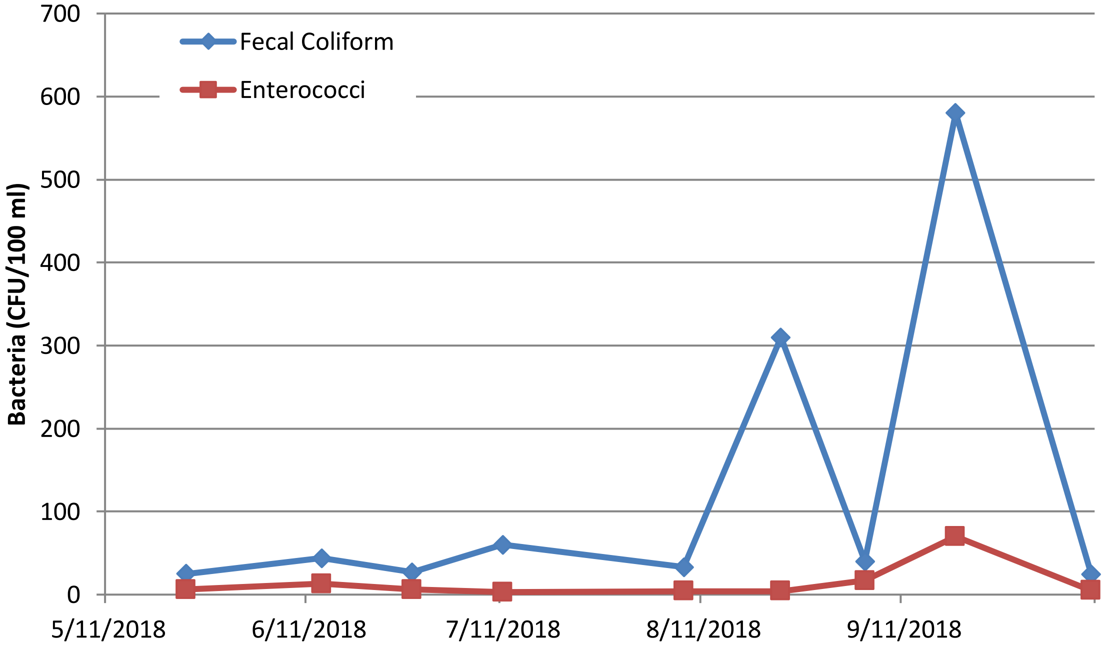


2018 In-Harbor Bacteria Graphs

2018 CSHH #14– NW Corner of Power Plant, Approx. 50 Yards from Cement Outfall

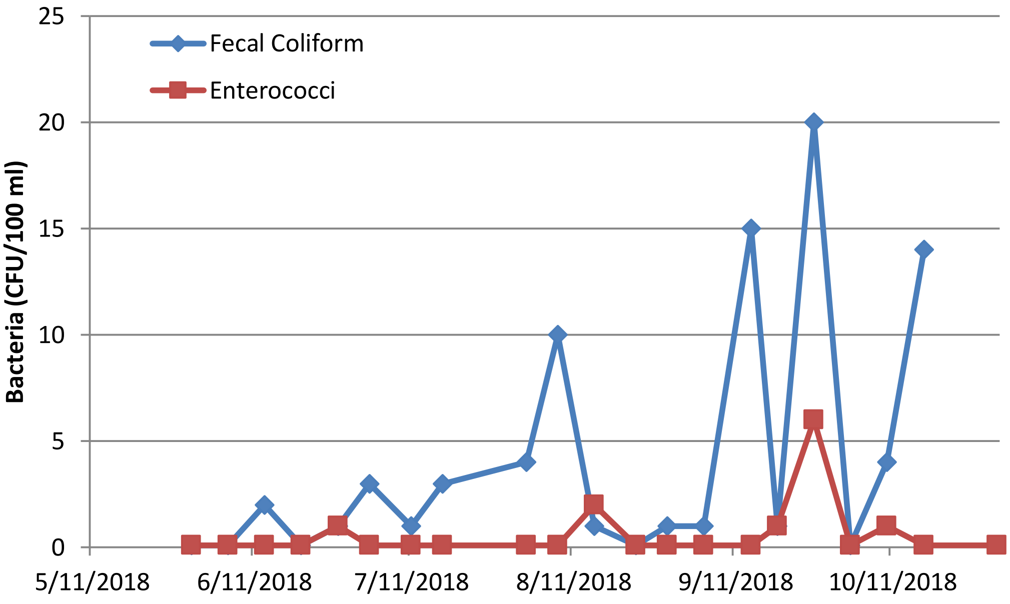


2018 CSHH #15– NW Corner of Tappen Pool

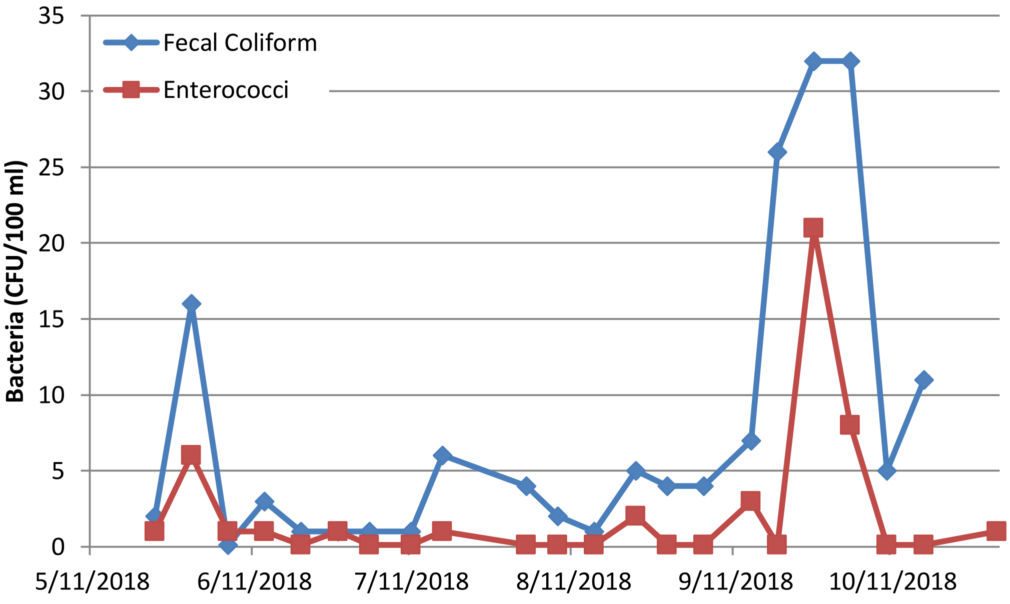


2018 In-Harbor Bacteria Graphs

2018 CSHH #16–Outer Harbor Midway E/W

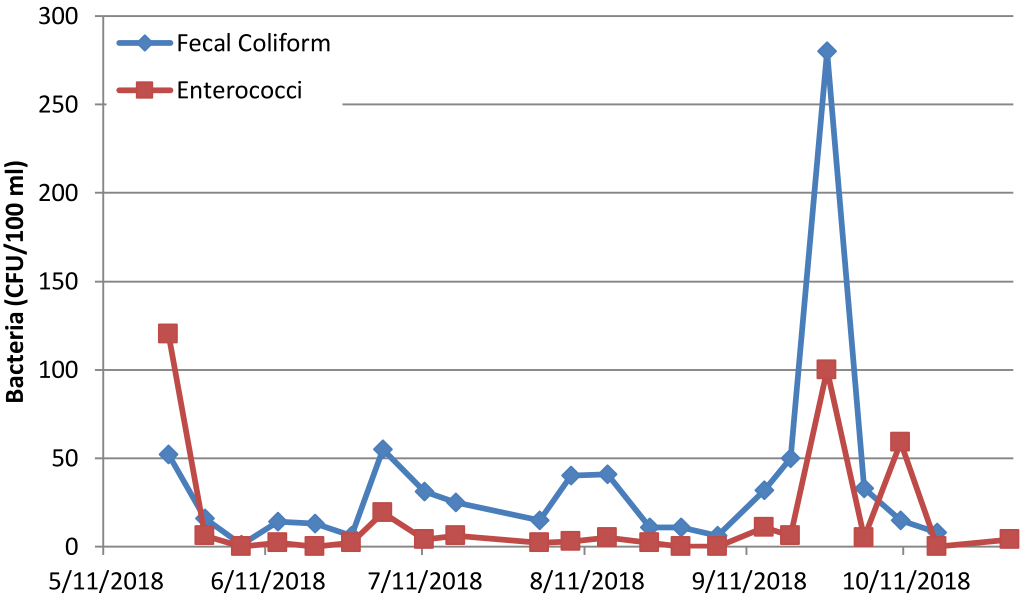


2018 CSHH #17–Outside Crescent Beach



2018 In-Harbor Bacteria Graphs

2018 CSHH #17A–Within Restricted Shellfishing Area



2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data

CSHH #8 - Glen Cove STP Outfall

	Fecal Coliform		***Enterococci***	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	17.00	68.00	20.00	31.87
10/24/18	54.00	138.23	26.00	60.17
10/17/18	70.00	218.26	54.00	78.77
10/10/18	73.00	214.39	13.00	76.94
10/3/18	310.00	272.00	90.00	98.63
9/26/18	590.00	186.52	**480.00**	57.38
9/19/18	530.00	125.69	100.00	25.30
9/14/18	64.00	116.98	48.00	22.28
9/5/18	240.00	167.04	45.00	21.59
8/29/18	47.00	117.88	6.00	15.65
8/23/18	82.00	148.34	8.00	19.89
8/15/18	370.00	169.57	53.00	28.56
8/8/18	380.00	95.99	41.00	25.74
8/2/18	42.00	56.93	9.00	21.24
7/17/18	140.00	73.19	34.00	26.14
7/11/18	38.00	56.39	35.00	20.47
7/3/18	47.00	53.78	19.00	15.60
6/27/18	21.00	54.88	10.00	14.46
6/20/18	400.00	103.87	54.00	20.69
6/13/18	38.00	74.15	10.00	16.28
6/6/18	30.00	92.66	9.00	19.15
5/30/18	52.00	162.85	13.00	27.93
5/23/18	510.00	0.00	60.00	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Scudder's Pond and Powerhouse Drain Outfalls
Regular Season Monitoring Bacteria Data

CSHH #9 - First Pipe West of STP Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	145.00	250.96	70.00	64.07
10/24/18	80.00	428.32	36.00	85.13
10/17/18	160.00	807.05	49.00	**181.82**
10/10/18	173.00	974.17	19.00	**205.33**
10/3/18	**3100.00**	690.71	**460.00**	**184.07**
9/26/18	**2100.00**	326.35	**290.00**	74.51
9/19/18	**1900.00**	200.11	**1600.00**	37.20
9/14/18	410.00	214.67	90.00	26.44
9/5/18	31.00	195.98	11.00	27.00
8/29/18	73.00	353.28	5.00	59.88
8/23/18	182.00	523.98	9.00	**111.40**
8/15/18	**2700.00**	567.26	**290.00**	**187.99**
8/8/18	260.00	187.17	100.00	**110.81**
8/2/18	590.00	173.05	**590.00**	89.73
7/17/18	250.00	139.78	73.00	36.00
7/11/18	32.00	100.48	35.00	24.65
7/3/18	190.00	96.40	43.00	22.47
6/27/18	78.00	68.73	10.00	19.28
6/20/18	450.00	101.57	55.00	40.11
6/13/18	48.00	70.01	11.00	37.07
6/6/18	26.00	79.40	22.00	55.57
5/30/18	35.00	138.74	20.00	88.32
5/23/18	550.00	0.00	**390.00**	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Scudder's Pond and Powerhouse Drain Outfalls
Regular Season Monitoring Bacteria Data

CSHH #10 - Pipe at Corner of Seawall West of STP Outfall

	Fecal Coliform		Enterococci	
Date	CFU/100ml	Log Avg FC	CFU/100ml	Log Avg Ent
10/31/18	127.00	410.77	**450.00**	**143.57**
10/24/18	270.00	849.34	100.00	**144.20**
10/17/18	120.00	**1227.15**	41.00	**244.45**
10/10/18	490.00	**1730.92**	58.00	**324.88**
10/3/18	**5800.00**	**1105.20**	**570.00**	**223.82**
9/26/18	**4800.00**	569.11	**460.00**	72.26
9/19/18	**1700.00**	339.01	**1400.00**	37.79
9/14/18	670.00	436.28	**170.00**	32.22
9/5/18	52.00	349.17	9.00	24.47
8/29/18	210.00	546.86	2.00	55.91
8/23/18	360.00	694.68	18.00	**128.55**
8/15/18	**6001.00**	669.19	**630.00**	**263.96**
8/8/18	220.00	219.92	43.00	**121.20**
8/2/18	490.00	199.84	**560.00**	**133.87**
7/17/18	310.00	144.86	**320.00**	66.16
7/11/18	70.00	110.49	28.00	34.31
7/3/18	150.00	106.41	64.00	39.82
6/27/18	35.00	84.01	13.00	30.55
6/20/18	560.00	142.41	**170.00**	62.60
6/13/18	80.00	101.13	12.00	48.77
6/6/18	58.00	109.34	59.00	77.83
5/30/18	46.00	150.13	17.00	89.39
5/23/18	490.00	0.00	**470.00**	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data

CSHH #14A - At Powerhouse Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/2018	--	--	**160.00**	**101.55**
10/24/2018	220.00	**1068.11**	80.00	**206.03**
10/17/2018	450.00	**1203.77**	59.00	**270.14**
10/10/2018	**6001.00**	**1157.55**	55.00	**351.48**
10/3/2018	390.00	824.47	**260.00**	**639.89**
9/26/2018	**6000.00**	**1079.39**	**5500.00**	**618.86**
9/19/2018	400.00	676.45	**310.00**	**247.26**
9/14/2018	370.00	942.47	**220.00**	**179.21**
9/5/2018	**1100.00**	800.93	**1100.00**	**158.75**
8/29/2018	**1500.00**	699.77	**220.00**	**126.97**
8/23/2018	580.00	578.32	56.00	**110.67**
8/15/2018	**2100.00**	601.78	62.00	**200.30**
8/8/2018	164.00	230.24	**120.00**	**325.05**
8/2/2018	560.00	276.28	**360.00**	**364.63**
7/17/2018	680.00	200.57	**601.00**	**162.38**
7/11/2018	45.00	148.25	**430.00**	74.23
7/3/2018	340.00	157.03	**190.00**	48.08
6/27/2018	520.00	175.92	**121.00**	52.68
6/20/2018	60.00	222.95	19.00	89.36
6/13/2018	150.00	309.54	12.00	**131.59**
6/6/2018	60.00	394.08	49.00	**292.36**
5/30/2018	600.00	**1009.95**	**300.00**	**714.14**
5/23/2018	**1700.00**	0.00	**1700.00**	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data

CSHH #15A - Scudder's Pond Outfall Pipe, North of Tappen Beach Pool Area

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	--	--	80.00	85.12
10/24/18	48.00	336.13	70.00	**196.16**
10/17/18	150.00	715.66	38.00	**433.75**
10/10/18	210.00	866.37	70.00	**360.17**
10/3/18	430.00	794.27	**300.00**	**293.14**
9/26/18	**6600.00**	675.27	**5200.00**	**193.91**
9/19/18	**2100.00**	453.34	**3700.00**	76.59
9/14/18	390.00	320.34	15.00	38.58
9/5/18	136.00	507.71	25.00	98.17
8/29/18	191.00	495.16	38.00	**104.40**
8/23/18	900.00	628.31	50.00	**134.41**
8/15/18	370.00	256.51	**120.00**	**114.14**
8/8/18	**3900.00**	180.14	**1600.00**	72.00
8/2/18	120.00	75.45	34.00	30.57
7/17/18	25.00	92.59	26.00	34.07
7/11/18	90.00	106.78	19.00	28.14
7/3/18	120.00	97.79	52.00	30.19
6/27/18	210.00	81.08	38.00	25.42
6/20/18	120.00	89.28	47.00	40.28
6/13/18	51.00	82.92	10.00	38.76
6/6/18	58.00	97.50	27.00	60.89
5/30/18	47.00	126.41	22.00	91.43
5/23/18	340.00	0.00	**380.00**	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Data

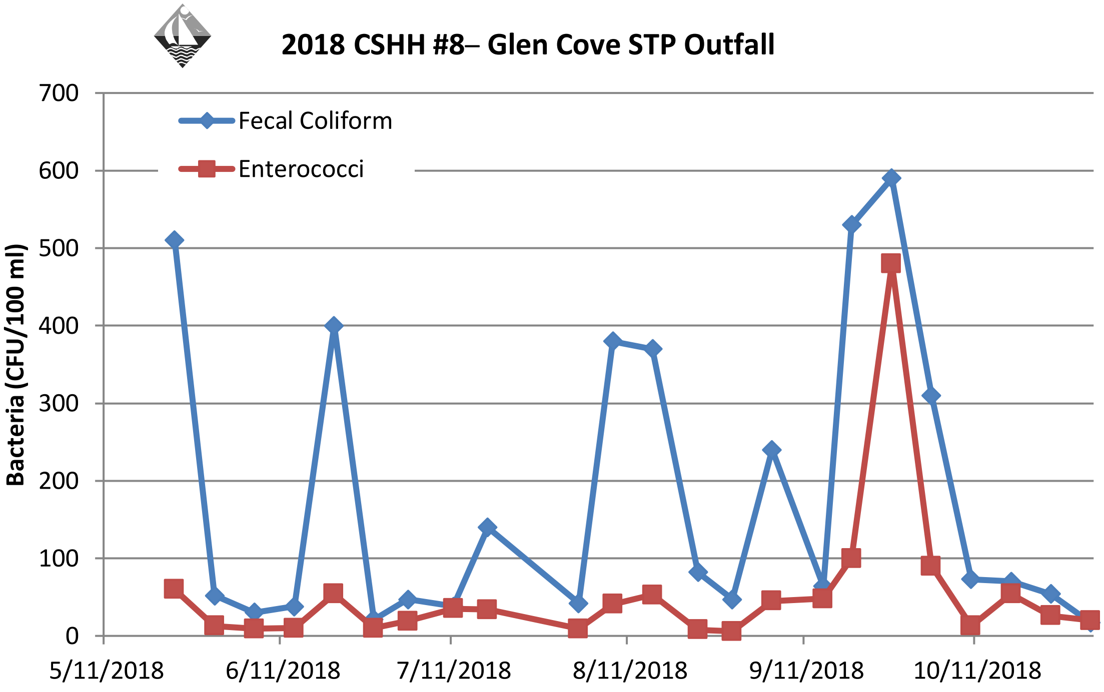
CSHH #15B - Scudder's Pond Weir on the East Side of Shore Road

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log Avg FC**	**CFU/100ml**	**Log Avg Ent**
10/31/18	--	--	90.00	83.05
10/24/18	50.00	337.40	28.00	**215.77**
10/17/18	150.00	914.64	32.00	**750.57**
10/10/18	360.00	**1210.36**	**590.00**	**798.55**
9/26/18	**4800.00**	**1093.69**	**4100.00**	**417.30**
9/19/18	**2700.00**	668.00	**4100.00**	**194.84**
9/14/18	460.00	748.60	41.00	56.50
9/5/18	240.00	**1201.11**	44.00	**202.96**
8/15/18	**3800.00**	341.78	100.00	83.18
8/8/18	**1900.00**	130.19	**1900.00**	63.52
8/2/18	35.00	86.48	18.00	18.93
7/17/18	54.00	116.19	14.00	18.74
7/11/18	80.00	110.50	34.00	11.06
7/3/18	370.00	102.89	15.00	8.82
6/27/18	250.00	83.47	12.00	8.14
6/20/18	53.00	95.88	27.00	15.05
6/13/18	42.00	111.20	1.00	13.00
6/6/18	56.00	153.83	11.00	30.58
5/30/18	130.00	254.95	10.00	50.99
5/23/18	500	0	260	0

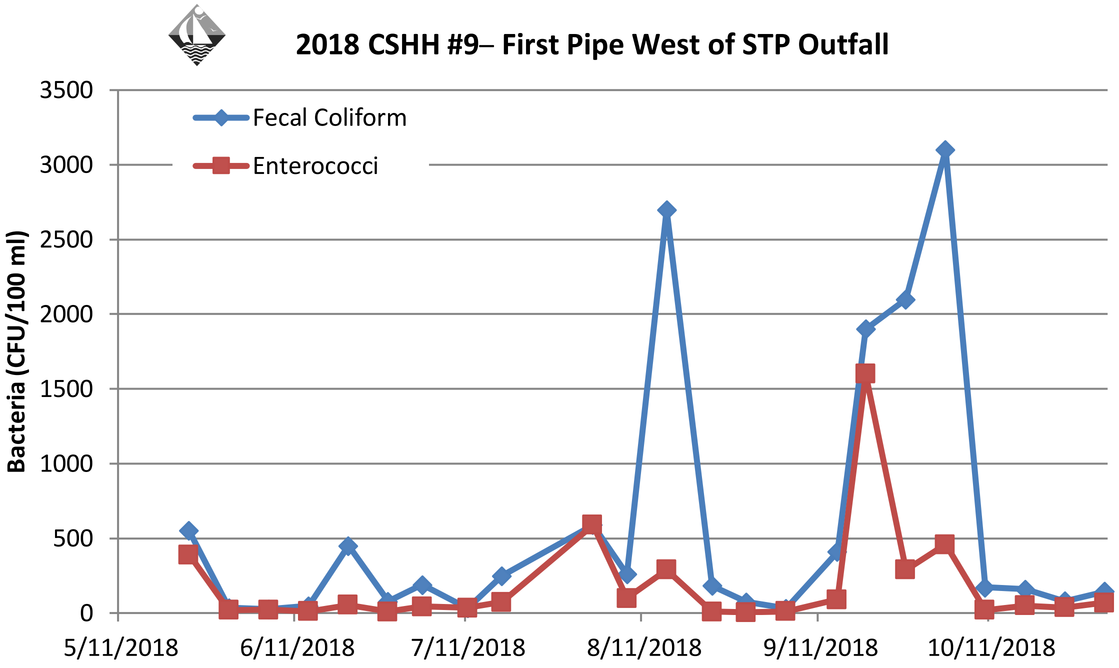
Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

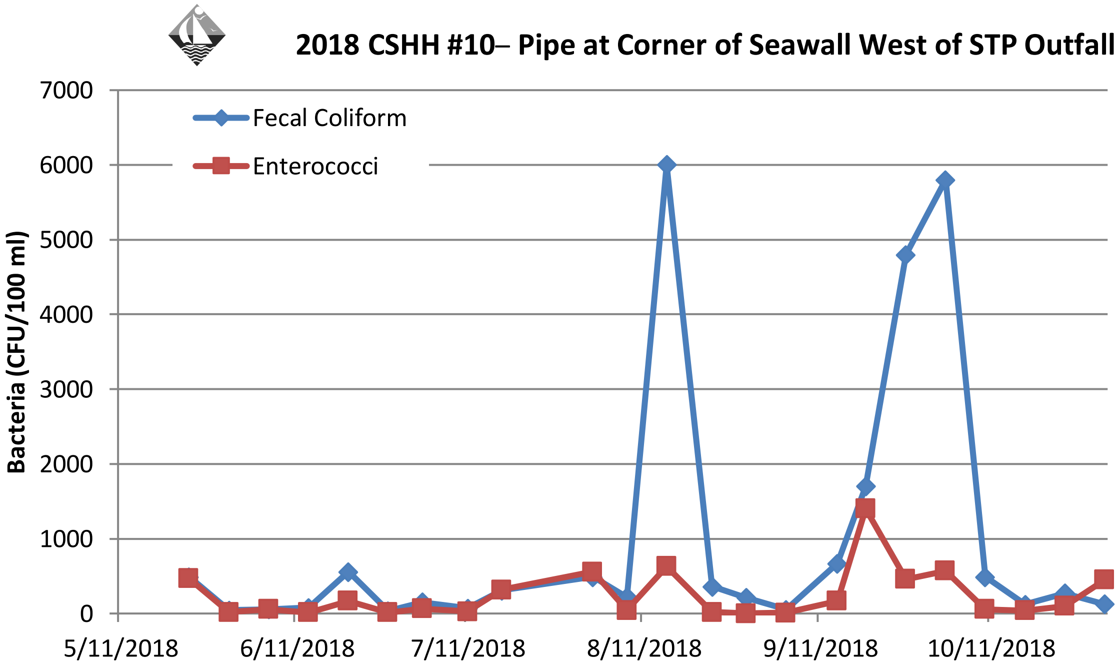
2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Graphs

For each of the following graphs in this section, note that the NYS shellfish bed closure standard uses fecal coliform as the indicator bacteria, which may not exceed 1,000 CFU/100 ml, and the NYS beach closure standard uses entercocci as an indicator bacteria, which may not exceed 104 CFU/100 ml.

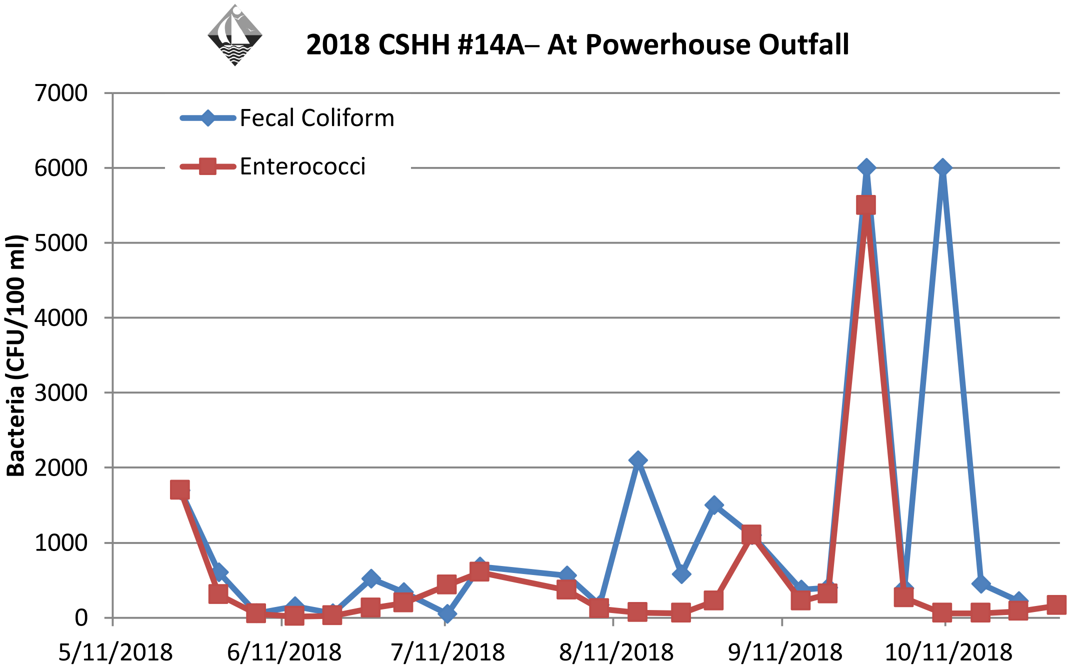


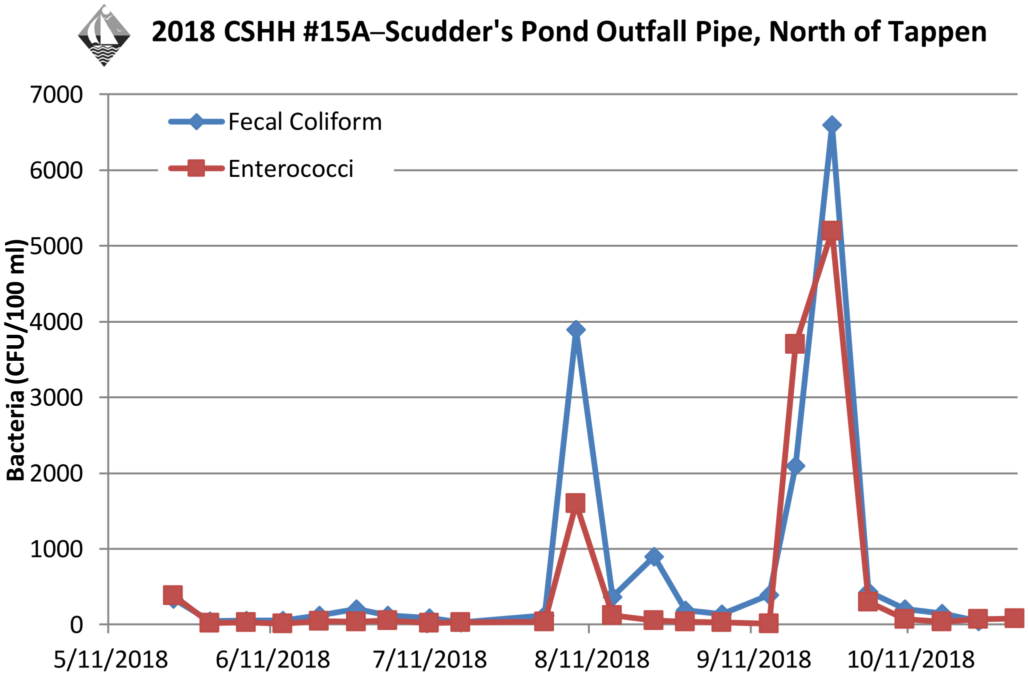
2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Graphs



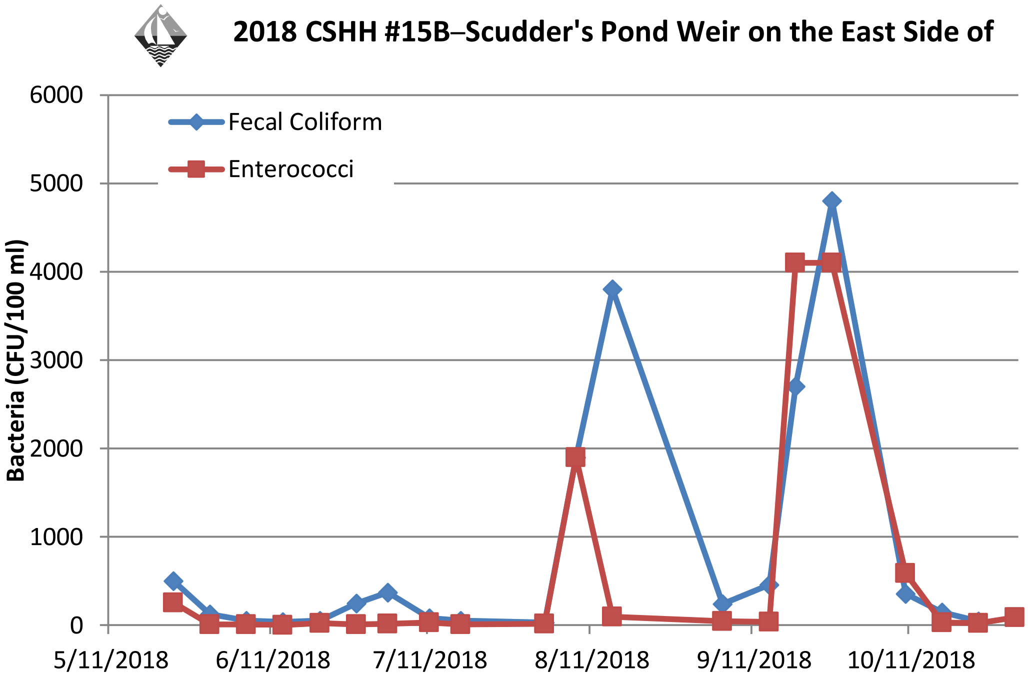


2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Graphs





2018 Scudder's Pond and Powerhouse Drain Outfalls Regular Season Monitoring Bacteria Graphs



2018-2019 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Data

CSHH #14A - At Powerhouse Outfall

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml.**	**Log AvgFC**	**CFU/100ml.**	**Log AvgEnt**
4/25/2019	**1700.00**	**3116.70**	**130.00**	0.00
4/15/2019	**6800.00**	**1472.37**	0.10	3.61
4/10/2019	**5300.00**	**1435.97**	59.00	9.15
4/4/2019	**1600.00**	**1272.83**	9.00	9.12
3/28/2019	**3000.00**	**1046.11**	12.00	5.02
3/21/2019	40.00	**1031.77**	8.00	15.03
3/14/2019	**6000.00**	**2881.86**	**5200.00**	48.38
3/7/2019	**2900.00**	**2357.91**	0.10	13.51
2/28/2019	600.00	**2727.05**	0.10	5.49
2/21/2019	**2800.00**	**2527.08**	**1200.00**	13.79
2/13/2019	**6800.00**	**2923.30**	0.10	5.74
2/6/2019	**2200.00**	**1576.32**	**6001.00**	5.91
1/30/2019	**6001.00**	903.37	0.10	5.91
1/23/2019	410.00	791.58	55.00	20.87
1/16/2019	**5800.00**	659.03	36.00	10.35
1/9/2019	310.00	386.04	0.10	10.35
1/3/2019	136.00	281.58	0.10	1.15
12/28/2018	**3100.00**	504.05	0.10	1.15
12/20/2018	164.00	320.08	8.00	0.78
12/13/2018	400.00	232.93	0.10	0.24
12/6/2018	64.00	209.15	1.00	0.38
11/29/2018	**2500.00**	310.38	0.10	0.38
11/15/2018	46.00	109.36	26.00	1.16
11/8/2018	260.00	0.00	2.00	0.88

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018-2019 Scudder's Pond and Powerhouse Drain Outfalls Winter-Monitoring Bacteria Data

CSHH #15A - Scudder's Pond Outfall Pipe, North of Tappen Beach Pool Area

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml**	**Log AvgFC**	**CFU/100ml**	**Log AvgEnt**
4/25/19	22.00	38.96	0.10	0.10
4/15/19	69.00	0.00	0.10	0.00
3/14/19	7.00	0.00	0.10	0.00
2/6/19	1.00	0.00	0.10	0.00
1/3/19	43.00	30.05	0.10	0.32
12/13/18	21.00	35.20	1.00	7.14
11/29/18	59.00	0.00	51.00	0.00

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

	Fecal Coliform		*Enterococci*	
Date	**CFU/100ml.**	**Log AvgFC**	**CFU/100ml.**	**Log AvgEnt**
4/25/19	26.00	0.00	0.10	0.00
3/14/19	0.10	0.00	0.10	0.00
2/6/19	1.00	0.00	0.10	0.00
1/3/19	34.00	40.82	0.10	0.10
12/13/18	49.00	0.00	0.10	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

Village Club of Sands Point

	Enterococci	
Date	**CFU/100ml.**	**Log Avg Ent**
8/27/18	21.00	5.41
8/22/18	5.00	8.32
8/13/18	**190.00**	5.19
8/8/18	34.00	5.76
8/6/18	2.00	4.73
8/1/18	1.00	3.39
7/30/18	0.10	3.95
7/25/18	59.00	5.87
7/23/18	60.00	4.40
7/18/18	0.10	1.42
7/16/18	6.00	1.98
7/11/18	**280.00**	1.50
7/9/18	10.00	0.78
7/2/18	0.10	0.65
6/27/18	1.00	0.65
6/25/18	14.00	0.61
6/20/18	0.10	0.37
6/18/18	0.10	0.44
6/13/18	0.10	1.15
6/11/18	10.00	1.55
6/6/18	0.10	0.69
6/4/18	14.00	0.87
5/30/18	0.10	0.40
5/23/18	1.00	0.44
5/21/18	0.10	0.40
5/16/18	61.00	0.60
5/14/18	4.00	0.36
5/9/18	0.10	0.22
5/7/18	0.10	0.24
5/2/18	0.10	0.26
4/30/18	0.10	0.30
4/25/18	1.00	0.37
4/24/18	0.10	0.30
4/18/18	0.10	0.39
4/16/18	24.00	0.62
4/11/18	0.10	0.10
4/9/18	0.10	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

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

	Enterococci	
Date	**CFU/100ml.**	**Log Avg Ent**
8/29/18	9.00	8.72
8/27/18	12.00	8.69
8/22/18	4.00	7.79
8/20/18	4.00	8.39
8/15/18	1.00	11.25
8/13/18	82.00	14.72
8/8/18	**1000.00**	13.90
8/6/18	1.00	8.64
8/1/18	9.00	10.33
7/30/18	2.00	10.51
7/25/18	7.00	13.03
7/23/18	5.00	14.08
7/18/18	19.00	6.80
7/16/18	33.00	5.98
7/11/18	**340.00**	4.63
7/9/18	2.00	2.71
7/2/18	5.00	3.76
6/27/18	5.00	4.31
6/25/18	29.00	4.23
6/20/18	1.00	1.92
6/18/18	0.10	2.08
6/13/18	2.00	2.98
6/11/18	10.00	3.13
6/6/18	2.00	1.65
6/4/18	52.00	1.61
5/30/18	17.00	0.59
5/23/18	1.00	0.40
5/21/18	0.10	0.36
5/16/18	52.00	0.70
5/14/18	0.10	0.44
5/9/18	0.10	0.79
5/7/18	1.00	0.99
5/2/18	0.10	0.99
4/30/18	0.10	1.37
4/25/18	2.00	2.13
4/24/18	0.10	2.15
4/18/18	1.00	4.64
4/16/18	29.00	7.74
4/11/18	**160.00**	4.00
4/9/18	0.10	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

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

	Enterococci	
Date	**CFU/100ml.**	**Log Avg Ent**
8/29/18	70.00	2.61
8/27/18	0.10	1.81
8/22/18	0.10	2.47
8/20/18	19.00	3.53
8/15/18	2.00	3.79
8/13/18	28.00	4.06
8/8/18	5.00	2.76
8/6/18	4.00	2.59
8/1/18	1.00	2.79
7/30/18	1.00	3.18
7/25/18	1.00	4.80
7/23/18	4.00	5.84
7/18/18	15.00	3.60
7/16/18	9.00	3.01
7/11/18	24.00	2.54
7/9/18	0.10	1.92
7/2/18	8.00	2.30
6/27/18	1.00	1.41
6/25/18	**130.00**	1.48
6/20/18	3.00	0.64
6/18/18	0.10	0.53
6/13/18	0.10	0.97
6/11/18	58.00	1.29
6/6/18	0.10	0.48
6/4/18	10.00	0.58
5/30/18	0.10	0.37
5/23/18	1.00	0.41
5/21/18	0.10	0.37
5/16/18	13.00	0.57
5/14/18	1.00	0.40
5/9/18	0.10	0.28
5/7/18	0.10	0.31
5/2/18	0.10	0.36
4/30/18	1.00	0.43
4/25/18	1.00	0.37
4/24/18	0.10	0.31
4/18/18	0.10	0.41
4/16/18	27.00	0.65
4/11/18	0.10	0.10
4/9/18	0.10	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

Tappen Beach

	Enterococci	
Date	**CFU/100ml.**	**Log Avg Ent**
8/29/18	10.00	2.22
8/27/18	1.00	1.88
8/22/18	38.00	2.83
8/20/18	4.00	2.12
8/15/18	2.00	2.49
8/13/18	48.00	2.55
8/8/18	2.00	1.86
8/6/18	1.00	1.85
8/1/18	0.10	1.85
7/30/18	0.10	2.66
7/25/18	7.00	6.67
7/23/18	16.00	6.63
7/18/18	21.00	2.37
7/16/18	2.00	1.80
7/11/18	54.00	3.42
7/9/18	0.10	2.42
7/2/18	1.00	2.92
6/27/18	33.00	3.73
6/25/18	31.00	2.84
6/20/18	0.10	1.03
6/18/18	0.10	1.38
6/13/18	55.00	2.41
6/11/18	21.00	1.63
6/6/18	0.10	0.96
6/4/18	13.00	1.28
5/30/18	9.00	1.20
5/23/18	0.10	0.81
5/21/18	0.10	1.02
5/16/18	4.00	2.15
5/14/18	5.00	2.00
5/9/18	3.00	1.00
5/7/18	0.10	0.89
5/2/18	0.10	1.17
4/30/18	99.00	1.66
4/25/18	2.00	0.84
4/24/18	0.10	0.71
4/18/18	1.00	1.15
4/16/18	**176.00**	1.21
4/11/18	0.10	0.10
4/9/18	0.10	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

Sea Cliff Beach

	Enterococci	
Date	**CFU/100ml.**	**Log Avg Ent**
8/29/18	39.00	5.33
8/27/18	1.00	4.27
8/22/18	13.00	7.53
8/20/18	8.00	7.09
8/15/18	5.00	6.70
8/13/18	89.00	6.92
8/8/18	17.00	4.89
8/6/18	6.00	4.25
8/1/18	1.00	2.70
7/30/18	0.10	3.06
7/25/18	48.00	6.22
7/23/18	26.00	4.82
7/18/18	16.00	3.83
7/16/18	2.00	3.21
7/11/18	19.00	3.88
7/9/18	1.00	3.19
7/2/18	0.10	2.59
6/27/18	4.00	4.92
6/25/18	46.00	5.05
6/20/18	1.00	2.41
6/18/18	16.00	2.69
6/13/18	6.00	2.00
6/11/18	6.00	1.75
6/6/18	0.10	1.04
6/4/18	5.00	1.40
5/30/18	32.00	0.67
5/23/18	3.00	0.39
5/21/18	0.10	0.31
5/16/18	3.00	0.60
5/14/18	1.00	0.50
5/9/18	1.00	0.34
5/7/18	0.10	0.30
5/2/18	0.10	0.34
4/30/18	0.10	0.41
4/25/18	1.00	0.52
4/24/18	0.10	0.45
4/18/18	0.10	0.66
4/16/18	**192.00**	1.24

	Enterococci	
Date	**CFU/100ml.**	**Log Avg Ent**
4/11/18	0.10	0.10
4/9/18	0.10	0.00

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

Morgan Memorial Beach

	Enterococci	
Date	**CFU/100ml.**	**Log Avg Ent**
8/29/18	3.00	0.00
8/28/18	1.00	1.73
8/27/18	0.10	0.67
8/22/18	0.10	0.42
8/21/18	0.10	0.31
8/15/18	3.00	0.46
8/14/18	0.10	0.37
8/13/18	0.10	0.31
8/8/18	1.00	0.27
8/7/18	2.00	0.34
8/1/18	5.00	0.44
7/31/18	1.00	0.44
7/30/18	2.00	0.51
7/25/18	2.00	0.57
7/24/18	0.10	0.57
7/23/18	4.00	0.66
7/18/18	**180.00**	1.45
7/17/18	1.00	1.41
7/16/18	2.00	1.44
7/12/18	3.00	2.25
7/11/18	1.00	2.12
7/10/18	5.00	2.28
7/9/18	5.00	2.43
7/3/18	48.00	3.73
7/2/18	13.00	4.18
6/27/18	1.00	3.71
6/26/18	8.00	5.48
6/25/18	15.00	5.96
6/19/18	35.00	6.75
6/18/18	17.00	7.34
6/12/18	**140.00**	9.39
6/11/18	70.00	12.20
6/6/18	34.00	16.37
6/5/18	6.00	15.16
6/4/18	**170.00**	18.01
5/30/18	7.00	20.40
5/29/18	1.00	16.45
5/23/18	15.00	16.35
5/22/18	3.00	16.66
5/21/18	3.00	14.74
5/16/18	2.00	12.91
5/15/18	14.00	13.29
5/14/18	21.00	13.70
5/9/18	18.00	9.16
5/8/18	0.10	6.47
5/7/18	19.00	6.99
5/2/18	0.10	3.34
5/1/18	70.00	4.22
4/24/18	1.00	3.59
4/17/18	3.00	3.53
4/10/18	3.00	3.49

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

Crescent Beach

	Enterococci			Enterococci	
Date	**CFU/100ml.**	**Log Avg Ent**	**Date**	**CFU/100ml.**	**Log Av g Ent**
9/27/18	3.00	0.00	8/8/18	18.00	1.34
9/27/18	1.00	1.73	8/8/18	1.00	1.33
9/27/18	0.10	0.67	8/8/18	5.00	1.38
9/20/18	0.10	0.42	8/7/18	21.00	1.88
9/20/18	0.10	0.31	8/7/18	12.00	1.98
9/20/18	0.10	0.26	8/7/18	1.00	1.94
9/13/18	0.10	0.23	8/1/18	17.00	2.06
9/13/18	0.10	0.20	8/1/18	20.00	2.19
9/13/18	0.10	0.19	8/1/18	26.00	2.33
9/5/18	1.00	0.22	7/31/18	**310.00**	3.83
9/5/18	1.00	0.26	7/31/18	**210.00**	4.29
9/5/18	1.00	0.29	7/31/18	**190.00**	4.77
8/29/18	3.00	0.34	7/30/18	27.00	5.00
8/29/18	10.00	0.44	7/30/18	24.00	5.21
8/29/18	3.00	0.50	7/30/18	19.00	5.39
8/28/18	0.10	0.45	7/25/18	2.00	5.25
8/28/18	0.10	0.41	7/25/18	2.00	5.13
8/28/18	0.10	0.38	7/25/18	1.00	4.94
8/27/18	0.10	0.35	7/24/18	**110.00**	10.85
8/27/18	0.10	0.33	7/24/18	43.00	11.29
8/27/18	0.10	0.31	7/24/18	16.00	11.40
8/22/18	3.00	0.31	7/23/18	51.00	13.08
8/22/18	2.00	0.34	7/23/18	**180.00**	14.32
8/22/18	9.00	0.40	7/23/18	56.00	14.98
8/21/18	44.00	0.50	7/18/18	0.10	12.75
8/21/18	10.00	0.57	7/18/18	4.00	12.29
8/21/18	43.00	0.68	7/18/18	2.00	11.63
8/15/18	16.00	0.77	7/17/18	11.00	13.47
8/15/18	1.00	0.78	7/17/18	8.00	13.23
8/15/18	19.00	0.88	7/17/18	26.00	13.53
8/14/18	10.00	0.96	7/16/18	13.00	15.21
8/14/18	6.00	1.02	7/16/18	9.00	14.94
8/14/18	3.00	1.06	7/16/18	8.00	14.63
8/13/18	6.00	1.12	7/13/18	1.00	13.42
8/13/18	4.00	1.16	7/13/18	5.00	13.01
8/13/18	9.00	1.24	7/13/18	8.00	12.82

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

	Enterococci	
Date	**CFU/100ml.**	**Log AvgEnt**
7/11/18	7.00	12.59
7/11/18	17.00	12.70
7/11/18	15.00	12.76
7/10/18	5.00	12.65
7/10/18	3.00	12.09
7/10/18	14.00	12.14
7/3/18	14.00	10.14
7/3/18	8.00	10.04
7/3/18	8.00	9.96
6/27/18	34.00	10.41
6/27/18	56.00	11.03
6/27/18	32.00	11.43
6/26/18	1.00	9.10
6/26/18	13.00	9.22
6/26/18	38.00	9.66
6/25/18	4.00	9.39
6/25/18	46.00	9.87
6/25/18	49.00	10.36
6/22/18	13.00	10.43
6/22/18	14.00	10.52
6/22/18	12.00	10.56
6/19/18	**6001.00**	12.53
6/19/18	**1600.00**	14.24
6/19/18	**6001.00**	16.62
6/18/18	**240.00**	21.04
6/18/18	**290.00**	22.84
6/18/18	**360.00**	24.83
6/12/18	34.00	25.06
6/12/18	64.00	25.74
6/12/18	8.00	24.91
6/6/18	55.00	25.45
6/6/18	60.00	26.03
6/6/18	52.00	26.50
6/5/18	**110.00**	40.18
6/5/18	56.00	40.60
6/5/18	13.00	39.22
6/4/18	15.00	38.13
6/4/18	14.00	37.05
6/4/18	6.00	35.22
5/30/18	2.00	32.60
5/30/18	4.00	30.85
5/30/18	4.00	29.27
5/29/18	74.00	34.16
5/29/18	**120.00**	35.30
5/29/18	67.00	35.89
5/23/18	**320.00**	37.91
5/23/18	**1600.00**	41.53
5/23/18	**480.00**	44.02
5/22/18	68.00	59.91
5/22/18	71.00	60.20
5/22/18	**120.00**	61.37
5/21/18	21.00	59.62
5/21/18	14.00	57.39
5/21/18	14.00	55.35
5/16/18	49.00	55.18
5/16/18	43.00	54.84
5/16/18	53.00	54.80
5/15/18	0.10	38.68
5/15/18	0.10	32.62
5/15/18	1.00	29.61
5/14/18	20.00	29.30
5/14/18	18.00	28.93
5/14/18	6.00	27.78
5/9/18	9.00	20.08
5/9/18	14.00	19.86
5/9/18	7.00	19.24
5/8/18	1.00	17.64
5/8/18	2.00	16.57
5/8/18	5.00	16.03
5/7/18	1.00	14.87

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Beach-Monitoring Bacteria Data

Crescent Beach (cont.)

	Enterococci	
Date	**CFU/100ml.**	**Log AvgEnt**
5/7/18	4.00	14.37
5/7/18	16.00	14.41
5/2/18	1.00	14.15
5/2/18	0.10	12.12
5/2/18	3.00	11.62
5/1/18	35.00	4.69
5/1/18	29.00	5.03
5/1/18	49.00	5.47
4/24/18	**380.00**	4.26
4/24/18	3.00	4.19
4/24/18	**140.00**	4.85
4/10/18	4.00	6.30
4/10/18	6.00	6.28
4/10/18	11.00	6.48

Note: CFU refers to the number of colony forming units, or the number of bacterial cells in the water sample. Log AvgFC (log average for fecal coliform) and Log AvgEnt (log average for enterococci) refer to the running seasonal average of bacteria results at each location. Boldfaced, italicized values exceed the NYS shellfish bed closure standards of 1,000 CFU/100 ml for fecal coliform and 200 Log AvgFC or NYS beach closure standards of 104 CFU/100 ml for enterococci and 35 Log AvgEnt.

2018 Sea Cliff Precipitation Data

CSHH 2018 (JANUARY-DECEMBER) PRECIPITATION DATA FOR SEA CLIFF

JANUARY	AMT (MM)	AMT (IN)	MARCH	AMT (MM)	AMT (IN)	MAY	AMT (MM)	AMT (IN)	JULY	AMT (MM)	AMT (IN)	SEPTEMBER	AMT (MM)	AMT (IN)	NOVEMBER	AMT (MM)	AMT (IN)
4**blizzard	28.19	1.11	1	6.35	0.25	3	1.52	0.06	3	1.02	0.04	6	7.87	0.31	2	2.54	0.10
8*	2.54	0.10	2+*	63.75	2.51	10	4.32	0.17	4	0.51	0.02	8	1.27	0.05	3	8.64	0.34
12	27.18	1.07	7*	28.70	1.13	12	6.35	0.25	6	3.30	0.13	9	8.89	0.35	5	18.80	0.74
13	4.57	0.18	9T	0.00	0.00	13	3.56	0.14	15A†	13.46	0.53	10	28.70	1.13	6	17.02	0.67
17*	5.59	0.22	13**	6.35	0.25	14T	0.00	0.00	17C†	26.92	1.06	11	9.40	0.37	9	21.34	0.84
22	1.27	0.05	14T**	0.00	0.00	15	9.40	0.37	21	2.54	0.10	12	13.97	0.55	13	31.50	1.24
23	11.18	0.44	15*	2.54	0.10	16	16.51	0.65	22A†	24.13	0.95	13	1.52	0.06	15*	55.37	2.18
28	6.86	0.27	16T**	0.00	0.00	17	4.32	0.17	23†	1.27	0.05	17T	0.00	0.00	19T	0.00	0.00
29.T	0.00	0.00	21*	35.56	1.40	19	19.81	0.78	25C†	25.65	1.01	18	28.45	1.12	21T	0.00	0.00
30*	12.70	0.50	22*	25.40	1.00	22	6.35	0.25	27	5.08	0.20	25	18.03	0.71	24	25.40	1.00
			25T	0.00	0.00	23	2.54	0.10				26	3.05	0.12	25	18.54	0.73
			29	0.51	0.02	26	10.67	0.42				27	13.21	0.52	26	27.69	1.09
			30	3.56	0.14	27†	14.99	0.59				28	24.38	0.96	28Tsnow	0.00	0.00
						31	2.29	0.09							30	1.78	0.07
																.	
TOTAL	**100.08**	**3.94**	**TOTAL**	**172.72**	**6.80**	**TOTAL**	**102.62**	**4.04**	**TOTAL**	**103.89**	**4.09**	**TOTAL**	**158.75**	**6.25**	**TOTAL**	**228.60**	**9.00**

FEBRUARY	AMT (MM)	AMT (IN)	APRIL	AMT (MM)	AMT (IN)	JUNE	AMT (MM)	AMT (IN)	AUGUST	AMT (MM)	AMT (IN)	OCTOBER	AMT (MM)	AMT (IN)	DECEMBER	AMT (MM)	AMT (IN)
2	6.35	0.25	1T	0.00	0.00	1	4.57	0.18	1	3.05	0.12	2	11.94	0.47	1	3.81	0.15
4	29.21	1.15	2*	38.10	1.50	3	0.76	0.03	2T	0.00	0.00	4	1.52	0.06	2	19.05	0.75
5	1.27	0.05	3	8.38	0.33	4†	13.46	0.53	3T	0.00	0.00	8	0.25	0.01	8Tsnow	0.00	0.00
7	23.88	0.94	4	3.30	0.13	5	0.51	0.02	4B†	17.02	0.67	9	0.25	0.01	13*	0.76	0.03
9T**	0.00	0.00	6	2.03	0.08	10	0.51	0.02	7	9.14	0.36	11	30.23	1.19	14	5.08	0.20
10	8.89	0.35	10	1.27	0.05	13	1.52	0.06	8A†	10.41	0.41	12	20.57	0.81	15	5.08	0.20
11	33.02	1.30	15	2.29	0.09	18	2.29	0.09	11B†	65.53	2.58	13	3.56	0.14	16	34.29	1.35
12	0.25	0.01	16	61.72	2.43	19	1.27	0.05	13C	11.43	0.45	15	2.79	0.11	20	4.83	0.19
14	0.76	0.03	17T	0.00	0.00	21†	22.86	0.90	14C	3.30	0.13	20	2.79	0.11	21	53.85	2.12
15	5.84	0.23	19	5.59	0.22	22T	0.00	0.00	17C	3.81	0.15	21	0.51	0.02	22T	0.00	0.00
16	4.57	0.18	25	9.40	0.37	23	0.76	0.03	18A†	16.26	0.64	23T	0.00	0.00	24	2.79	0.11
17*	25.40	1.00	26	1.27	0.05	24	0.76	0.03	19T	0.00	0.00	27	34.29	1.35	28	24.38	0.96
19	1.27	0.05	27	2.03	0.08	28A†	26.67	1.05	20	0.25	0.01	29	3.56	0.14	30**	0.76	0.03
21	2.29	0.09	28T	0.00	0.00				22A	7.11	0.28				31	33.02	1.30
22	3.81	0.15	29	3.30	0.13				31T	0.00	0.00						
23	3.30	0.13	30	0.51	0.02												
24	3.30	0.13															
25	22.35	0.88															
TOTAL	**175.77**	**6.92**	**TOTAL**	**139.19**	**5.48**	**TOTAL**	**75.95**	**2.99**	**TOTAL**	**147.32**	**5.80**	**TOTAL**	**112.27**	**4.42**	**TOTAL**	**187.71**	**7.39**

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.

†Advisory/closure for rain dates: Of the seven beaches that are tested for bacteria by the Nassau County Department of Health, four beaches were closed preemptively following half an inch or more of rain.
Morgan Beach, Sea Cliff Beach, and Tappen Beach were closed on the following ten dates: 6/28, 7/15, 7/18, 7/22, 7/23, 7/26, 8/4, 8/8, 8/11, 8/18. North Hempstead Beach Park, Morgan Bea
on 5/27. North Hempstead Beach Park had two additional closures on 6/4 and 6/21, totaling thirteen preemptive closures for the season. Crescent beach remained closed all season.

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

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

2019 Partial Sea Cliff Precipitation Data

CSHH 2019 (JANUARY-AUGUST) PRECIPITATION DATA FOR SEA CLIFF					
MO/DAY	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**
JAN			**MARCH**		
1	3.30	0.13	1*	3.30	0.13
5	17.27	0.68	2*	21.34	0.84
7T	0.00	0.00	3*	1.52	0.06
8	4.06	0.16	4*	25.40	1.00
9	3.56	0.14	10	14.99	0.59
18**	1.27	0.05	13T	0.00	0.00
19	9.14	0.36	15	6.35	0.25
20	29.97	1.18	21	10.16	0.40
24	50.80	2.00	22	22.86	0.90
27	0.51	0.02	29	0.25	0.01
29	9.14	0.36	31	5.59	0.22
30**	1.27	0.05			
TOTAL	**130.30**	**5.13**	**TOTAL**	**111.8**	**4.40**
MO/DAY	**AMT(MM)**	**AMT(IN)**	**MO/DAY**	**AMT(MM)**	**AMT(IN)**
FEB			**APRIL**		
6	4.57	0.18	2	1.52	0.06
7	7.37	0.29	5	7.11	0.28
8	9.14	0.36	8	7.62	0.30
12,13*	22.86	0.90	9	3.30	0.13
18	4.06	0.16	12	7.62	0.30
20,21*	19.56	0.77	13	15.49	0.61
24	23.62	0.93	14	0.25	0.01
28**	1.27	0.05	15	16.76	0.66
			17	1.27	0.05
			18T	0.00	0.00
			21	0.76	0.03
			22	12.95	0.51
			23	0.51	0.02
			25	6.10	0.24
			26	34.80	1.37
			28	0.51	0.02
			30	4.57	0.18
TOTAL	**92.46**	**3.64**	**TOTAL**	**121.16**	**4.77**

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. †Advisory/closure for rain dates ( ):

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

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

.

1997-2018 Monthly Precipitation

Total Precipitation Per Month (mm)

	June	July	August	September	October
2018	75.95	103.89	147.32	158.75	112.27
2017	124.7	118.4	131.6	64.8	145.5
2016	36.6	134.1	141.9	75.9	147.1
2015	130.3	75.7	76.2	75.2	156.5
2014	81	78.5	93.5	59.5	112
2013	235	69	59	75.5	8.5
2012	175.5	140.5	140.5	117.5	92.5
2011	127.5	48.5	381.5	163	122
2010	50.5	103.5	61.5	97	146
2009	294	150.5	83	69	175
2008	9.5	91	205.5	177.5	118
2007	159.5	198.5	132.5	36.5	136
2006	262	148	89	105	166.5
2005	45	81	41	28.5	460.5
2004	95	214	91	310.5	40
2003	291.5	87	88	194.5	134
2002	180.5	22.5	175.5	116.5 (9/15-9/30)	180
2001	167	70.5	165	94	19.5
2000	146	159	158	125	6
1999	31	21	135	323	92
1998	191	59	145	90	97
1997	47	232	141	84	27 (10/1-15)

Appendix C

2004-2018 Nitrogen Data
2004-2018 Nitrogen Range Graphs

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**
5/23/2018	0.088	0.05	0.12	0.1	0.21	0.23	0.33	1	1.1	0.36	1.6	0.83	0	0.14	1.3	0.13	4.2	4.9	0	0.05	0.05
5/30/2018	0.15	0.05	0.072	0	0	0	0	1	0.91	0.91	0.46	0.53	0.57	0	9.1	0	4.4	3.7	0.05	0.05	0.05
6/6/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.68	0.05	0.18	0.05	1.1	0	0.15	0	1.3	2.5	0.05	0.05	0.05
6/13/2018	0.05	0.05	0.05	0	0	0	0	0.38	0.71	0.83	1.4	1.1	1.9	0	7.8	0.05	3.1	3.2	0.05	0.05	0.05
6/20/2018	0.05	0.05	0.05	0	0	0	0	0.37	0.9	0.2	0.45	0.74	0.73	0	0.49	0	0.67	3.1	0.05	0.05	0.05
6/27/2018	0.05	0.05	0.05	0	0	0.05	0.056	0.32	0.61	0.6	0.78	1.1	0.78	0	7.9	0.05	2.1	2.5	0.05	0.05	0.05
7/3/2018	0.05	0.05	0.05	0	0	0	0	0.27	0.7	0.6	0.51	0.35	1.1	0	9.7	0	1.7	1.9	0.05	0.05	0.05
7/11/2018	0.05	0.05	0.05	0.05	0.11	0.05	0.36	0.36	0.47	0.36	0.11	0.95	0	0.24	8	0.05	1.5	1.6	0.05	0.05	0.05
7/17/2018	0.05	0.05	0.05	0	0	0	0	0.53	1.8	1.5	2.2	1.4	3.1	0	10.2	0	1.7	1.6	0.05	0.05	0.05
8/2/2018	0.066	0.05	0.076	0	0	0	0	0.45	0.8	0.64	0.51	0.42	1.4	0	7.6	0	1.4	1.8	0.05	0.05	0.05
8/8/2018	0.05	0.05	0.05	0.05	0.11	0.095	0.25	0.56	0.74	0.7	0.93	0.4	1.2	0.1	0.32	0.05	1.8	1.8	0.05	0.05	0.05
8/15/2018	0.21	0.077	0.05	0	0	0	0	0.57	1.3	0.71	1.3	1.2	1.5	0	7.9	0	2.1	2.9	0.05	0.05	0.05
8/23/2018	0.089	0.077	0.064	0	0.16	0.099	0.24	0.43	0.72	0.57	0.74	0.71	1.2	0	4.6	0.05	3.1	0	0.071	0.05	0.05
8/29/2018	0.15	0.05	0.05	0	0	0	0	0.64	1.2	0.94	1.2	1.1	0	0	10.5	0	4.3	0	0.079	0.05	0.05
9/5/2018	0.05	0.05	0.068	0.1	0.24	0.22	0.38	0.44	1	0.56	0.3	0.46	0.55	0.1	0.78	0.074	0.53	3.8	0.05	0.05	0.05
9/14/2018	0.2	0.17	0.19	0	0	0	0	0.54	0.87	0.7	0.43	0.43	0.69	0	6.4	0	3.1	2.6	0.16	0.17	0.18
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
9/26/2018	0.31	0.25	0.3	0	0	0	0	0.57	1.1	1.2	0.59	0.63	0.59	0	4.7	0	3.8	4.2	0.25	0.25	0.26
10/2/2018	0.35	0.34	0.41	0	0	0	0	0.6	1.4	1.5	0.79	0.9	2.4	0	0.84	0	1	0	0.38	0.32	0.32
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
10/17/2018	0.34	0.29	0.31	0	0	0	0	1.1	1.4	1.2	1.2	1.2	3.3	0	0.72	0	4.7	5.2	0.29	0.3	0.3
10/24/2018	0.43	0	0	0.41	0.48	0.45	0.54	0.76	1	1	0.88	0.89	1.3	0.48	7.6	0	6.1	5	0	0	0
10/31/2018	0.41	0.26	0.36	0	0	0	0	0.44	0.68	0.5	0.84	0.65	0	0	0.92	0	3.7	5.2	0.23	0.27	0.27

Note: 0.55 is the detection limit, therefore an entry of 0.55 indicates that the real measurement is less than 0.55

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**
5/23/2018	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	0.05	0.05	0.05	0.05	0.05	0	0.05	0.05
5/30/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.062	0	0.05	0.05	0.05	0.05	0.05
6/6/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.05	0	0.05	0.05	0.05	0.05	0.05
6/13/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.12	0.05	0.05	0.05	0.05	0.05	0.05
6/20/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.05	0	0.05	0.053	0.05	0.05	0.05
6/27/2018	0.05	0.05	0.05	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	0.064	0.05	0.05	0.05	0.05	0.05	0.05
7/3/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.092	0	0.05	0.05	0.05	0.05	0.05
7/11/2018	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	0.05	0.15	0.05	0.05	0.05	0.05	0.05	0.05
7/17/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.061	0	0.05	0.05	0.05	0.05	0.05
8/2/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.13	0	0.05	0.05	0.05	0.05	0.05
8/8/2018	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
8/15/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.1	0	0.05	0.05	0.05	0.05	0.05
8/23/2018	0.05	0.05	0.05	0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0	0.067	0.05	0.05	0	0.05	0.05	0.05
8/29/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0	0	0.28	0	0.05	0	0.05	0.05	0.05
9/5/2018	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
9/14/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.14	0	0.05	0.05	0.05	0.05	0.05
9/19/2018	0.078	0.073	0.062	0.083	0.084	0.075	0.067	0.05	0.05	0.05	0.05	0.05	0.05	0.078	0.076	0.072	0.062	0.05	0.083	0.07	0.067
9/26/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.093	0	0.05	0.05	0.05	0.05	0.05
10/2/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.05	0	0.05	0	0.05	0.05	0.05
10/10/2018	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.18	0.05	0.05	0.05	0.05	0.05	0.05
10/17/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0	0.05	0	0.05	0.05	0.05	0.05	0.05
10/24/2018	0.05	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.085	0	0.05	0.05	0	0	0
10/31/2018	0.05	0.05	0.05	0	0	0	0	0.05	0.05	0.05	0.05	0.05	0	0	0.05	0	0.05	0.05	0.05	0.05	0.05

Note: 0.55 is the detection limit, therefore an entry of 0.55 indicates that the real measurement is less than 0.55

2018 Nitrogen Data

Ammonia-Nitrogen																					
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**
5/23/2018	0.23	0.14	0.66	0.23	0.19	0.36	0.36	0.17	0.30	0.64	0.21	0.2	0	0.19	0.34	0.17	0.27	0.29	0	0.13	0.12
5/30/2018	0.19	0.1	0.1	0	0	0	0	0.11	0.11	0.12	0.11	0.10	0.23	0	1.1	0	0.41	0.40	0.1	0.1	0.1
6/6/2018	0.1	0.1	0.1	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0	0.1	0	0.1	0.1	0.1	0.1	0.1
6/13/2018	0.1	0.1	0.1	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0	0.98	0.1	0.12	0.14	0.1	0.1	0.1
6/20/2018	0.1	0.1	0.1	0	0	0	0	0.1	0.1	0.55	0.1	0.1	0.1	0	0.1	0	0.1	0.1	0.1	0.1	0.1
6/27/2018	0.11	0.1	0.1	0	0	0.15	0.13	0.1	0.1	0.13	0.1	0.1	0.24	0	1.3	0.1	0.14	0.12	0.1	0.1	0.1
7/3/2018	0.18	0.1	0.1	0	0	0	0	0.18	0.17	0.27	0.1	0.1	0.19	0	1.1	0	0.14	0.1	0.1	0.1	0.1
7/11/2018	0.1	0.1	0.1	0.1	0.1	0.12	0.1	0.1	0.1	0.1	0.1	0.1	0	0.1	1.3	0.1	0.1	0.1	0.1	0.1	0.1
7/17/2018	0.16	0.1	0.1	0	0	0	0	0.14	0.3	0.55	0.15	0.12	0.14	0	0.99	0	0.1	0.1	0.1	0.1	0.1
8/2/2018	0.28	0.1	0.1	0	0	0	0	0.1	0.14	0.15	0.1	0.1	0.18	0	1.2	0	0.11	0.1	0.1	0.1	0.1
8/8/2018	0.18	0.1	0.1	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	0.1	0.1	0.1	0.1	0.1
8/15/2018	0.34	0.1	0.11	0	0	0	0	0.39	0.88	0.73	0.49	0.39	0.33	0	1.5	0	0.15	0.17	0.1	0.1	0.1
8/23/2018	0.19	0.15	0.1	0	0.27	0.49	0.71	0.21	0.2	0.22	0.23	0.22	0.24	0	0.99	0.11	0.1	0	0.13	0.1	0.12
8/29/2018	0.33	0.1	0.1	0	0	0	0	0.13	0.1	0.11	0.13	0.14	0	0	1	0	0.1	0	0.1	0.11	0.1
9/5/2018	0.22	0.1	0.1	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	0.1	0.1	0.1	0.1
9/14/2018	0.54	0.13	0.1	0	0	0	0	0.17	0.2	0.22	0.2	0.23	0.22	0	1.2	0	0.28	0.38	0.1	0.1	0.1
9/19/2018	0.17	0.1	0.1	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	0.1	0.1	0.1	0.1
9/26/2018	0.27	0.1	0.13	0	0	0	0	0.15	0.13	0.14	0.13	0.14	0.25	0	0.8	0	0.1	0.1	0.1	0.1	0.1
10/2/2018	0.2	0.16	0.16	0	0	0	0	0.2	0.17	0.28	0.22	0.21	0.22	0	0.38	0	0.22	0	0.21	0.28	0.24
10/10/2018	0.25	0.1	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	0.1	0.1	0.1
10/17/2018	0.44	0.1	0.12	0	0	0	0	0.23	0.19	0.2	0.21	0.21	0.19	0	0.29	0	0.1	0.1	0.1	0.1	0.1
10/24/2018	0.19	0	0	0.19	0.18	0.18	0.31	0.1	0.14	0.14	0.13	0.14	0.2	0.12	1.4	0	0.1	0.1	0	0	0
10/31/2018	0.13	0.1	0.1	0	0	0	0	0.1	0.1	0.32	0.13	0.14	0	0	0.18	0	0.1	0.1	0.1	0.1	0.1

Note: 0.55 is the detection limit, therefore an entry of 0.55 indicates that the real measurement is less than 0.55

2018 Nitrogen Data

	Total Inorganic Nitrogen (TIN)																					
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**
5/23/2018	0.69	0.45	1.07	0.28	0.24	0.41	0.41	0.66	1.03	1.19	1.10	0.90	0.00	0.24	1.31	0.22	4.02	5.54	0.23	0.45	0.44
5/30/2018	0.67	0.15	0.15	0.41	0.48	0.45	0.54	0.92	1.16	1.17	1.04	1.04	1.58	0.48	8.76	0.00	6.56	5.45	0.15	0.15	0.15
6/6/2018	0.49	0.44	0.46	0.00	0.00	0.00	0.00	1.25	1.55	1.35	1.35	1.35	3.45	0.00	0.87	0.00	4.85	5.35	0.44	0.45	0.45
6/13/2018	0.42	0.53	0.48	0.29	0.35	0.34	0.48	0.67	1.04	1.05	0.92	1.00	1.25	0.32	9.70	0.46	4.87	5.59	0.46	0.45	0.45
6/20/2018	0.50	0.49	0.56	0.00	0.00	0.00	0.00	0.75	1.55	2.10	0.94	1.05	2.55	0.00	0.99	0.00	1.15	0.15	0.53	0.47	0.47
6/27/2018	0.47	0.40	0.45	0.00	0.00	0.20	0.18	0.72	1.25	1.38	0.74	0.78	0.88	0.00	6.06	0.15	3.99	4.37	0.40	0.40	0.41
7/3/2018	0.39	0.28	0.35	0.14	0.14	0.21	0.19	0.51	1.18	0.80	0.35	0.55	0.90	0.19	1.57	0.25	1.15	3.35	0.31	0.27	0.27
7/11/2018	0.35	0.32	0.34	0.15	0.15	0.17	0.15	0.69	1.02	0.85	0.58	0.58	0.69	0.15	7.85	0.15	3.25	2.75	0.31	0.32	0.33
7/17/2018	0.26	0.20	0.22	0.10	0.24	0.22	0.38	0.63	1.35	1.16	0.50	0.63	0.74	0.10	1.83	0.07	0.68	3.95	0.20	0.20	0.20
8/2/2018	0.48	0.20	0.20	0.00	0.00	0.00	0.00	0.79	1.39	1.14	1.35	1.25	0.23	0.00	11.83	0.00	4.46	0.15	0.23	0.20	0.20
8/8/2018	0.32	0.23	0.21	0.27	0.42	0.45	0.74	0.61	0.89	0.74	0.91	0.87	1.40	0.21	4.87	0.24	3.25	0.15	0.22	0.20	0.20
8/15/2018	0.60	0.23	0.21	0.00	0.00	0.00	0.00	1.01	2.23	1.49	1.84	1.64	1.88	0.00	9.50	0.00	2.30	3.12	0.20	0.20	0.20
8/23/2018	0.29	0.25	0.20	0.05	0.43	0.64	1.01	0.82	0.99	0.97	1.21	0.67	1.49	0.10	1.38	0.21	1.95	1.80	0.23	0.20	0.22
8/29/2018	0.45	0.20	0.23	0.00	0.00	0.00	0.00	0.63	0.95	0.80	0.69	0.61	1.40	0.00	8.88	0.00	1.55	1.80	0.20	0.21	0.20
9/5/2018	0.32	0.20	0.20	0.22	0.27	0.50	0.57	0.73	1.97	1.69	2.38	1.59	3.34	0.32	10.46	0.16	1.87	1.75	0.20	0.20	0.20
9/14/2018	0.64	0.23	0.20	0.05	0.11	0.05	0.36	0.58	0.72	0.63	0.36	1.23	0.27	0.24	9.34	0.05	1.83	2.03	0.20	0.20	0.20
9/19/2018	0.30	0.22	0.21	0.24	0.36	0.46	0.67	0.49	0.89	0.85	0.77	0.60	1.47	0.29	10.03	0.26	1.98	2.05	0.23	0.22	0.22
9/26/2018	0.37	0.20	0.23	0.00	0.00	0.05	0.06	0.52	0.79	0.79	0.96	1.29	1.08	0.00	8.79	0.05	2.25	2.65	0.20	0.20	0.20
10/2/2018	0.30	0.26	0.26	0.00	0.00	0.00	0.00	0.62	1.12	0.53	0.72	1.00	1.00	0.00	0.92	0.00	0.94	3.10	0.31	0.38	0.34
10/10/2018	0.35	0.20	0.23	0.20	0.27	0.34	0.40	0.61	0.95	1.07	1.69	1.39	2.27	0.21	9.38	0.24	3.42	3.38	0.20	0.20	0.20
10/17/2018	0.54	0.20	0.22	0.00	0.00	0.00	0.00	0.33	0.92	0.30	0.44	0.31	1.34	0.00	0.49	0.00	1.45	2.65	0.20	0.20	0.20
10/24/2018	0.39	0.05	0.07	0.24	0.23	0.23	0.36	1.15	1.10	1.10	0.64	0.72	0.82	0.17	10.59	0.00	4.55	3.85	0.05	0.05	0.05
10/31/2018	0.27	0.20	0.27	0.10	0.21	0.23	0.33	1.15	1.25	0.73	1.78	1.02	0.00	0.14	1.53	0.13	4.35	5.05	0.15	0.20	0.20

Note: 0.55 is the detection limit, therefore an entry of 0.55 indicates that the real measurement is less than 0.55

2016 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#12**	**CSHH#13**	**CSHH#14**	**CSHH#14a**	**CSHH#15**	**CSHH#15a**	**CSHH#15b**	**CSHH#16**	**CSHH#17**
5/11/2016	0.01	0.03	0.06					0.23		0.00						0.02	0.02
5/19/2016		0.01	0.01					0.01	0.23	0.00			0.03		0.55	0.02	0.01
5/25/2016	0.08	0.01	0.01					0.00							0.29	0.01	0.00
6/1/2016	0.00	0.02	0.07					0.19	0.18	0.19		0.55			0.55	0.01	0.02
6/8/2016	0.08	0.02	0.02					0.39		0.55		0.55			0.55	0.01	0.00
6/15/2016	0.00	0.02		0.00	0.09	0.06	0.00					0.55	0.01	0.55	0.55	0.01	0.01
6/22/2016	0.00	0.04	0.01					0.30		0.49				0.34	0.55	0.00	0.03
6/29/2016	0.02	0.04	0.00	0.01	0.08	0.03	0.07	0.33			0.00	0.04		0.55	0.55	0.01	0.02
7/6/2016	0.06	0.02	0.01					0.27		0.55		0.55		0.55	0.55	0.01	0.02
7/13/2016	0.02	0.03	0.07	0.02	0.01	0.02	0.01				0.01	0.55		0.55	0.55	0.01	0.02
7/20/2016	0.05	0.02	0.01					0.20		0.55		0.55		0.05	0.55	0.01	0.02
7/27/2016	0.02	0.01	0.01					0.34	0.17	0.55		0.52		0.43	0.55	0.01	0.02
8/3/2016	0.07	0.03	0.02	0.04	0.07	0.51	0.07	0.18		0.37	0.03	0.55	0.02	0.55	0.55	0.01	0.02
8/10/2016												0.55		0.55	0.55		
8/17/2016	0.05	0.05	0.04		0.15	0.07	0.07	0.27		0.55	0.07	0.55	0.04	0.55	0.07	0.05	0.03
8/24/2016	0.08	0.07	0.07					0.27		0.45		0.55		0.40	0.55	0.01	0.03
8/31/2016	0.11	0.03	0.01	0.03	0.13	0.09	0.11	0.14				0.55		0.55	0.55	0.03	0.03
9/9/2016	0.12	0.12	0.16					0.37		0.55						0.03	0.07
9/14/2016	0.10	0.08	0.09	0.10	0.14	0.14	0.14	0.26		0.55	0.13	0.25	0.12	0.02	0.04	0.09	0.06
9/21/2016	0.09	0.08	0.10					0.03		0.23		0.55		0.55	0.55	0.10	0.08
	0.55	>0.55															

Note: 0.55 is the detection limit, therefore an entry of 0.55 indicates that the real measurement is less than 0.55

2016 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#12	CSHH#13	CSHH#14	CSHH#14a	CSHH#15	CSHH#15a	CSHH#15b	CSHH#16	CSHH#17
5/11/2016	0.011	0.004	0.003					0.006		0.004						0.005	0.009
5/19/2016		0.003	0.003					0.003	0.005	0.006			0.006		0.047	0.004	0.002
5/25/2016	0.005	0.004	0.004					0.007							0.053	0.003	0.001
6/1/2016	0.001	0.002	0.005					0.006	0.005	0.008		0.010			0.058	0.003	0.001
6/8/2016	0.002	0.002	0.000					0.007		0.019		0.074			0.071	0.000	0.000
6/15/2016	0.002	0.001		0.003	0.003	0.002	0.005					0.008	0.001	0.059	0.055	0.001	0.000
6/22/2016	0.001	0.003	0.005					0.010		0.007				0.073	0.069	0.000	0.002
6/29/2016	0.001	0.000	0.005	0.002	0.003	0.000	0.000	0.008			0.000	0.006		0.034	0.065	0.001	0.002
7/6/2016	0.001	0.001	0.010					0.012		0.007		0.081		0.037	0.043	0.001	0.001
7/13/2016	0.001	0.001	0.002	0.002	0.002	0.002	0.021				0.003	0.028		0.048	0.045	0.001	0.001
7/20/2016	0.001	0.001	0.002					0.001		0.010		0.133		0.055	0.040	0.001	0.002
7/27/2016	0.003	0.002	0.001					0.006	0.002	0.015		0.011		0.048	0.054	0.002	0.003
8/3/2016	0.006	0.003	0.005	0.005	0.006	0.008	0.005	0.007		0.006	0.005	0.119	0.005	0.045	0.056	0.003	0.003
8/10/2016												0.051		0.054	0.045		
8/17/2016	0.013	0.016	0.018		0.016	0.017	0.010	0.011		0.021	0.014	0.151	0.011	0.049	0.051	0.014	0.012
8/24/2016	0.009	0.008	0.021					0.010		0.008		0.051		0.033	0.047	0.005	0.010
8/31/2016	0.021	0.012	0.003	0.012	0.021	0.022	0.026	0.013				0.337		0.038	0.051	0.004	0.005
9/9/2016	0.018	0.029	0.024					0.022		0.007						0.023	0.014
9/14/2016	0.029	0.024	0.021	0.028	0.058	0.053	0.028	0.015		0.012	0.032	0.212	0.025	0.023	0.020	0.026	0.017
9/21/2016	0.021	0.026	0.022					0.017		0.016		0.165		0.023	0.031	0.033	0.027

Note: 0.55 is the detection limit, therefore an entry of 0.55 indicates that the real measurement is less than 0.55

2016 Nitrogen Data

Ammonia-Nitrogen																	
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14a**	**CSHH#15**	**CSHH#15a**	**CSHH#15b**	**CSHH#16**	**CSHH#17**
5/11/2016	0.25	0	0					0		0.25						0.10	
5/19/2016	0.25	0	0					0.10		0.25						0	0.05
5/25/2016	0.25	0.25	0.25					0.10								0.10	0.10
6/1/2016	0.10	0.10	0.25					0.25									0.10
6/8/2016	0.25	0.10	0.10					0.25		0.10							
6/15/2016	0.25	0.25		0.25	0.25	0.25	0.30					0.25	0.25			0.25	
6/22/2016	0.25	0.25						0.50								0.25	0.25
6/29/2016	0.25	0.25	0.25													0.25	0.25
7/6/2016	0.10							0.10									
7/13/2016	0.00	0.00	0.00	0.00	0.10	0.10	0.25				0.00					0.00	0.00
7/20/2016	0.00		0.05					0.00		0.05							0.05
7/27/2016	0.00	0.05	0.00					0.10		0.25						0.00	0.05
8/3/2016	0.25	0.10	0.00					0.25		0.50						0.25	0.10
8/10/2016																	
8/17/2016	0.25	0.25	0.25				0.25	0.50		0.50						0.25	
8/24/2016	0.25	0.25	0.25					0.50		0.50						0.25	0.25
8/31/2016	0.25	0.25	0.25				0.50	0.25								0.25	0.25
9/9/2016	0.50	0.25	0.25					0.50		0.50						0.25	0.25
9/14/2016	0.25	0.25	0.25	0.25	0.50	0.25	0.25	0.25		0.50	0.25					0.25	
9/21/2016	0.50	0.25	0.25					0.25		0.50						0.25	0.25

Note: 0.55 is the detection limit, therefore an entry of 0.55 indicates that the real measurement is less than 0.55

2016 Nitrogen Data

Total Inorganic Nitrogen (TIN)*																	
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#14a**	**CSHH#15**	**CSHH#15a**	**CSHH#15b**	**CSHH#16**	**CSHH#17**
5/11/2016	0.27	0.03	0.06					0.24		0.25						0.13	
5/19/2016		0.01	0.01					0.11		0.26						0.02	0.06
5/25/2016	0.34	0.26	0.26					0.11								0.11	0.10
6/1/2016	0.10	0.12	0.33					0.45									0.12
6/8/2016	0.33	0.12	0.12					0.65		0.67							
6/15/2016	0.25	0.27		0.25	0.34	0.31							0.26			0.26	
6/22/2016	0.25	0.29						0.81								0.25	0.28
6/29/2016	0.27	0.29	0.26													0.26	0.27
7/6/2016	0.16							0.38									
7/13/2016	0.02	0.03	0.07	0.02	0.11	0.12					0.01					0.01	0.02
7/20/2016	0.05		0.06					0.20		0.61							0.07
7/27/2016	0.02	0.06	0.01					0.45		0.82						0.01	0.07
8/3/2016	0.33	0.13	0.03					0.44		0.88						0.26	0.12
8/10/2016																	
8/17/2016	0.31	0.32	0.31					0.78		1.07						0.31	
8/24/2016	0.34	0.33	0.34					0.78		0.96						0.27	0.29
8/31/2016	0.38	0.29	0.26					0.40								0.28	0.29
9/9/2016	0.64	0.40	0.43					0.89		1.06						0.30	0.33
9/14/2016	0.38	0.35	0.36	0.38	0.70	0.44		0.53		1.06	0.41					0.37	
9/21/2016	0.61	0.36	0.37					0.30		0.75						0.38	0.36

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

Note: 0.55 is the detection limit, therefore an entry of 0.55 indicates that the real measurement is less than 0.55

2015 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#12**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#16**	**CSHH#17**
5/7/2015	0.03	0.01	0.00					0.01		0.00			0.01	0.01
5/13/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.03	0.00		0.00	0.00
5/21/2015	0.04	0.02	0.00					0.00		0.04			0.01	0.01
5/27/2015	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01		0.01	0.01		0.02	0.01
6/3/2015	0.09	0.02	0.06					0.48		0.12			0.01	0.01
6/10/2015	0.01	0.01	0.03					0.20		0.55			0.01	0.01
6/17/2015	0.02	0.01	0.00					0.13		0.18			0.02	0.01
6/24/2015	0.03	0.00	0.01					0.29		0.55			0.00	0.00
7/1/2015	0.01	0.00	0.00	0.00	0.01	0.01	0.00				0.00	0.02	0.00	0.00
7/8/2015	0.01	0.02	0.04					0.34					0.02	0.01
7/16/2015	0.02	0.02	0.04					0.13		0.19			0.01	0.00
7/22/2015	0.00	0.02	0.01					0.55		0.01			0.01	0.02
7/29/2015	0.01	0.02	0.03	0.01	0.03	0.02	0.01	0.12		0.39	0.02	0.00	0.02	0.01
8/5/2015	0.07	0.01	0.01					0.20					0.02	0.06
8/13/2015	0.07	0.02	0.01					0.24		0.55			0.01	0.01
8/19/2015	0.02	0.02	0.02					0.01		0.00			0.03	0.00
9/2/2015	0.00	0.00	0.00					0.16		0.00			0.00	0.00
9/9/2015	0.07	0.03	0.04					0.26		0.55			0.04	0.02
9/25/2015	0.02	0.10	0.11	0.03	0.03	0.01	0.02	0.50		0.09	0.03	0.01	0.12	
10/1/2015	0.03	0.07	0.03					0.07		0.02				
10/7/2015	0.12	0.11	0.11	0.09	0.17	0.18	0.32	0.35	0.29	0.29	0.22	0.23	0.14	0.08
10/14/2015	0.18	0.13	0.13					0.23		0.35			0.12	0.12
10/21/2015	0.23	0.24	0.27					0.41		0.43			0.15	0.16
10/29/2015	0.23	0.03	0.18							0.37			0.18	0.14
11/4/2015	0.22	0.04	0.18					0.26		0.52			0.03	0.02

2015 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#12**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#16**	**CSHH#17**
5/7/2015	0.002	0.004	0.004					0.001		0.008			0.004	0.004
5/13/2015	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.035		0.000			0.000	0.002
5/21/2015	0.011	0.003	0.003					0.016		0.045			0.008	0.009
5/27/2015	0.006	0.006	0.004	0.005	0.016	0.005	0.006	0.012		0.023	0.004		0.006	0.007
6/3/2015	0.002	0.001	0.004					0.012		0.001			0.002	0.003
6/10/2015	0.005	0.002	0.004					0.007		0.026			0.004	0.013
6/17/2015	0.006	0.007	0.003					0.015		0.013			0.006	0.000
6/24/2015	0.016	0.004	0.007					0.047		0.033			0.004	0.002
7/1/2015	0.004	0.004	0.002	0.010	0.002	0.005	0.006				0.004	0.002	0.002	0.002
7/8/2015	0.005	0.003	0.006					0.028					0.006	0.004
7/16/2015	0.006	0.000	0.004					0.002		0.017			0.006	0.000
7/22/2015	0.005	0.004	0.005					0.016		0.037			0.000	0.002
7/29/2015	0.005	0.003	0.005	0.001	0.005	0.004	0.008	0.008		0.009	0.001	0.003	0.012	0.002
8/5/2015	0.015	0.001	0.001					0.010					0.005	0.004
8/13/2015	0.012	0.003	0.001					0.009		0.025			0.002	0.003
8/19/2015	0.013	0.002	0.002					0.008		0.007			0.005	0.005
9/2/2015	0.003	0.005	0.001					0.008		0.010			0.005	0.002
9/9/2015	0.020	0.019	0.014					0.012		0.010			0.015	0.013
9/25/2015	0.066	0.065	0.066	0.069	0.062	0.063	0.059	0.059		0.067	0.065	0.063	0.065	
10/1/2015	0.049	0.060	0.057					0.029		0.025				
10/7/2015	0.033	0.038	0.032	0.032	0.031	0.036	0.039	0.032	0.026	0.036	0.043	0.033	0.052	0.034
10/14/2015	0.040	0.045	0.045					0.036		0.024			0.049	0.050
10/21/2015	0.056	0.030	0.049					0.041		0.032			0.074	0.068
10/29/2015	0.061	0.078	0.066							0.028			0.072	0.071
11/4/2015	0.069	0.073	0.071					0.056		0.048			0.073	0.068

2015 Nitrogen Data

Ammonia-Nitrogen														
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#16**	**CSHH#17**
5/7/2015	0													
5/13/2015	0							0						
5/21/2015	0													
5/27/2015	0						0	0						
6/3/2015	0							0						
6/10/2015	0							0						
6/17/2015	0.50	0						0						
6/24/2015	0							0						
7/1/2015	0							0.5						
7/8/2015	0							0						
7/16/2015														
7/22/2015	0													
7/29/2015	0						0.5	0.5						
8/5/2015	0.25		0					0.25						0
8/13/2015	0.50	0.1						0.1		0.5			0.1	0.25
8/19/2015	0.50	0.25	0.25					0.5		0.25				
9/2/2015	0	0.1	0.25							0.25			0.25	0.25
9/9/2015	0.50	0.5	0.5					0.5		0.5			0.25	0.25
9/25/2015	0.50	0.5	0.5	0.5	0.5	0.5	0.1	0.5			0.5	0.5		
10/1/2015	1.00	0.5						1		1				
10/7/2015	1.00	0.5	0.5	0.5	0.5	1	1	0.5			0.5	0.5	0.5	0.5
10/14/2015	0.50	0.5	0.5					0.5		1			0.5	0.5
10/21/2015	0.50	0.5	0.5					0.5		0.5				0.5
10/29/2015	0.25	0	0							0.25			0	0
11/4/2015	0.10	0	0.25					0.1		0.5			0	0

2015 Nitrogen Data

Total Inorganic Nitrogen (TIN)*														
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#12**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#16**	**CSHH#17**
5/7/2015	0.03													
5/13/2015	0.00							0.04						
5/21/2015	0.05													
5/27/2015	0.03						0.02	0.02						
6/3/2015	0.09							0.49						
6/10/2015	0.02							0.21						
6/17/2015	0.53	0.02						0.15						
6/24/2015	0.05							0.34						
7/1/2015	0.01													
7/8/2015	0.02							0.37						
7/16/2015														
7/22/2015	0.01													
7/29/2015	0.02						0.52	0.63						
8/5/2015	0.34		0.01					0.46						
8/13/2015	0.58	0.12						0.35						
8/19/2015	0.53	0.27	0.27					0.52						
9/2/2015	0.00	0.11	0.25											
9/9/2015	0.59	0.55	0.55					0.77						
9/25/2015	0.59	0.67	0.68	0.60	0.59	0.57	0.18	1.06		0.66	0.60			
10/1/2015	1.08	0.63						1.10						
10/7/2015	1.15	0.65	0.64	0.62	0.70	1.22	1.36	0.88		0.83	0.76	0.76		
10/14/2015	0.72	0.68	0.68					0.77						
10/21/2015	0.79	0.77	0.82					0.95						
10/29/2015	0.54	0.11	0.25											
11/4/2015	0.39	0.11	0.50					0.42						

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2014 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#13**	**CSHH#14**	**CSHH#15**
5/21/2014	0.04	0.04	0.03					0.15	0.03		
5/28/2014	0.03	0.02	0.03					0.03	0.04		
6/4/2014	0.05	0.03	0.05					0.09	0.16		
6/11/2014	0.05	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.06	0.04	0.03
6/18/2014	0.05	0.02	0.04					0.41	0.55		
6/26/2014	0.02	0.03	0.02	0.02	0.03	0.03	0.08	0.35	0.50	0.02	0.02
7/2/2014	0.03	0.02	0.02					0.54	0.55		
7/9/2014	0.03	0.01	0.02	0.04	0.10	0.03	0.04	0.41	0.55	0.02	0.02
7/17/2014	0.02	0.02	0.02					0.18	0.03		
7/23/2014	0.05	0.04	0.02	0.02	0.03	0.03	0.04	0.32	0.55	0.01	0.01
7/30/2014	0.04	0.05	0.05					0.03	0.04		
8/6/2014	0.04	0.02	0.02	0.03	0.04	0.05	0.05	0.02	0.02	0.04	0.03
8/14/2014	0.10	0.05	0.07					0.30	0.09		
8/21/2014	0.03	0.03	0.03	0.03	0.06	0.06	0.11	0.20	0.28	0.04	0.04
8/27/2014	0.05	0.03	0.05					0.12	0.50		
9/4/2014	0.03	0.03	0.06					0.06	0.28		
9/10/2014	0.03	0.04	0.05					0.03	0.04		
9/17/2014	0.04	0.03	0.02	0.03	0.05	0.06	0.07	0.08	0.05	0.04	
9/24/2014	0.03	0.04	0.05					0.03	0.04		
10/1/2014	0.10	0.06	0.07					0.20	0.22		
10/9/2014	0.11	0.04	0.03	0.05	0.08	0.07	0.08	0.32	0.45	0.22	0.04
10/15/2014	0.17	0.15	0.20					0.34	0.35		
10/29/2014	0.03	0.02	0.02					0.03	0.03		
11/5/2014	0.22	0.16	0.16	0.15	0.21	0.22	0.01	0.55	0.55		0.12

2014 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#13**	**CSHH#14**	**CSHH#15**
5/21/2014	0.007	0.006	0.005					0.015	0.011		
5/28/2014	0.011	0.006	0.005					0.008	0.007		
6/4/2014	0.007	0.003	0.007					0.008	0.011		
6/11/2014	0.008	0.007	0.006	0.010	0.035	0.026	0.041	0.011	0.009	0.007	0.006
6/18/2014	0.008	0.003	0.008					0.012	0.010		
6/26/2014	0.011	0.009	0.008	0.007	0.009	0.009	0.012	0.007	0.010	0.013	0.004
7/2/2014	0.006	0.003	0.006					0.009	0.008		
7/9/2014	0.006	0.005	0.003	0.007	0.008	0.008	0.010	0.010	0.013	0.008	0.007
7/17/2014	0.007	0.008	0.004					0.006	0.010		
7/23/2014	0.030	0.002	0.003	0.022	0.008	0.029	0.040	0.018	0.017	0.004	0.007
7/30/2014	0.012	0.012	0.008					0.010	0.013		
8/6/2014	0.007	0.002	0.006	0.007	0.008	0.011	0.010	0.008	0.010	0.006	0.005
8/14/2014	0.023	0.011	0.018					0.018	0.010		
8/21/2014	0.007	0.004	0.005	0.008	0.010	0.013	0.011	0.008	0.013	0.008	0.007
8/27/2014	0.008	0.002	0.005					0.008	0.009		
9/4/2014	0.007	0.005	0.013					0.014	0.013		
9/10/2014	0.012	0.012	0.008					0.010	0.013		
9/17/2014	0.007	0.006	0.005	0.010	0.034	0.026	0.040	0.012	0.008	0.007	
9/24/2014	0.011	0.012	0.008					0.010	0.012		
10/1/2014	0.02	0.012	0.017					0.018	0.015		
10/9/2014	0.013	0.01	0.004	0.014	0.015	0.014	0.013	0.008	0.017	0.018	0.010
10/15/2014	0.053	0.053	0.041					0.046	0.037		
10/29/2014	0.021	0.013	0.02					0.023	0.014		
11/5/2014	0.023	0.024	0.015	0.026	0.022	0.017	0.020	0.027	0.012		0.019

2014 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/21/2014	0							0			
5/28/2014	0							0			
6/4/2014	0										
6/11/2014	0							0			
6/18/2014											
6/26/2014	0							0			
7/2/2014	0							0			
7/9/2014	0							0			
7/17/2014	0							0			
7/23/2014	0.25	0.25					0.25	0			
7/30/2014	0							0			
8/6/2014	0						0	0			
8/14/2014	0							0.25			
8/21/2014	0						0	0			
8/27/2014	0							0			
9/4/2014	0							0			
9/10/2014	0							0			
9/17/2014	0						0	0.25			
9/24/2014	0							0			
10/1/2014	0							0			
10/9/2014	0							0			
10/15/2014	0							0			
10/29/2014	0							0			
11/5/2014	0						0	0			

2014 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/21/2014	0.05							0.17			
5/28/2014	0.04							0.04			
6/4/2014	0.06										
6/11/2014	0.06							0.10			
6/18/2014											
6/26/2014	0.03							0.36			
7/2/2014	0.04							0.55			
7/9/2014	0.04							0.42			
7/17/2014	0.03							0.19			
7/23/2014	0.33	0.29					0.33	0.34			
7/30/2014	0.05							0.04			
8/6/2014	0.05						0.06	0.03			
8/14/2014	0.12							0.57			
8/21/2014	0.04						0.12	0.21			
8/27/2014	0.06							0.13			
9/4/2014	0.04							0.07			
9/10/2014	0.04							0.04			
9/17/2014	0.05						0.11	0.34			
9/24/2014	0.04							0.04			
10/1/2014	0.12							0.22			
10/9/2014	0.12							0.33			
10/15/2014	0.22							0.39			
10/29/2014	0.05							0.05			
11/5/2014	0.24						0.03	0.58			

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2013 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#13**	**CSHH#14**	**CSHH#15**
5/10/2013		0.008	0.007					0.010	0.017		
5/15/2013	0.011	0.005	0.007					0.011	0.014		
5/31/2013	0.008	0.008	0.008					0.008	0.009		
6/5/2013	0.007	0.005	0.004	0.008	0.007	0.008	0.011	0.009		0.024	
6/12/2013	0.005	0.003	0.005					0.020	0.032	0.021	
6/19/2013	0.006	0.003	0.005	0.004	0.005	0.006	0.017	0.005	0.008	0.002	
6/26/2013	0.003	0.002	0.003					0.026	0.010		
7/3/2013	0.005	0.007	0.007	0.009	0.009	0.002	0.008	0.008	0.019	0.007	0.009
7/17/2013	0.002	0.003	0.003					0.006	0.011		
7/24/2013	0.007	0.005	0.006					0.019	0.026		
7/31/2013	0.005	0.005	0.005	0.005	0.008	0.009	0.012	0.022	0.019	0.010	
8/8/2013	0.026		0.022	0.015	0.024	0.019	0.021	0.013	0.024	0.019	0.021
8/14/2013	0.009		0.008					0.016	0.016		
8/21/2013	0.006		0.005					0.009	0.010		
8/28/2013	0.007	0.005	0.005					0.006	0.007		
9/4/2013	0.011	0.007	0.008					0.010	0.011		
9/18/2013	0.030	0.020	0.028	0.027	0.027	0.025	0.031	0.029	0.027	0.026	0.026
9/25/2013	0.020	0.007	0.011					0.010	0.012		
10/1/2013	0.013	0.009	0.003	0.014	0.016	0.013	0.013	0.007	0.016	0.017	0.009
10/8/2013	0.021	0.013	0.018					0.017	0.016		
10/15/2013	0.024	0.020	0.021	0.027	0.023	0.025	0.027	0.023	0.018	0.024	0.023
10/22/2013	0.035	0.040	0.035					0.033	0.019		
10/29/2013	0.034	0.038	0.040	0.035	0.035	0.031	0.032	0.032	0.033	0.037	0.037
11/6/2013	0.033	0.036	0.035					0.030	0.022		
11/13/2013	0.032			0.029	0.026	0.029	0.034	0.025	0.021		

2013 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#13**	**CSHH#14**	**CSHH#15**
5/10/2013		0.04	0.04					0.03	0.03		
5/15/2013	0.04	0.04	0.04					0.03	0.03		
5/31/2013	0.04	0.02	0.03					0.13	0.05		
6/5/2013	0.03	0.03	0.03	0.04	0.04	0.05	0.04	0.13		0.04	
6/12/2013	0.04	0.02	0.02					0.54	0.54	0.54	
6/19/2013	0.01	0.02	0.03	0.02	0.02	0.03	0.27	0.25	0.02	0.01	
6/26/2013	0.02	0.03	0.01					0.03	0.01		
7/3/2013	0.04	0.02	0.02	0.03	0.06	0.06	0.04	0.38	0.21	0.05	0.02
7/17/2013	0.02	0.01	0.02					0.15	0.12		
7/24/2013	0.03	0.01	0.02					0.23	0.39		
7/31/2013	0.03	0.03	0.04	0.03	0.03	0.03	0.05	0.35	0.20	0.07	
8/8/2013	0.06		0.03	0.03	0.02	0.03	0.03	0.32	0.54	0.03	0.04
8/14/2013	0.03		0.02					0.30	0.47		
8/21/2013	0.04		0.03					0.03	0.08		
8/28/2013	0.03	0.02	0.01					0.02	0.16		
9/4/2013	0.04	0.03	0.03					0.36	1.06		
9/18/2013	0.13	0.11	0.08	0.03	0.11	0.03	0.12	0.23	0.17	0.08	0.02
9/25/2013	0.08	0.04	0.06					0.10	0.04		
10/1/2013	0.11	0.04	0.02	0.05	0.09	0.06	0.09	0.32	0.46	0.22	0.04
10/8/2013	0.10	0.06	0.08					0.21	0.23		
10/15/2013	0.16	0.15	0.10	0.11	0.14	0.17	0.28	0.28	0.48	0.09	0.07
10/22/2013	0.16	0.15	0.10					0.11	0.14		
10/29/2013	0.15	0.14	0.13	0.16	0.10	0.12	0.11	0.13	0.11	0.13	0.13
11/6/2013	0.18	0.11	0.18					0.40	0.72		
11/13/2013	0.21			0.18	0.43	0.24	0.49	0.29	0.26		
>0.55 = 0.54											

2013 Nitrogen Data

	Ammonia-Nitrogen										
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/10/2013	0	0									
5/15/2013	0							0			
5/31/2013	0							0			
6/5/2013	0							0			
6/12/2013	0							0			
6/19/2013	0							0			
6/26/2013	0								0		
7/3/2013	0.15						0.15	0.25			0.15
7/17/2013	0							0			
7/24/2013	0							0			
7/31/2013	0							0			
8/8/2013	0.5	0.25	0.25	0.25	0.25		0.5	0.5	0.25		
8/14/2013	2.5							0.15			
8/21/2013	0.1		0.25					0.25	0.25		
8/28/2013	0.04	0						0			
9/4/2013	0	0.25	0								
9/18/2013	0.25		0.25			0.25		0.25	0.25	0.25	
9/25/2013	0							0			
10/1/2013	0							0			
10/8/2013	0.25		0.25					0	0.25		
10/15/2013	0						0	0			
10/22/2013	0							0.25			
10/29/2013	0							0			
11/6/2013	0							0			
11/13/2013								0			

Note: 0.55 is the detection limit, therefore an entry of 0.54 indicates that the real measurement is less than 0.55

2013 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/10/2013		0.05									
5/15/2013	0.05							0.04			
5/31/2013	0.05							0.14			
6/5/2013	0.04							0.14			
6/12/2013	0.05							0.56			
6/19/2013	0.02							0.26			
6/26/2013	0.02								0.02		
7/3/2013	0.20						0.20	0.64			0.18
7/17/2013	0.02							0.16			
7/24/2013	0.04							0.25			
7/31/2013	0.04							0.37			
8/8/2013	0.59		0.30	0.30	0.29		0.55	0.83	0.81		
8/14/2013	2.54							0.47			
8/21/2013	0.15		0.29					0.29	0.34		
8/28/2013	0.08	0.03						0.03			
9/4/2013	0.05	0.29	0.04								
9/18/2013	0.41		0.36			0.31		0.51	0.45	0.36	
9/25/2013	0.10							0.11			
10/1/2013	0.12							0.33			
10/8/2013	0.37		0.35					0.23	0.50		
10/15/2013	0.18						0.31	0.30			
10/22/2013	0.20							0.39			
10/29/2013	0.18							0.16			
11/6/2013	0.21							0.43			
11/13/2013								0.32			
* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)											

2012 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#13	CSHH#14	CSHH#15
5/30/2012											
6/6/2012											
6/13/2012	0.008	0.005	0.007	0.008	0.010	0.015	0.024	0.011	0.023	0.014	
6/20/2012	0.006	0.003	0.003					0.005	0.013		
6/27/2012	0.008	0.008	0.007					0.011	0.020		
7/3/2012	0.007	0.005	0.006	0.005	0.006	0.008	0.007	0.007	0.013	0.006	0.003
7/11/2012	0.008	0.008	0.008					0.009	0.012		
7/18/2012	0.006	0.005	0.004	0.006	0.007	0.005	0.014	0.009	0.010	0.008	0.005
7/25/2012	0.007	0.007	0.005					0.011	0.009		
8/1/2012	0.010	0.004	0.009	0.007	0.008	0.021	0.019	0.010	0.014	0.011	0.008
8/8/2012	0.012	0.004	0.004					0.012	0.011		
8/16/2012	0.015	0.010	0.010	0.011	0.016	0.013	0.018	0.014	0.015	0.017	NA
8/22/2012	0.026	0.024	0.021					0.024	0.019		
8/29/2012	0.016	0.030	0.023	0.018	0.021	0.024	0.032	0.023	0.015	0.018	0.018
9/7/2012	0.025	0.030	0.022					0.021	0.029		
9/12/2012	0.040	0.040	0.034	0.045	0.036	0.037	0.107		0.028	0.048	0.033
9/20/2012	0.052	0.055	0.055					0.050	0.046		
10/5/2012	0.054	0.051	0.046					0.051	0.020		
10/12/2012	0.075	0.078	0.075					0.064	0.026		
10/18/2012	0.086	0.107	0.090					0.065	0.060		
10/25/2012	0.088	0.093	0.089					0.076	0.024		

2012 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#13**	**CSHH#14**	**CSHH#15**
5/30/2012											
6/6/2012											
6/13/2012	0.02	0.01	0.02	0.02	0.04	0.04	0.06	0.03	0.05	0.02	
6/20/2012	0.05	0.06	0.05					0.06	0.07		
6/27/2012	0.04	0.03	0.02					0.2	0.37		
7/3/2012	0.02	0.02	0.02	0.03	0.04	0.03	0.05	0.1	0.27	0.03	0.02
7/11/2012	0.02	0.02	0.02					0.02	0.02		
7/18/2012	0.02	0.02	0.03	0.02	0.06	0.02	0.11	0.4	0.27	0.03	0.02
7/25/2012	0.04	0.03	0.02					0.08	0.26		
8/1/2012	0.04	0	0.01	0.02	0.03	0.06	0.19	0.05	0.2	0.03	0.02
8/8/2012	0.03	0.02	0.03					0.16	0.12		
8/16/2012	0.08	0.03	0.07	0.07	0.09	0.05	0.06	0.04	0.51	0.07	NA
8/22/2012	0.03	0.03	0.04					0.04	0.04		
8/29/2012	0.04	0.07	0.08	0.06	0.14	0.07	0.07	0.14	0.1	0.06	0.04
9/7/2012	0.1	0.07	0.08					0.2	0.36		
9/12/2012	0.09	0.11	0.07	0.11	0.13	0.13	0.23		0.37	0.14	0.09
9/20/2012	0.03	0.03	0.02					0.02	0.02		
10/5/2012	0.12	0.1	0.14					0.47	0.02		
10/12/2012	0.15	0.13	0.18					0.48	0.55		
10/18/2012	0.22	0.19	0.27					0.55	0.28		
10/25/2012	0.17	0.16	0.22					0.38	0.55		

2012 Nitrogen Data

	Ammonia-Nitrogen										
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/30/2012	0.05	1.00	0.05					0.00	0.00		
6/6/2012	0.25	0.10	0.25					0.25	0.25		
6/13/2012	0.00						0.00	0.00			
6/20/2012	0.00	0.00						0.00			
6/27/2012	0.00							0.00			
7/3/2012	0.00	0.00	0.00				0.00	0.00			
7/11/2012	0.25	0.25	0.25					0.25	0.00		
7/18/2012	0.25	0.25	0.00	0.00	0.00		0.25	0.25	0.00	0.25	0.25
7/25/2012	0.25	0.25	0.25					0.25	0.25		
8/1/2012	0.25	0.25	0.25					0.25	0.25		0.25
8/8/2012	0.50	0.25	0.25					0.50	0.15		
8/16/2012	0.50		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
8/22/2012	0.25	0.25	0.25					0.50	0.25		
8/29/2012	0.50	0.25		0.50	0.25		0.00	0.25	0.25	0.25	0.25
9/7/2012	0.50	0.25	0.50					0.50			
9/12/2012	0.25	0.25	0.50	0.25	0.25		0.25	0.25		0.25	0.25
9/20/2012	0.50	0.50	0.50					0.50			
10/5/2012	1.00								0.50		
10/12/2012	0.00	0.00	0.00								
10/18/2012	0.00	0.25	0.00					0.00	0.25		
10/25/2012	0.25	0.25	0.25					0.25	0.00		

2012 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/30/2012											
6/6/2012											
6/13/2012	0.03						0.08	0.04			
6/20/2012	0.06	0.06						0.07			
6/27/2012	0.05							0.21			
7/3/2012	0.03	0.03	0.03				0.06	0.11			
7/11/2012	0.28	0.28	0.28					0.28	0.03		
7/18/2012	0.28	0.28	0.03	0.03	0.07		0.37	0.66	0.28	0.29	0.28
7/25/2012	0.30	0.29	0.28					0.34	0.52		
8/1/2012	0.30	0.25	0.27					0.31	0.46		0.28
8/8/2012	0.54	0.27	0.28					0.67	0.28		
8/16/2012	0.60		0.33	0.33	0.36	0.31	0.33	0.30	0.78	0.34	
8/22/2012	0.31	0.30	0.31					0.56	0.31		
8/29/2012	0.56	0.35		0.58	0.41		0.10	0.41	0.37	0.33	0.31
9/7/2012	0.63	0.35	0.60					0.72			
9/12/2012	0.38	0.40	0.60	0.41	0.42		0.59			0.44	0.37
9/20/2012	0.58	0.59	0.58					0.57			
10/5/2012	1.17								0.54		
10/12/2012	0.23	0.21	0.26								
10/18/2012	0.31	0.55	0.36					0.62	0.59		
10/25/2012	0.51	0.50	0.56					0.71	0.57		

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2011 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#13**	**CSHH#14**	**CSHH#15**
5/26/2011	0.018	0.024	0.017	0.018	0.015	0.018	0.017	0.018	0.016	0.018	0.017
6/1/2011	0.007	0.002	0.009					0.007			
6/8/2011	0.007	0.004	0.009					0.010	0.010		
6/15/2011	0.006	0.002	0.009	0.008				0.010	0.008	0.008	
6/22/2011	0.005	0.005	0.013					0.009	0.021		
6/29/2011	0.011	0.007	0.005	0.012	0.009	0.005	0.015	0.011	0.011	0.027	0.004
7/6/2011	0.007	0.007	0.006					0.011	0.008		
7/14/2011	0.008	0.005	0.007	0.009	0.008	0.014	0.018	0.011	0.011	0.008	0.011
7/21/2011	0.006	0.003	0.007					0.008	0.010		
7/27/2011	0.007	0.006	0.004	0.014	0.006	0.007	0.018	0.029	0.012	0.003	0.008
8/3/2011	0.008	0.007	0.007					0.011	0.017		
8/17/2011	0.016	0.008	0.009					0.013	0.018		
8/24/2011	0.005	NA	0.007	0.007	0.009	0.012	0.011	0.010	0.010	0.006	0.007
8/31/2011	0.021	0.020	0.020					0.021	0.020		
9/14/2011	0.028	0.034	0.032					0.032	0.017		
9/21/2011	0.017	0.024	0.013					0.013	0.016		
9/28/2011	0.022	0.019	0.016	0.015	0.019	0.022	0.028	0.023	0.023	0.017	0.017
10/6/2011	0.034	0.032	0.030	0.035	0.035	0.043	0.039	0.038	0.032	0.036	0.035
10/12/2011	0.013	0.022	0.028					0.026	0.009		
10/20/2011	0.035	0.041	0.045					0.026	0.016		
10/26/2011	0.016	0.049	0.016	0.018	0.030	NA	0.023	0.032	0.034	0.032	0.024
11/2/2011	0.043	0.038	0.031					0.044	0.035		
11/9/2011	0.038	NA	0.038	0.037	0.035	0.035	0.035	0.021	0.020	0.036	0.034

2011 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#13**	**CSHH#14**	**CSHH#15**
5/26/2011	0.03	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.04	0.03
6/1/2011	0.04	0.02	0.03					0.03			
6/8/2011	0.02	0.02	0.02					0.03	0.03		
6/15/2011	0.03	0.01	0.03	0.02				0.03	0.03	0.03	
6/22/2011	0.02	0.02	0.01					0.01	0.01		
6/29/2011	0.05	0.03	0.03	0.04	0.03	0.03	0.06	0.03	0.02	0.06	0.03
7/6/2011	0.03	0.03	0.03					0.03	0.03		
7/14/2011	0.03	0.03	0.02	0.05	0.03	0.04	0.07	0.12	0.21	0.03	0.04
7/21/2011	0.02	0.02	0.03					0.09	0.54		
7/27/2011	0.03	0.03	0.04	0.04	0.04	0.02	0.25	0.27	0.25	0.01	0.02
8/3/2011	0.02	0.03	0.03					0.04	0.06		
8/17/2011	0.05	0.04	0.03					0.03	0.04		
8/24/2011	0.03	NA	0.04	0.02	0.03	0.04	0.03	0.02	0.01	0.03	0.02
8/31/2011	0.08	0.05	0.06					0.16	0.18		
9/14/2011	0.03	0.03	0.03					0.03	0.02		
9/21/2011	0.04	0.08	0.07					0.07	0.11		
9/28/2011	0.07	0.07	0.06	0.02	0.03	0.02	0.06	0.13	0.20	0.02	0.03
10/6/2011	0.04	0.03	0.04	0.03	0.04	0.04	0.04	0.05	0.03	0.03	0.03
10/12/2011	0.04	0.06	0.06					0.02	0.02		
10/20/2011	0.08	0.14	0.08					0.38	0.54		
10/26/2011	0.05	0.12	0.05	0.07	0.12	NA	0.09	0.18	0.36	0.02	0.07
11/2/2011	0.02	0.02	0.04					0.02	0.01		
11/9/2011	0.17	NA	0.12	0.11	0.17	0.04	0.28	0.21	0.03	0.11	0.04

Note: 0.55 is the detection limit, therefore an entry of 0.54 indicates that the real measurement is less than 0.55

2011 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/26/2011	0										
6/1/2011	0										
6/8/2011	0							0			
6/15/2011	0							0			
6/22/2011	0							0			
6/29/2011	0						0	0			
7/6/2011	0										
7/14/2011			0					0			
7/21/2011	0							0			
7/27/2011	0						0	0			
8/3/2011	0							0			
8/17/2011	0							0			
8/24/2011	0						0	0			
8/31/2011	0							0			
9/14/2011	0.25	0	0					0			
9/21/2011	0							0.25			
9/28/2011	0.25	0.25	0.25		0.25		0.5	0.25	0.25		
10/6/2011	0.25	0	0	0	0.1	0.25	0.25	0	0		0
10/12/2011	0							0.25			
10/20/2011	0							0			
10/26/2011	0						0	0.25			
11/2/2011	0							0.25			
11/9/2011	0						0	0			
**Salicylate result											

2011 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/26/2011	0.05										
6/1/2011	0.05										
6/8/2011	0.03							0.04			
6/15/2011	0.04							0.04			
6/22/2011	0.03							0.02			
6/29/2011	0.06						0.08	0.04			
7/6/2011	0.04										
7/14/2011			0.03					0.13			
7/21/2011	0.03							0.10			
7/27/2011	0.04						0.27	0.30			
8/3/2011	0.03							0.05			
8/17/2011	0.07							0.04			
8/24/2011	0.04						0.04	0.03			
8/31/2011	0.10							0.18			
9/14/2011	0.31	0.06	0.06					0.06			
9/21/2011	0.06							0.33			
9/28/2011	0.34	0.34	0.33		0.30		0.59	0.40	0.47		
10/6/2011	0.32	0.06	0.07	0.07	0.18	0.33	0.33	0.09	0.06		0.07
10/12/2011	0.05							0.30			
10/20/2011	0.12							0.41			
10/26/2011	0.07						0.11	0.46			
11/2/2011	0.06							0.31			
11/9/2011	0.21						0.32	0.23			

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2010 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#13**	**CSHH#14**	**CSHH#15**
5/20/2010	0.017	0.024	0.015					0.019			
5/26/2010	0.030	0.010	0.010					0.015			
6/2/2010	0.011	0.007	0.008					0.011	0.012		
6/9/2010	0.008	NA	0.007					0.005	0.007		
6/16/2010	0.008	0.003	0.007					0.006	0.010		
6/23/2010	0.008	0.003	0.005					0.012	0.019		
6/30/2010	0.009	0.013	0.002					0.008	0.012		
7/7/2010	0.005	0.005	0.002					0.007	0.004		
7/15/2010	0.007	0.025	0.004					0.005			
7/21/2010	0.005	0.004	0.005					0.007	0.010		
7/28/2010	0.007	0.005	0.005					0.011	0.011		
8/4/2010	0.008	0.004	0.005					0.009	0.005		
8/11/2010	0.012	0.007	0.007					0.009	0.015		
8/18/2010	0.013	0.005	0.008					0.008	0.012		
8/26/2010	0.030	0.018	0.021	.				0.018	0.017		
9/2/2010	0.012	0.020	0.011					0.018	0.011		
9/8/2010	0.043	0.033	0.039	0.038	0.040	0.042	0.044	0.037		0.035	0.038
9/15/2010	0.039	0.061	0.039					0.023	0.015		
9/22/2010	0.024	0.029	0.021					0.013	0.018		
9/29/2010	0.027	0.024	0.025					NA	0.013		
10/13/2010	0.058	0.058	0.056					0.035	0.042		
10/20/2010	0.075	0.069	0.070					0.059	0.051		
10/28/2010	0.053	0.051	0.056					0.031	0.013		
11/3/2010	0.053	0.050	0.052	0.054	0.050	0.052	0.049	0.047	0.024	0.051	0.050

2010 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#13**	**CSHH#14**	**CSHH#15**
5/20/2010	0.01	0.01	0.09					0.01			
5/26/2010	0.02	0.02	0.03					0.02			
6/2/2010	0.03	0.02	0.03					0.05	0.04		
6/9/2010	0.04	NA	0.03					0.04	0.04		
6/16/2010	0.02	0.01	0.01					0.06	0.02		
6/23/2010	0.03	0.02	0.03					0.01	0.55		
6/30/2010	0.03	0.03	0.03					0.02	0.01		
7/7/2010	0.02	0.02	0.02					0.02	0.02		
7/15/2010	0.03	0.03	0.03					0.03			
7/21/2010	0.03	0.02	0.03					0.03	0.03		
7/28/2010	0.07	0.02	0.03					0.04	0.02		
8/4/2010	0.02	0.02	0.01					0.02	0.03		
8/11/2010	0.04	0.02	0.04					0.02	0.04		
8/18/2010	0.04	0.04	0.05					0.05	0.05		
8/26/2010	0.02	0.02	0.02					0.02	0.01		
9/2/2010	0.05	0.03	0.04					0.04	0.02		
9/8/2010	0.03	0.01	0.02	0.02	0.02	0.02	0.03	0.02		0.05	0.02
9/15/2010	0.03	0.01	0.03					0.03	0.02		
9/22/2010	0.02	0.02	0.01					0	0.01		
9/29/2010	0.01	0	0.01					NA	0		
10/13/2010	0.03	0.03	0.02					0.02	0.03		
10/20/2010	0.03	0.02	0.02					0.02	0.04		
10/28/2010	0.03	0.01	0.01					0.03	0.01		
11/3/2010	0.02	0.02	0.01	0.03	0.02	0.01	0.02	0.02	0.01	0.02	0.02

2010 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/20/2010	0	0.2	0					0			
5/26/2010	0	0	0					0			
6/2/2010	0		0					0	0		
6/9/2010	0						0	0			
6/16/2010	0	0						0			
6/23/2010	1	0						0	0		
6/30/2010	0							0	NA		
7/7/2010	0							0.10	0.05		
7/15/2010	0.1	0						0			
7/21/2010	0	0					0	0	0		
7/28/2010	0							0			
8/4/2010	0							0			
8/11/2010	0						0	0	NA		NA
8/18/2010	0	0						0	0		
8/26/2010	0							0			
9/2/2010	0		0					0			
9/8/2010	0						0	NA	NA		
9/15/2010	0							0			
9/22/2010	0							0	0		
9/29/2010	0							0	0		
10/13/2010	0							0	NA		
10/20/2010	0							0	0		
10/28/2010	0							NA	NA		
11/3/2010	0	NA	NA		NA	NA	0	0			
**Salicylate result											

2010 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
5/20/2010	0.03	0.23	0.11					0.03			
5/26/2010	0.05	0.03	0.04					0.04			
6/2/2010	0.04		0.04					0.06	0.05		
6/9/2010	0.05							0.05			
6/16/2010	0.03	0.01						0.07			
6/23/2010	1.04	0.02						0.02	0.57		
6/30/2010	0.04							0.03			
7/7/2010	0.03							0.13	0.07		
7/15/2010	0.14	0.06						0.04			
7/21/2010	0.04	0.02						0.04	0.04		
7/28/2010	0.08							0.05			
8/4/2010	0.03							0.03			
8/11/2010	0.05							0.03			
8/18/2010	0.05	0.05						0.06	0.06		
8/26/2010	0.05							0.04			
9/2/2010	0.06		0.05					0.06			
9/8/2010	0.07						0.07				
9/15/2010	0.07							0.05			
9/22/2010	0.04							0.01	0.03		
9/29/2010	0.04								0.01		
10/13/2010	0.09							0.06			
10/20/2010	0.11							0.08	0.09		
10/28/2010	0.08										
11/3/2010	0.07						0.07	0.07			
* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)											

2009 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#13**	**CSHH#14**	**CSHH#15**	**CSHH#10A**
5/13/2009	0.003	0	0					0	0.001			
5/20/2009	0.009	0.006	0.008					0.008	0.014			
5/27/2009	0.012	0.020	0.009					0.010	0.008			
6/3/2009	0.031	0.010	0.011					0.018	0.016			
6/10/2009	0.010	0.009	0.008					0.012	0.016			
6/17/2009	0.006	0.006	0.005					0.008	0.015			
6/24/2009	0.009	0.005	0.012					0.014	0.016			
7/1/2009	0.008	0.004	0.005					0.009	0.007			
7/8/2009	0.005	0.010	0.005					0.031	0.018			
7/15/2009	0.008	0.003	0.014					0.013	0.012			0.014
7/22/2009	0.006	0.005	0.006					0.005	0.008			
7/29/2009	0.006	0.004	0.006					0.011	0.013			
8/5/2009	0.008	0.003	0.004					0.010	0.008			
8/12/2009	0.016	0.004	0.014					0.013	NA			
8/19/2009	0.010	0.006	0.009					0.011	0.014			
8/26/2009	0.003	0.005	0.007					0.006	0.016			
9/2/2009	0.006	0.010	0.004					0.010	0.010	0.007	0.009	
9/9/2009	0.019	0.015	0.008					0.008	0.011			
9/16/2009	0.032	NA	0.025					0.017	0.017	0.025	0.017	
9/23/2009	0.064	0.068	0.038					0.021	0.020			
9/30/2009	0.037	NA	0.044					0.020	0.012			
10/8/2009	0.046	NA	0.052					0.017	0.014			
10/14/2009	0.037	0.048	0.051					0.043	0.046			
10/21/2009	0.034	0.036	0.030					0.033	0.025			
10/30/2009	0.045	0.036	0.042					0.036	0.041		NA	

2009 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#13**	**CSHH#14**	**CSHH#15**	**CSHH#10A**
5/13/2009	0	0	0					0	0			
5/20/2009	0.04	0.03	0.04					0.03	0.02			
5/27/2009	0.06	0.05	0.05					0.04	0.04			
6/3/2009	0.03	0.03	0.04					0.03	0.03			
6/10/2009	0.05	0.03	0.04					0.02	0.02			
6/17/2009	0.03	0.02	0.02					0.03	0.03			
6/24/2009	0.03	0.03	0.03					0.02	0.02			
7/1/2009	0.02	0.02	0.02					0.03	0.01			
7/8/2009	0.03	0.03	0.03					0.06	0.04			
7/15/2009	0.04	0.03	0.03					0.04	0.02			0.03
7/22/2009	0.03	0.02	0.02					0.02	0			
7/29/2009	0.01	0.02	0.02					0.01	0.01			
8/5/2009	0.03	0.02	0.04					0.01	0.02			
8/12/2009	0.03	0.03	0.04					0.03	NA			
8/19/2009	0.04	0.04	0.03					0.05	0.05			
8/26/2009	0.04	0.02	0.02					0.03	0.03			
9/2/2009	0.04	0.02	0.03					0.02	0.03	0.04	0.04	
9/9/2009	0.05	0.04	0.05					0.05	0.06			
9/16/2009	0.02	NA	0.01					0.02	0.02	0.02	0.02	
9/23/2009	0.02	0.02	0.02					0.01	0.03			
9/30/2009	0.01	NA	0.03					0.01	0.01			
10/8/2009	0.03	NA	0.02					0.02	0.01			
10/14/2009	0.05	0.02	0.03					0.06	0.07			
10/21/2009	0.07	0.02	0.07					0.01	0.01			
10/30/2009	0.02	0.02	0.03					0.02	0.02		NA	

2009 Nitrogen Data

Ammonia-Nitrogen												
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#10A**
5/13/2009	0	0	0					0	NA			
5/20/2009	0	0	0					0.025	NA			
5/27/2009	0.25	0.1	0.1					0.1	0.25			
6/3/2009	0	0.05	0					0	NA			
6/10/2009	0	0	0					0.25	0.25			
6/17/2009	0	0	0					0	0			
6/24/2009	0	0	0					0	0			
7/1/2009	1	0	NA					1	NA			
7/8/2009	0	0	0					0	NA			
7/15/2009	0	0	0					6.1	0			0.5
7/22/2009	0	0	0					NA	0			
7/29/2009	0	0	0					0	0			
8/5/2009	0	0	0					0	0			
8/12/2009	0	0	0					0	0			
8/19/2009	0	0	0					0	0.25			
8/26/2009	0	0	NA					0	0			
9/2/2009	0	0	0					0	NA	0	0	
9/9/2009	0	0	0					0.25	NA			
9/16/2009	0	NA	NA					0.25	NA	NA	0	
9/23/2009	0	0	0					0.10	0			
9/30/2009	0	NA	0					0	0			
10/8/2009	0.25	NA	0					0.25	0.25			
10/14/2009	0	0	0					0	0.10			
10/21/2009	0.25	0	0					0	0			
10/30/2009	0	0.05	0.10					0	0		0.25	

2009 Nitrogen Data

Total Inorganic Nitrogen (TIN)*												
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**	**CSHH#10A**
5/13/2009	0.00	0.00	0.00					0.00				
5/20/2009	0.05	0.04	0.05					0.06				
5/27/2009	0.32	0.17	0.16					0.15	0.30			
6/3/2009	0.06	0.09	0.05					0.05				
6/10/2009	0.06	0.04	0.05					0.28	0.29			
6/17/2009	0.04	0.03	0.03					0.04	0.05			
6/24/2009	0.04	0.04	0.04					0.03	0.04			
7/1/2009	1.03	0.02						1.04				
7/8/2009	0.04	0.04	0.04					0.09				
7/15/2009	0.05	0.03	0.04					6.15	0.03			0.54
7/22/2009	0.04	0.03	0.03						0.01			
7/29/2009	0.02	0.02	0.03					0.02	0.02			
8/5/2009	0.04	0.02	0.04					0.02	0.03			
8/12/2009	0.05	0.03	0.05					0.04				
8/19/2009	0.05	0.05	0.04					0.06	0.31			
8/26/2009	0.04	0.03						0.04	0.05			
9/2/2009	0.05	0.03	0.03					0.03		0.05	0.05	
9/9/2009	0.07	0.06	0.06					0.31				
9/16/2009	0.05							0.29			0.04	
9/23/2009	0.08	0.09	0.06					0.13	0.05			
9/30/2009	0.05		0.07					0.03	0.02			
10/8/2009	0.33		0.07					0.29	0.27			
10/14/2009	0.09	0.07	0.08					0.10	0.22			
10/21/2009	0.35	0.06	0.10					0.04	0.04			
10/30/2009	0.07	0.11	0.17					0.06	0.06			

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2008 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#13**	**CSHH#14**	**CSHH#15**
5/21/2008	0.140	NA	0.012	0.016	NA	NA	NA	NA			
6/11/2008	NA	0.011	0.009	NA	NA	NA	NA	0.008			
6/19/2008	0.014	0.009	0.008	NA	NA	NA	NA	0.017			
6/25/2008	0.009	0.009	0.009	NA	NA	NA	NA	0.008			
7/2/2008	0.008	0.010	0.008	NA	NA	NA	NA	0.011			
7/9/2008	0.006	0.007	0.009	NA	NA	NA	NA	0.006			
7/17/2008	0.008	0.004	0.006	NA	NA	NA	NA	0.010			
7/30/2008	NA	0.009	0.007	NA	NA	NA	NA	0.006			
8/6/2008	0.011	0.011	0.011	NA	NA	NA	NA	0.007	0.017		
8/13/2008	0.012	0.005	0.007	NA	NA	NA	NA	0.011	0.013		
8/20/2008	0.011	0.008	0.007	NA	NA	NA	NA	0.009	0.008		
8/27/2008	0.01	0.005	NA	NA	NA	NA	NA	0.008	0.007		
9/3/2008	0.011	0.008	0.008	NA	NA	NA	NA	0.008	0.013		
9/10/2008	0.01	0.006	0.009	NA	NA	NA	NA	0.008	0.012		
9/17/2008	0.02	0.016	0.016	NA	NA	NA	NA	0.006	0.011		
9/24/2008	0.006	0.007	0.006	NA	NA	NA	NA	0.010	0.009		
10/2/2008	0.035	NA	0.009	NA	NA	NA	NA	0.015	NA		
10/8/2008	0.043	0.065	0.049	NA	NA	NA	NA	0.039	0.015		
10/16/2008	0.069	0.075	0.073	NA	NA	NA	NA	0.035	0.031		
10/22/2008	0.049	NA	0.046	NA	NA	NA	NA	0.024	0.015		
10/31/2008	0.035	0.038	0.038	NA	NA	NA	NA	0.037	0.012		
11/5/2008	0.036	0.039	0.033	NA	NA	NA	NA	0.025	0.026		

2008 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#13**	**CSHH#14**	**CSHH#15**
5/21/2008	0.02	NA	0.03	0.04	NA	NA	NA	NA			
6/11/2008	NA	0.03	0.04	NA	NA	NA	NA	0.03			
6/19/2008	0.03	0.04	0.04	NA	NA	NA	NA	0.04			
6/25/2008	0.04	0.04	0.03	NA	NA	NA	NA	0.15			
7/2/2008	0.05	0.05	0.04	NA	NA	NA	NA	0.04			
7/9/2008	0.03	0.03	0.04	NA	NA	NA	NA	0.02			
7/17/2008	0.05	0.03	0.02	NA	NA	NA	NA	0.03			
7/30/2008	NA	0.06	0.03	NA	NA	NA	NA	0.04			
8/6/2008	0.05	0.03	0.04	NA	NA	NA	NA	0.03	0.02		
8/13/2008	0.05	0.03	0.03	NA	NA	NA	NA	0.03	0.03		
8/20/2008	0.06	0.04	0.05	NA	NA	NA	NA	0.03	0.04		
8/27/2008	0.04	0.03	NA	NA	NA	NA	NA	0.03	0.03		
9/3/2008	0.05	0.03	0.04	NA	NA	NA	NA	0.03	0.02		
9/10/2008	0.03	0.03	0.03	NA	NA	NA	NA	0.03	0.04		
9/17/2008	0.03	0.03	0.04	NA	NA	NA	NA	0.03	0.03		
9/24/2008	0.04	0.07	0.04	NA	NA	NA	NA	0.04	0.04		
10/2/2008	0.03	NA	0.04	NA	NA	NA	NA	0.04	NA		
10/8/2008	0.02	0.02	0.02	NA	NA	NA	NA	0.02	0.02		
10/16/2008	0.04	0.02	0.03	NA	NA	NA	NA	0.02	0.02		
10/22/2008	0.05	NA	0.04	NA	NA	NA	NA	0.03	0.02		
10/31/2008	0.03	0.02	0.03	NA	NA	NA	NA	0.02	0.01		
11/5/2008	0.02	0.02	0.03	NA	NA	NA	NA	0.02	0.02		

**There are no ammonia-nitrogen readings and, thus, no calculated total inorganic nitrogen (TIN) in 2008.

2007 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#13**	**CSHH#14**	**CSHH#15**
6/21/2007	0.011	0.007	0.007	NA	NA	NA	NA	0.013			
6/27/2007	0.013	0.010	0.012	NA	NA	NA	NA	0.014			
7/5/2007	0.009	0.004	0.011	NA	NA	NA	NA	0.028			
7/16/2007	0.006	0.007	0.004	NA	NA	NA	NA	0.006			
7/20/2007	0.008	0.003	0.012	NA	NA	NA	NA	0.011			
7/25/2007	0.011	NA	0.024	NA	NA	NA	NA	0.009			
8/15/2007	0.008	0.006	0.008	NA	NA	NA	NA	0.010			
8/22/2007	0.016	0.018	0.016	NA	NA	NA	NA	0.014			
8/29/2007	0.016	0.027	0.018	NA	NA	NA	NA	0.011			
9/5/2007	0.013	0.011	0.011	NA	NA	NA	NA	0.010			
9/13/2007	0.029	0.029	0.024	NA	NA	NA	NA	0.025			
9/19/2007	0.038	0.056	0.046	NA	NA	NA	NA	0.040			
9/27/2007	0.052	0.056	0.051	NA	NA	NA	NA	0.026			
10/3/2007	0.039	0.035	0.030	NA	NA	NA	NA	0.025			
10/10/2007	0.032	0.028	0.028	NA	NA	NA	NA	0.029			
10/17/2007	0.021	0.019	0.026	NA	NA	NA	NA	0.016			
10/24/2007	0.024	0.024	0.037	NA	NA	NA	NA	0.021			
10/31/2007	0.021	0.024	0.024	NA	NA	NA	NA	0.018			

2007 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#13**	**CSHH#14**	**CSHH#15**
6/21/2007	0.04	0.04	0.04	NA	NA	NA	NA	0.66			
6/27/2007	0.04	0.04	0.04	NA	NA	NA	NA	0.23			
7/5/2007	0.02	0.03	0.03	NA	NA	NA	NA	0.07			
7/16/2007	0.02	0.03	0.04	NA	NA	NA	NA	0.29			
7/20/2007	0.04	0.03	0.03	NA	NA	NA	NA	0.07			
7/25/2007	0.03	NA	0.04	NA	NA	NA	NA	0.03			
8/15/2007	0.04	0.02	0.02	NA	NA	NA	NA	0.04			
8/22/2007	0.02	0.02	0.02	NA	NA	NA	NA	0.02			
8/29/2007	0.03	0.02	0.03	NA	NA	NA	NA	0.02			
9/5/2007	0.04	0.03	0.03	NA	NA	NA	NA	0.02			
9/13/2007	0.03	0.02	0.02	NA	NA	NA	NA	0.02			
9/19/2007	0.03	0.04	0.04	NA	NA	NA	NA	0.03			
9/27/2007	0.04	0.03	0.03	NA	NA	NA	NA	0.03			
10/3/2007	0.02	0.02	0.02	NA	NA	NA	NA	0.02			
10/10/2007	0.02	0.02	0.02	NA	NA	NA	NA	0.04			
10/17/2007	0.12	0.10	0.11	NA	NA	NA	NA	0.17			
10/24/2007	0.09	0.08	0.11	NA	NA	NA	NA	0.27			
10/31/2007	0.12	0.07	0.15	NA	NA	NA	NA	0.02			

**There was only one ammonia-nitrogen reading (6/21/07) and, thus, only one date of calculated total inorganic nitrogen (TIN) in 2007.

2006 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#13**	**CSHH#14**	**CSHH#15**
6/1/2006	0.002	0.005	0.003	NA	NA	NA	NA	0.001			
6/8/2006	0.016	0.025	0.010	NA	NA	NA	NA	0.015			
6/15/2006	0.014	0.016	0.015	NA	NA	NA	NA	0.016			
6/22/2006	0.006	0.013	0.007	NA	NA	NA	NA	0.003			
6/29/2006	0.015	0.009	0.001	NA	NA	NA	NA	0.005			
7/7/2006	0.009	0.013	0.007	NA	NA	NA	NA	0.015			
7/13/2006	0	0	0.001	NA	NA	NA	NA	0.012			
7/20/2006	0.014	0.014	0.006	NA	NA	NA	NA	0.010			
7/27/2006	0.008	0.005	0.006	NA	NA	NA	NA	0.005			
8/2/2006	0.010	0.006	0.007	NA	NA	NA	NA	0.003			
8/10/2006	0.010	0.013	0.015	NA	NA	NA	NA	0.022			
8/17/2006	0.004	0.004	0.013	NA	NA	NA	NA	0.002			
8/24/2006	0.008	0.013	0.008	NA	NA	NA	NA	0.008			
8/31/2006	0.030	NA	0.018	NA	NA	NA	NA	0.016			
9/7/2006	0.029	0.014	0.024	NA	NA	NA	NA	0.014			
9/14/2006	0.012	0.012	0.013	NA	NA	NA	NA	0.015			
9/21/2006	0.010	0.008	0.010	0.009	0.011	0.010	0.016	NA			
9/28/2006	0.009	0.015	0.011	NA	NA	NA	NA	0.013			
10/5/2006	0.010	0.009	0.008	NA	NA	NA	NA	0.008			
10/12/2006	0.008	0.007	0.009	NA	NA	NA	NA	0.011			

2006 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#13**	**CSHH#14**	**CSHH#15**
6/1/2006	0.04	0.06	0.06	NA	NA	NA	NA	0.09			
6/8/2006	0.07	0.07	0.07	NA	NA	NA	NA	0.11			
6/15/2006	0.09	0.01	0.02	NA	NA	NA	NA	0.82			
6/22/2006	0.03	0.02	0.01	NA	NA	NA	NA	0.31			
6/29/2006	0.15	0.07	0.12	NA	NA	NA	NA	0.48			
7/7/2006	0.03	0.04	0.03	NA	NA	NA	NA	0.83			
7/13/2006	0.05	0.04	0.05	NA	NA	NA	NA	0.02			
7/20/2006	0.05	0.07	0.03	NA	NA	NA	NA	0.10			
7/27/2006	0.02	0.05	0.03	NA	NA	NA	NA	0.04			
8/2/2006	0.04	0.05	0.08	NA	NA	NA	NA	0.72			
8/10/2006	0.03	0.03	0.08	NA	NA	NA	NA	0.94			
8/17/2006	0.06	0.03	0.05	NA	NA	NA	NA	0.19			
8/24/2006	0.07	0.02	0.09	NA	NA	NA	NA	0.31			
8/31/2006	0.04	NA	0.01	NA	NA	NA	NA	0.04			
9/7/2006	0.05	0.07	0.05	NA	NA	NA	NA	0.01			
9/14/2006	0.04	0.03	0.08	NA	NA	NA	NA	0.38			
9/21/2006	0.04	0.03	0.14	0.04	0.06	0.02	0.10	NA			
9/28/2006	0.03	0.03	0.03	NA	NA	NA	NA	0.32			
10/5/2006	0.03	0.04	0.17	NA	NA	NA	NA	0.29			
10/12/2006	0.07	0.03	0.05	NA	NA	NA	NA	0.25			

2006 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
6/1/2006	2.72	4.24	2.72	NA	NA	NA	NA	1.52			
6/8/2006	1.20	1.28	1.12	NA	NA	NA	NA	0.96			
6/15/2006	1.44	2.32	1.12	NA	NA	NA	NA	1.44			
6/22/2006	2.56	1.68	2.64	NA	NA	NA	NA	1.68			
6/29/2006	2.00	1.68	2.56	NA	NA	NA	NA	0.88			
7/7/2006	2.24	1.36	2.08	NA	NA	NA	NA	2.16			
7/13/2006	1.92	2.32	2.56	NA	NA	NA	NA	1.36			
7/20/2006	1.36	1.60	2.00	NA	NA	NA	NA	1.92			
7/27/2006	2.32	1.92	2.40	NA	NA	NA	NA	1.12			
8/2/2006	2.40	2.80	2.88	NA	NA	NA	NA	1.76			
8/10/2006	0.96	2.64	1.68	NA	NA	NA	NA	1.68			
8/17/2006	2.16	1.52	2.16	NA	NA	NA	NA	1.52			
8/24/2006	1.84	2.00	1.52	NA	NA	NA	NA	1.60			
8/31/2006	2.16	NA	2.40	NA	NA	NA	NA	1.52			
9/7/2006	2.40	2.80	2.16	NA	NA	NA	NA	1.60			
9/14/2006	2.56	2.56	2.80	NA	NA	NA	NA	1.84			
9/21/2006	2.40	1.84	2.32	2.48	2.72	2.40	2.48	NA			
9/28/2006	2.32	2.00	3.12	NA	NA	NA	NA	2.08			
10/5/2006	1.84	2.00	2.00	NA	NA	NA	NA	1.60			
10/12/2006	2.64	2.40	2.00	NA	NA	NA	NA	1.76			

2006 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
6/1/2006	2.76	4.31	2.78					1.61			
6/8/2006	1.29	1.38	1.20					1.09			
6/15/2006	1.54	2.35	1.16					2.28			
6/22/2006	2.60	1.71	2.66					1.99			
6/29/2006	2.17	1.76	2.68					1.37			
7/7/2006	2.28	1.41	2.12					3.01			
7/13/2006	1.97	2.36	2.61					1.39			
7/20/2006	1.42	1.68	2.04					2.03			
7/27/2006	2.35	1.98	2.44					1.17			
8/2/2006	2.45	2.86	2.97					2.48			
8/10/2006	1.00	2.68	1.78					2.64			
8/17/2006	2.22	1.55	2.22					1.71			
8/24/2006	1.92	2.03	1.62					1.92			
8/31/2006	2.23		2.43					1.58			
9/7/2006	2.48	2.88	2.23					1.62			
9/14/2006	2.61	2.60	2.89					2.24			
9/21/2006	2.45	1.88	2.47	2.53	2.79	2.43	2.60				
9/28/2006	2.36	2.05	3.16					2.41			
10/5/2006	1.88	2.05	2.18					1.90			
10/12/2006	2.72	2.44	2.06					2.02			

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2005 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#13**	**CSHH#14**	**CSHH#15**
6/2/2005	0.011	0.009	0.012	0.019	0.011	0.017	0.011	0.019			
6/9/2005	0	0	0.006	NA	NA	NA	NA	0.007			
6/16/2005	0.004	0.010	0.017	NA	NA	NA	NA	NA			
6/23/2005	0.017	0.011	0.010	NA	NA	NA	NA	0.032			
6/30/2005	0.015	0.006	0.011	NA	NA	NA	NA	0.025			
7/7/2005	0.005	0	0.004	NA	NA	NA	NA	0			
7/14/2005	0.005	0.001	0.002	NA	NA	NA	NA	0.005			
7/21/2005	0.014	0.015	0.004	NA	NA	NA	NA	0.011			
7/28/2005	0.002	0.002	0.003	NA	NA	NA	NA	0			
8/11/2005	0.013	0.006	0.010	0.018	NA	NA	NA	0.007			
8/18/2005	0.004	0	0	NA	NA	NA	NA	0.003			
8/25/2005	0.025	NA	0.011	NA	NA	NA	NA	0.008			
9/1/2005	0.015	0.018	0.019	0.011	0.028	0.020	0.016	0.021			
9/8/2005	0.010	0.007	0	NA	NA	NA	NA	0.006			
9/22/2005	0.024	0.017	0.017	NA	NA	NA	NA	0.023			
9/29/2005	0.021	0.016	0.021	NA	NA	NA	NA	0.010			
10/6/2005	0.036	0.032	0.021	NA	NA	NA	NA	0.019			
10/20/2005	0.023	0.031	0.024	NA	NA	NA	NA	0.020			
10/27/2005	0.038	0.047	0.039	NA	NA	NA	NA	0.028			
11/3/2005	0.053	0.066	0.053	NA	NA	NA	NA	0.040			

2005 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#13**	**CSHH#14**	**CSHH#15**
6/2/2005	0.03	0.07	0.09	0.02	0.10	0.09	0.09	0.23			
6/9/2005	0.01	0.06	0.03	NA	NA	NA	NA	0.07			
6/16/2005	0.02	0.04	0.01	NA	NA	NA	NA	NA			
6/23/2005	0.01	0.03	0	NA	NA	NA	NA	0.07			
6/30/2005	0.03	0.01	0.05	NA	NA	NA	NA	0.19			
7/7/2005	0.01	0.02	0.01	NA	NA	NA	NA	0.24			
7/14/2005	0.02	0	0.22	NA	NA	NA	NA	0.28			
7/21/2005	0.03	0	0	NA	NA	NA	NA	0.38			
7/28/2005	0.05	0.03	0.06	NA	NA	NA	NA	0.30			
8/11/2005	0	0	0.09	0.01	NA	NA	NA	0.40			
8/18/2005	0	0.03	0	NA	NA	NA	NA	0.23			
8/25/2005	0.07	NA	0.07	NA	NA	NA	NA	0.33			
9/1/2005	0.04	0.05	0	0.04	0.03	0.07	0.01	0.55			
9/8/2005	0.04	0.03	0.04	NA	NA	NA	NA	0.10			
9/22/2005	0.11	0.09	0.13	NA	NA	NA	NA	0.45			
9/29/2005	0.09	0.05	0.07	NA	NA	NA	NA	0.16			
10/6/2005	0.05	0.07	0.10	NA	NA	NA	NA	0.12			
10/20/2005	0.03	0.01	0.04	NA	NA	NA	NA	0.01			
10/27/2005	0.02	0.03	0.01	NA	NA	NA	NA	1.20			
11/3/2005	0	0.03	0.19	NA	NA	NA	NA	0.56			

2005 Nitrogen Data

Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
6/2/2005	0.40	1.12	0.56	1.04	1.52	0.56	0.72	1.04			
6/9/2005	1.12	0.80	0.88	NA	NA	NA	NA	0.96			
6/16/2005	0.40	1.12	0.72	NA	NA	NA	NA	NA			
6/23/2005	1.20	0.64	1.12	NA	NA	NA	NA	1.36			
6/30/2005	1.28	1.12	1.84	NA	NA	NA	NA	1.60			
7/7/2005	0.16	0.48	0.64	NA	NA	NA	NA	1.28			
7/14/2005	0.64	0.24	0.64	NA	NA	NA	NA	0.56			
7/21/2005	0.80	0.56	1.12	NA	NA	NA	NA	1.12			
7/28/2005	1.28	1.20	1.20	NA	NA	NA	NA	1.68			
8/11/2005	0.96	1.76	0.96	1.36	NA	NA	NA	0.80			
8/18/2005	0.72	0.80	1.44	NA	NA	NA	NA	1.12			
8/25/2005	0.88	NA	0.40	NA	NA	NA	NA	1.04			
9/1/2005	2.24	1.28	1.68	1.76	2.00	2.00	1.92	1.68			
9/8/2005	0.24	0.64	0.32	NA	NA	NA	NA	0.96			
9/22/2005	1.28	1.12	1.28	NA	NA	NA	NA	0.88			
9/29/2005	0.8	1.04	1.36	NA	NA	NA	NA	0.88			
10/6/2005	1.04	1.52	0.64	NA	NA	NA	NA	1.6			
10/20/2005	1.6	1.52	0.96	NA	NA	NA	NA	1.60			
10/27/2005	1.76	1.36	1.12	NA	NA	NA	NA	1.68			
11/3/2005	0.16	0.96	0.40	NA	NA	NA	NA	0.96			

2005 Nitrogen Data

Total Inorganic Nitrogen (TIN)*

Date	CSHH#1	CSHH#2	CSHH#3	CSHH#4	CSHH#5	CSHH#6	CSHH#7	CSHH#8	CSHH#13	CSHH#14	CSHH#15
6/2/2005	0.44	1.20	0.66	1.08	1.63	0.67	0.82	1.29			
6/9/2005	1.13	0.86	0.92					1.04			
6/16/2005	0.42	1.17	0.75								
6/23/2005	1.23	0.68	1.13					1.46			
6/30/2005	1.33	1.14	1.90					1.82			
7/7/2005	0.18	0.50	0.65					1.52			
7/14/2005	0.67	0.24	0.86					0.85			
7/21/2005	0.84	0.58	1.12					1.51			
7/28/2005	1.33	1.23	1.26					1.98			
8/11/2005	0.97	1.77	1.06	1.39				1.21			
8/18/2005	0.72	0.83	1.44					1.35			
8/25/2005	0.98		0.48					1.38			
9/1/2005	2.30	1.35	1.70	1.81	2.06	2.09	1.95	2.25			
9/8/2005	0.29	0.68	0.36					1.07			
9/22/2005	1.41	1.23	1.43					1.35			
9/29/2005	0.91	1.11	1.45					1.05			
10/6/2005	1.13	1.62	0.76					1.74			
10/20/2005	1.65	1.56	1.02					1.63			
10/27/2005	1.82	1.44	1.17					2.91			
11/3/2005	0.21	1.06	0.64					1.56			

* TIN = Nitrate + Nitrite + Ammonia (when samples have been collected for all three)

2004 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#13**	**CSHH#14**	**CSHH#15**
6/3/2004	0.003	0.019	0.007	0.009	0.009	0.003	0.002	0.019			
6/10/2004	0.017	0.017	0.012	0.017	0.018	0.021	0.014	0.011			
6/18/2004	0.008	0.003	0.019	0.006	0.008	0.009	0.013	0.007			
6/24/2004	0.012	0.006	0.001	NA	NA	NA	NA	0.013			
7/14/2004	0.021	0.007	0.003	0.009	0.018	0.007	0.025	0.011			
7/22/2004	0.009	0.015	0.006	NA	NA	NA	NA	0.007			
7/29/2004	0.005	0.008	0.002	0.008	0.002	0.009	0.017	0.015			
8/5/2004	0.008	0.012	0.008	NA	NA	NA	NA	0.007			
8/11/2004	0.007	0.006	0.001	NA	NA	NA	NA	0.008			
8/19/2004	0.002	0	0.009	NA	NA	NA	NA	0.006			
8/26/2004	0.003	0.015	0.010	0.002	0.015	0.004	0.007	0.002			
9/2/2004	0.012	0.006	0.009	NA	NA	NA	NA	0.011			
9/8/2004	0.012	NA	0.021	NA	NA	NA	NA	0.035			
9/15/2004	0.016	0.016	0.020	0.012	0.019	0.023	0.022	0.011			
9/22/2004	0.024	0.032	0.020	NA	NA	NA	NA	0.023			
9/30/2004	0.005	0.005	0.004	NA	NA	NA	NA	0.010			
10/7/2004	0.020	0.019	0.031	NA	NA	NA	NA	0.046			
10/14/2004	0.014	0.014	0.016	NA	NA	NA	NA	0.024			
10/21/2004	0.015	0.008	0.011	NA	NA	NA	NA	0.011			
10/28/2004	0.014	NA	0.016	NA	NA	NA	NA	0.020			
11/4/2004	0.025	0.018	0.028	NA	NA	NA	NA	0.012			
11/10/2004	0.019	0.028	0.019	NA	NA	NA	NA	0.019			

2004 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#13**	**CSHH#14**	**CSHH#15**
6/3/2004	0.12	0.05	0.04	0.08	0.11	0.09	0.11	0.84			
6/10/2004	0.11	0.05	0.19	0.1	0.25	0.15	0.47	0.94			
6/18/2004	0.05	0.05	0.01	0.1	0.07	0.08	0.07	0.48			
6/24/2004	0.07	0.01	0.06	NA	NA	NA	NA	0.48			
7/14/2004	0.03	0.06	0.02	0.05	0.08	0.15	0.55	0.20			
7/22/2004	0.05	0.03	0.01	NA	NA	NA	NA	0.22			
7/29/2004	0.08	0.05	0.08	0.06	0.20	0.03	0.01	0.03			
8/5/2004	0.03	0.04	0.02	NA	NA	NA	NA	0.12			
8/11/2004	0.03	0.04	0.01	NA	NA	NA	NA	0.09			
8/19/2004	0.07	0.03	0.02	NA	NA	NA	NA	0.39			
8/26/2004	0.01	0.01	0.08	0.02	0.65	0.04	0.27	0.07			
9/2/2004	0.06	0.02	0	NA	NA	NA	NA	0.38			
9/8/2004	0.04	NA	0.07	NA	NA	NA	NA	0.11			
9/15/2004	0.11	0.05	0.08	0.09	0.05	0.06	0.07	0.38			
9/22/2004	0.12	0.16	0.11	NA	NA	NA	NA	0.43			
9/30/2004	0.14	0.15	0.16	NA	NA	NA	NA	0.74			
10/7/2004	0	0.07	0.11	NA	NA	NA	NA	0.22			
10/14/2004	0.11	0.04	0.11	NA	NA	NA	NA	0.23			
10/21/2004	0.15	0.05	0.04	NA	NA	NA	NA	0.53			
10/28/2004	0.09	NA	0.03	NA	NA	NA	NA	0.05			
11/4/2004	0.06	0.07	0.12	NA	NA	NA	NA	0.53			
11/10/2004	0	0.07	0.05	NA	NA	NA	NA	0.71			

2004 Nitrogen Data

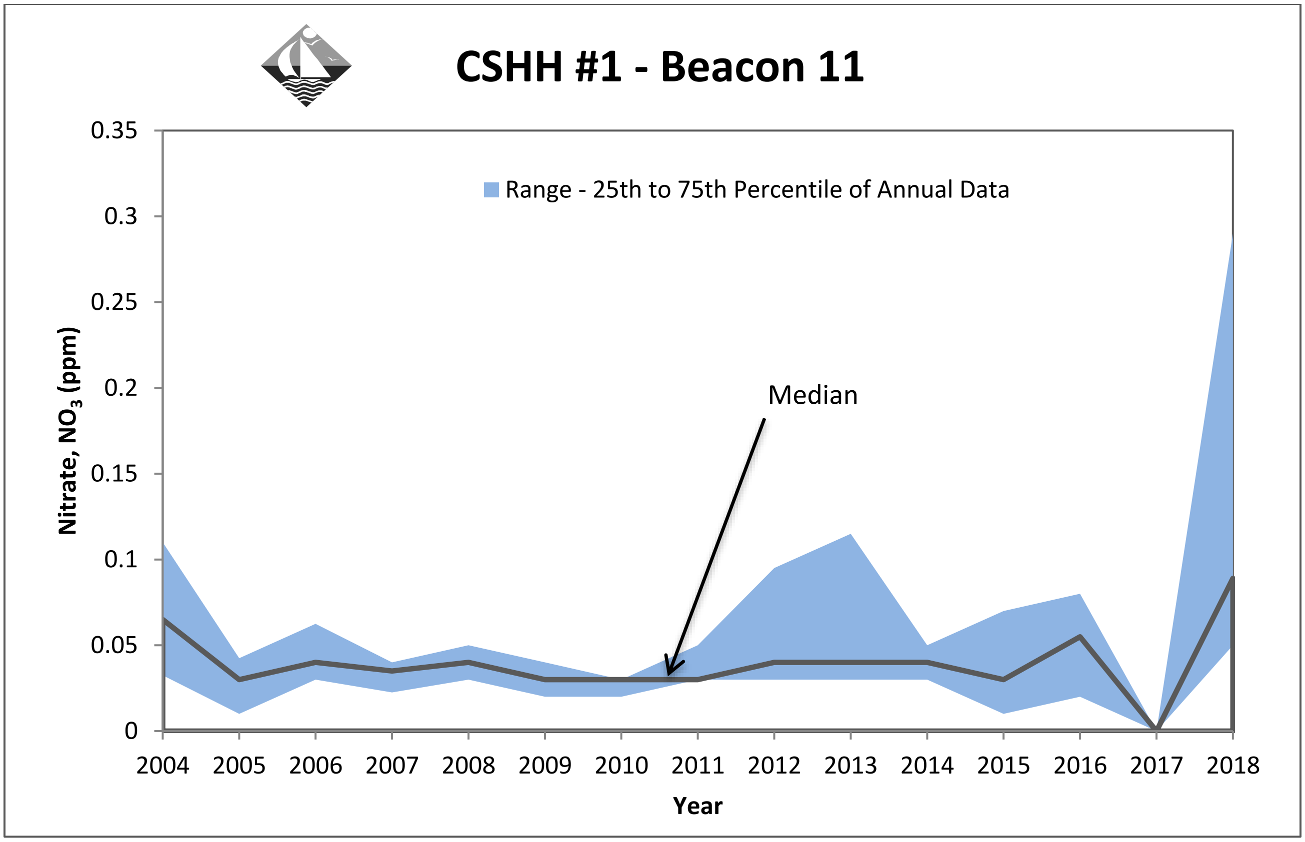
Ammonia-Nitrogen											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
6/3/2004	2.16	1.92	1.68	1.68	1.68	1.52	2	2.08			
6/10/2004	1.60	1.44	1.60	1.44	1.20	1.28	1.52	1.44			
6/18/2004	1.12	1.12	0.88	0.96	0.64	0.96	1.04	0.96			
6/24/2004	NA	NA	NA	NA	NA	NA	NA	NA			
7/14/2004	1.92	1.84	1.52	2.00	1.84	2.32	2.56	2.24			
7/22/2004	NA	NA	NA	NA	NA	NA	NA	NA			
7/29/2004	0.88	0.24	1.60	1.44	1.60	1.76	2.24	1.12			
8/5/2004	1.52	1.28	1.76	NA	NA	NA	NA	1.52			
8/11/2004	0.56	0.88	0.96	NA	NA	NA	NA	1.12			
8/19/2004	1.44	1.52	1.52	NA	NA	NA	NA	0.96			
8/26/2004	0.72	0.48	0.96	0.72	0.96	0.88	1.36	1.28			
9/2/2004	1.04	1.28	1.36	NA	NA	NA	NA	1.6			
9/8/2004	1.52	NA	1.60	NA	NA	NA	NA	1.20			
9/15/2004	0.96	0.88	0.88	0.88	0.88	0.96	0.48	0.72			
9/22/2004	1.76	1.36	2.08	NA	NA	NA	NA	1.52			
9/30/2004	1.52	0.48	1.28	NA	NA	NA	NA	0.96			
10/7/2004	2.16	1.28	1.28	NA	NA	NA	NA	1.44			
10/14/2004	1.28	1.04	1.04	NA	NA	NA	NA	1.44			
10/21/2004	1.52	1.52	1.28	NA	NA	NA	NA	2.16			
10/28/2004	1.20	NA	1.52	NA	NA	NA	NA	0.88			
11/4/2004	1.20	0.64	1.28	NA	NA	NA	NA	1.04			
11/10/2004	0.88	1.12	1.12	NA	NA	NA	NA	1.68			

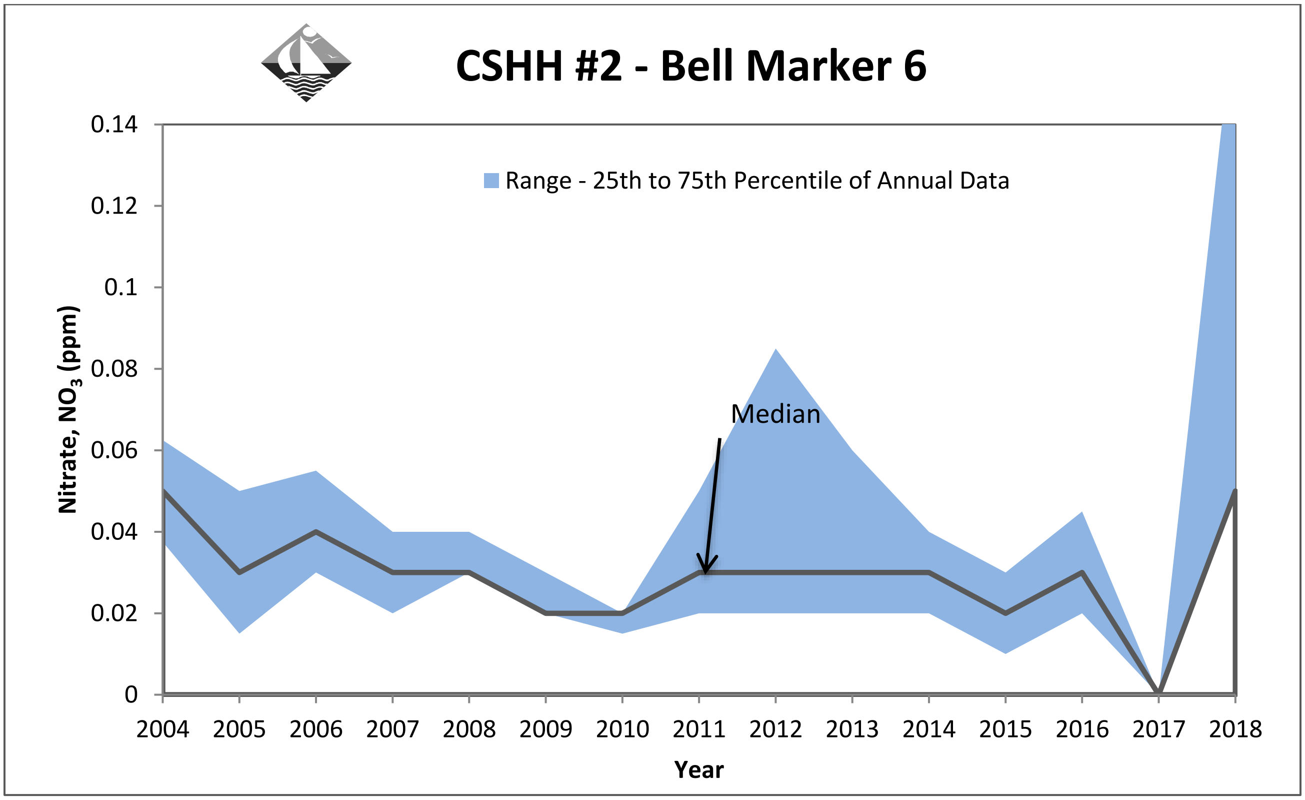
2004 Nitrogen Data

Total Inorganic Nitrogen (TIN)*											
Date	**CSHH#1**	**CSHH#2**	**CSHH#3**	**CSHH#4**	**CSHH#5**	**CSHH#6**	**CSHH#7**	**CSHH#8**	**CSHH#13**	**CSHH#14**	**CSHH#15**
6/3/2004	2.28	1.99	1.73	1.77	1.80	1.61	2.11	2.94			
6/10/2004	1.73	1.51	1.80	1.56	1.47	1.45	2.00	2.39			
6/18/2004	1.18	1.17	0.91	1.07	0.72	1.05	1.12	1.45			
6/24/2004											
7/14/2004	1.97	1.91	1.54	2.06	1.94	2.48	3.14	2.45			
7/22/2004											
7/29/2004	0.97	0.30	1.68	1.51	1.80	1.80	2.27	1.17			
8/5/2004	1.56	1.33	1.79					1.65			
8/11/2004	0.60	0.93	0.97					1.22			
8/19/2004	1.51	1.55	1.55					1.36			
8/26/2004	0.73	0.51	1.05	0.74	1.63	0.92	1.64	1.35			
9/2/2004	1.11	1.31	1.37					1.99			
9/8/2004	1.57		1.69					1.35			
9/15/2004	1.09	0.95	0.98	0.98	0.95	1.04	0.57	1.11			
9/22/2004	1.90	1.55	2.21					1.97			
9/30/2004	1.67	0.64	1.44					1.71			
10/7/2004	2.18	1.37	1.42					1.71			
10/14/2004	1.40	1.09	1.17					1.69			
10/21/2004	1.69	1.58	1.33					2.70			
10/28/2004	1.30		1.57					0.95			
11/4/2004	1.29	0.73	1.43					1.58			
11/10/2004	0.90	1.22	1.19					2.41			

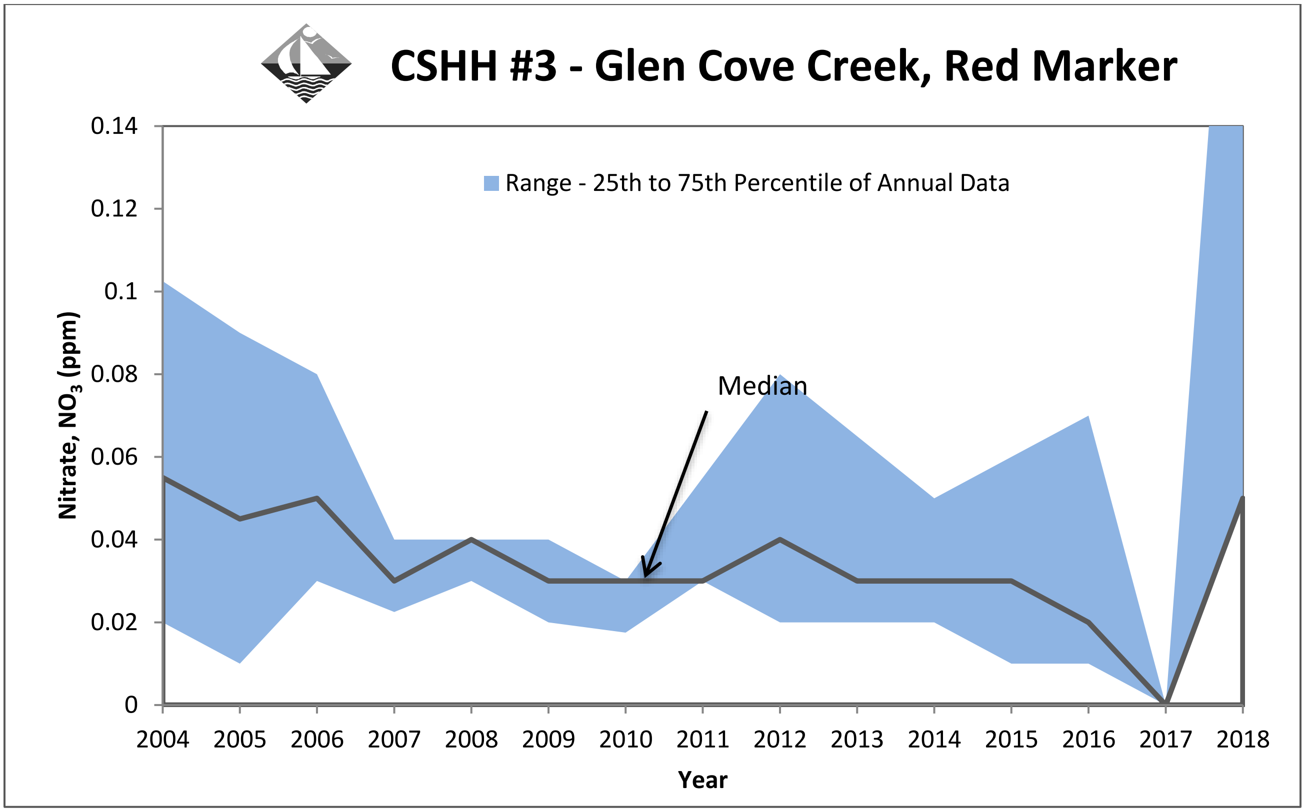
2004-2018 Nitrogen Range Graphs

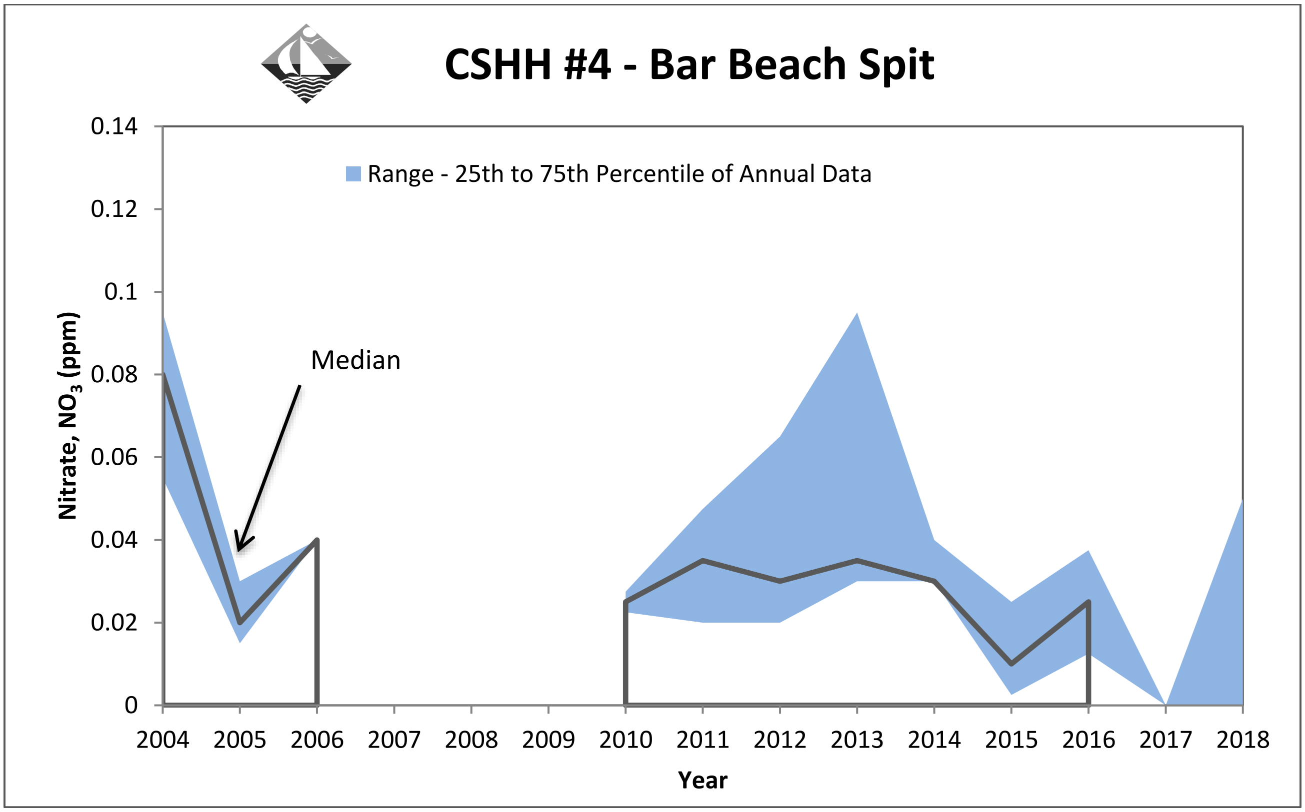
Nitrate



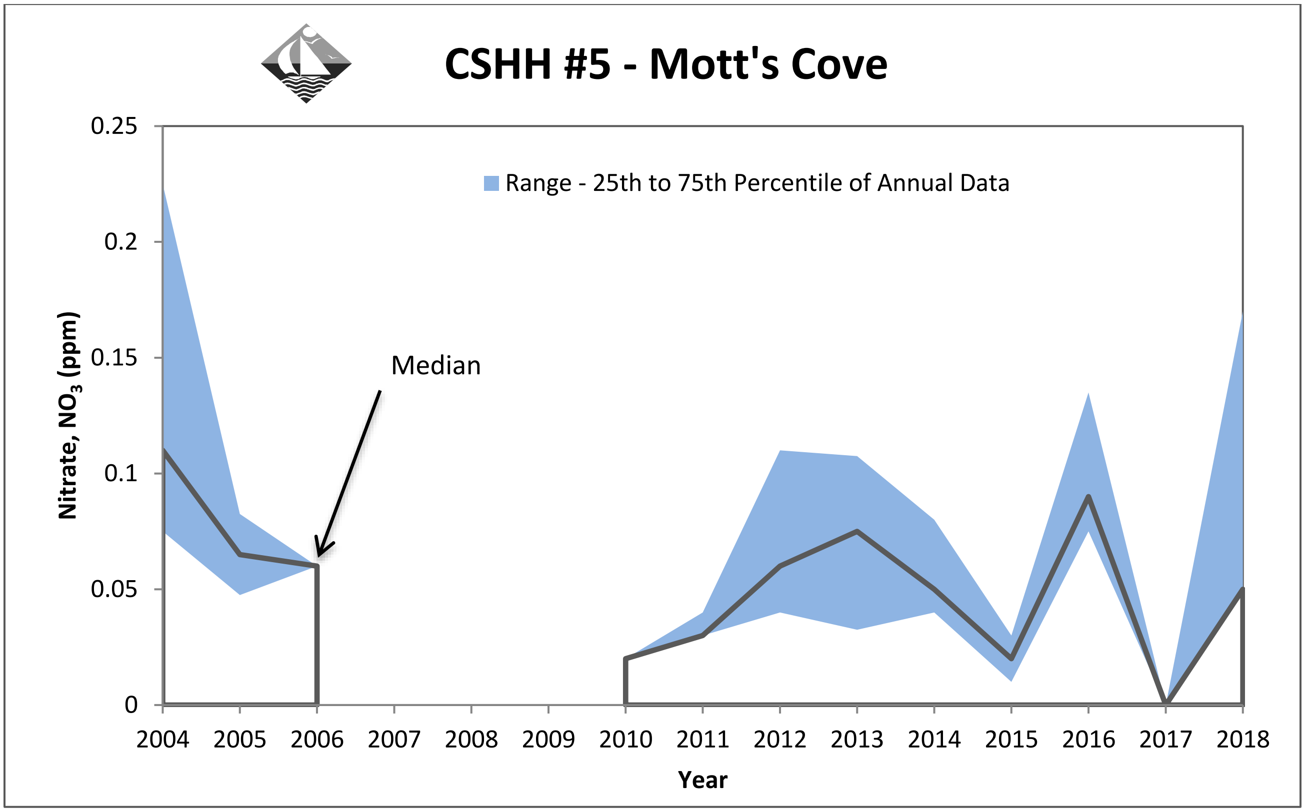


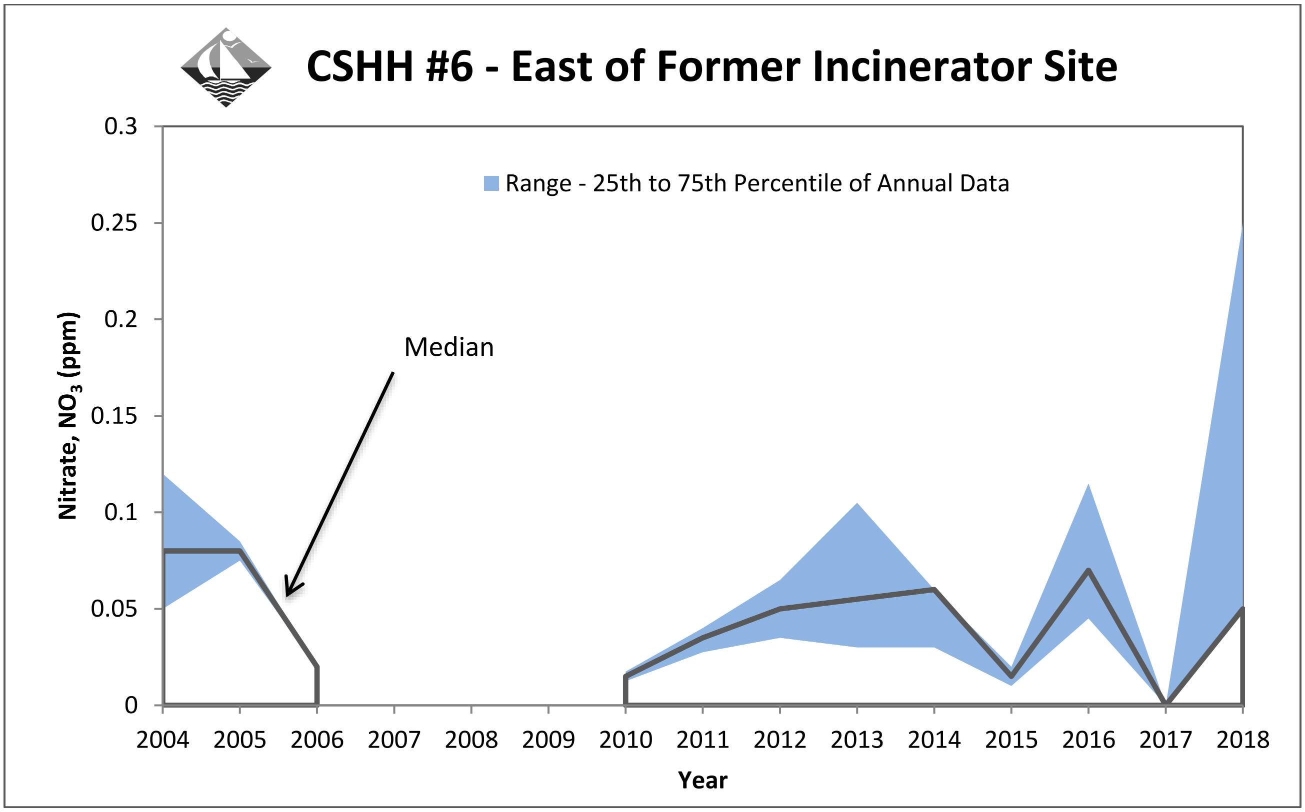
2004-2018 Nitrogen Range Graphs



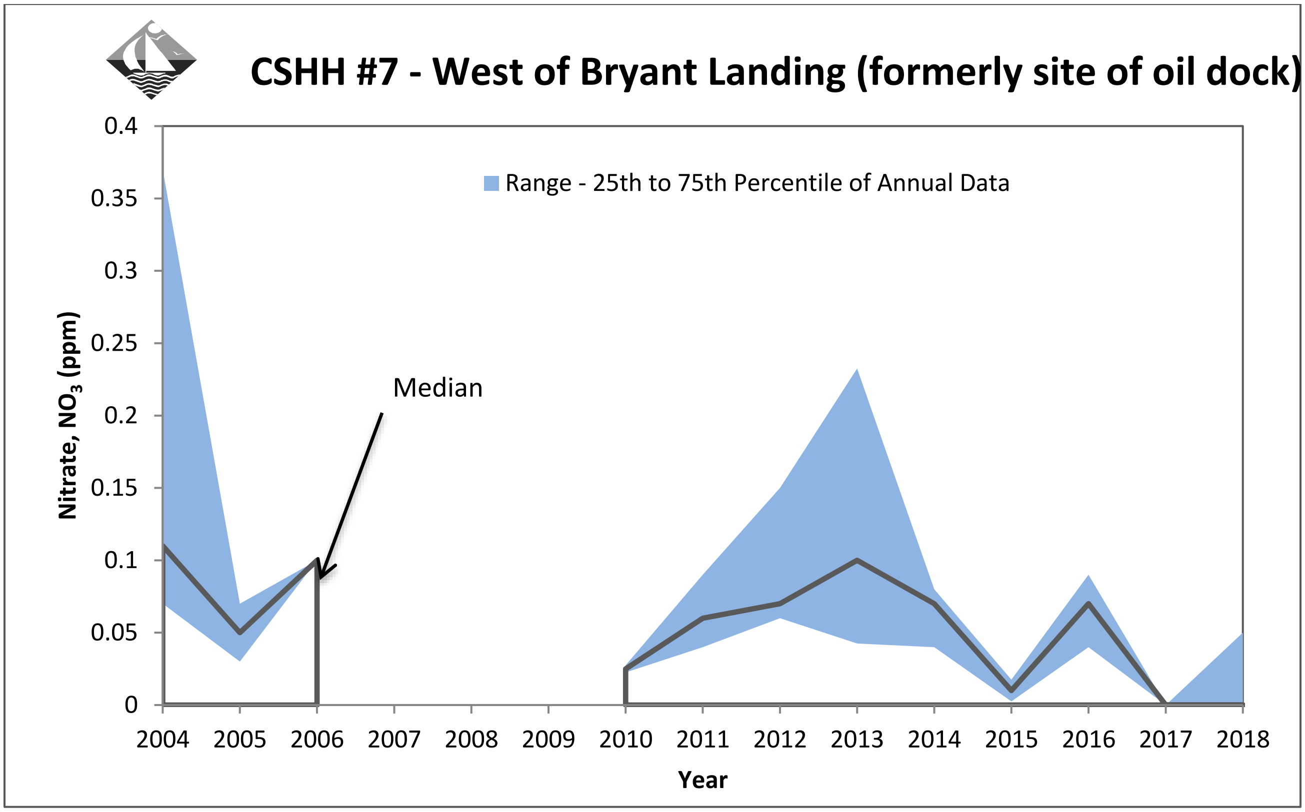


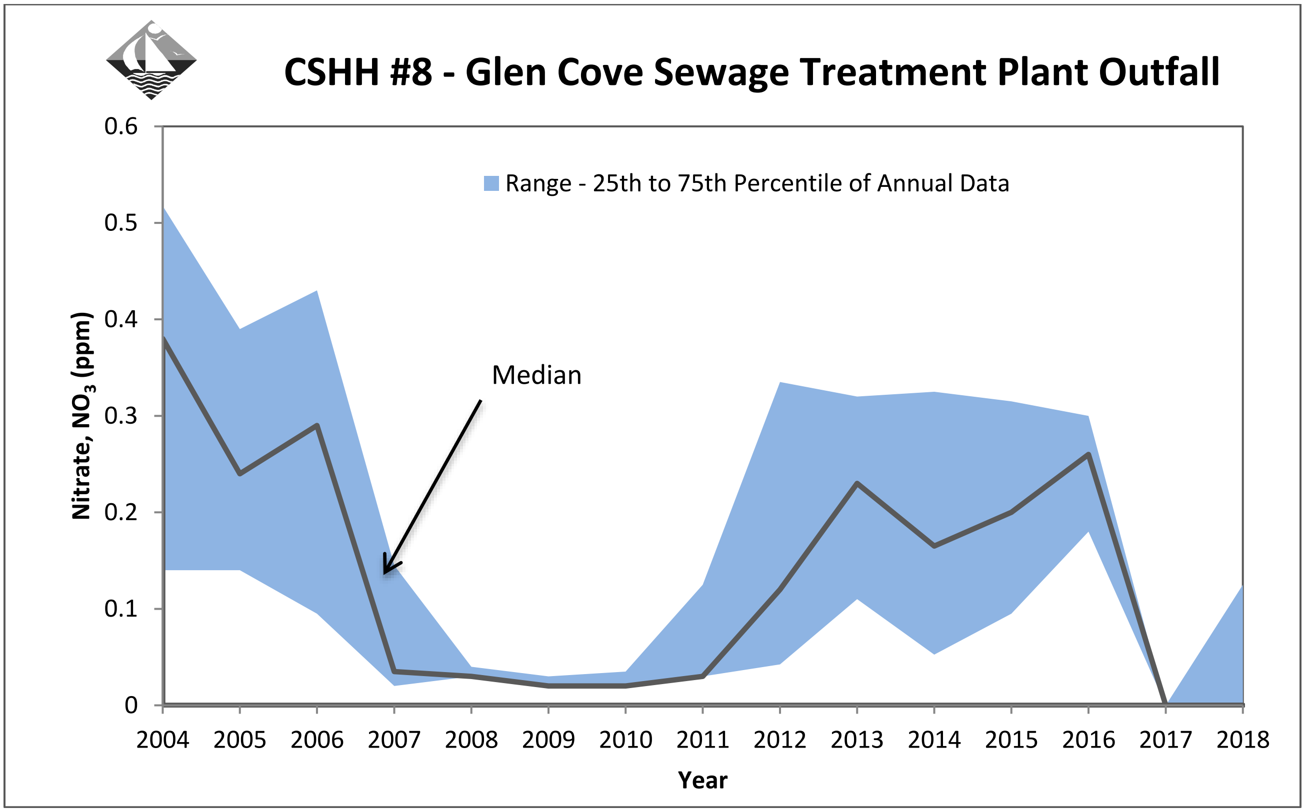
2004-2018 Nitrogen Range Graphs



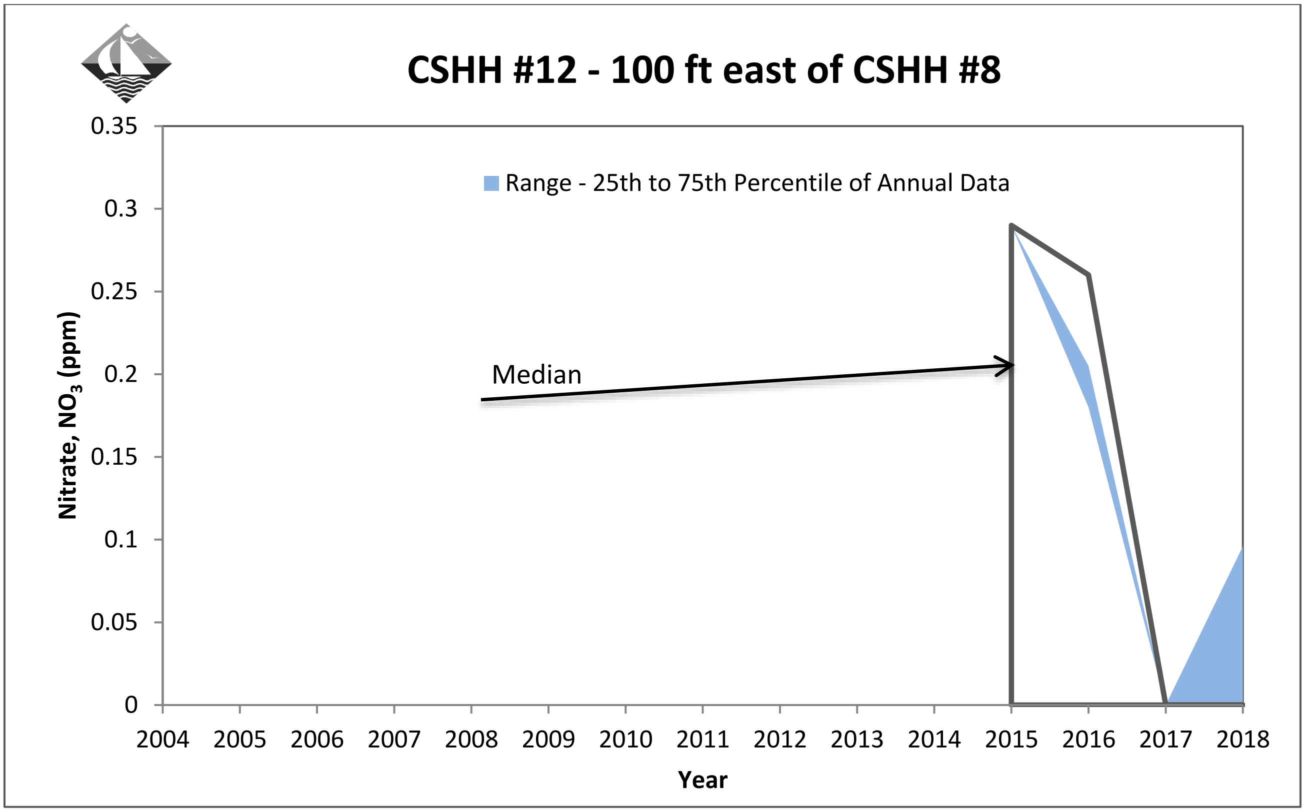


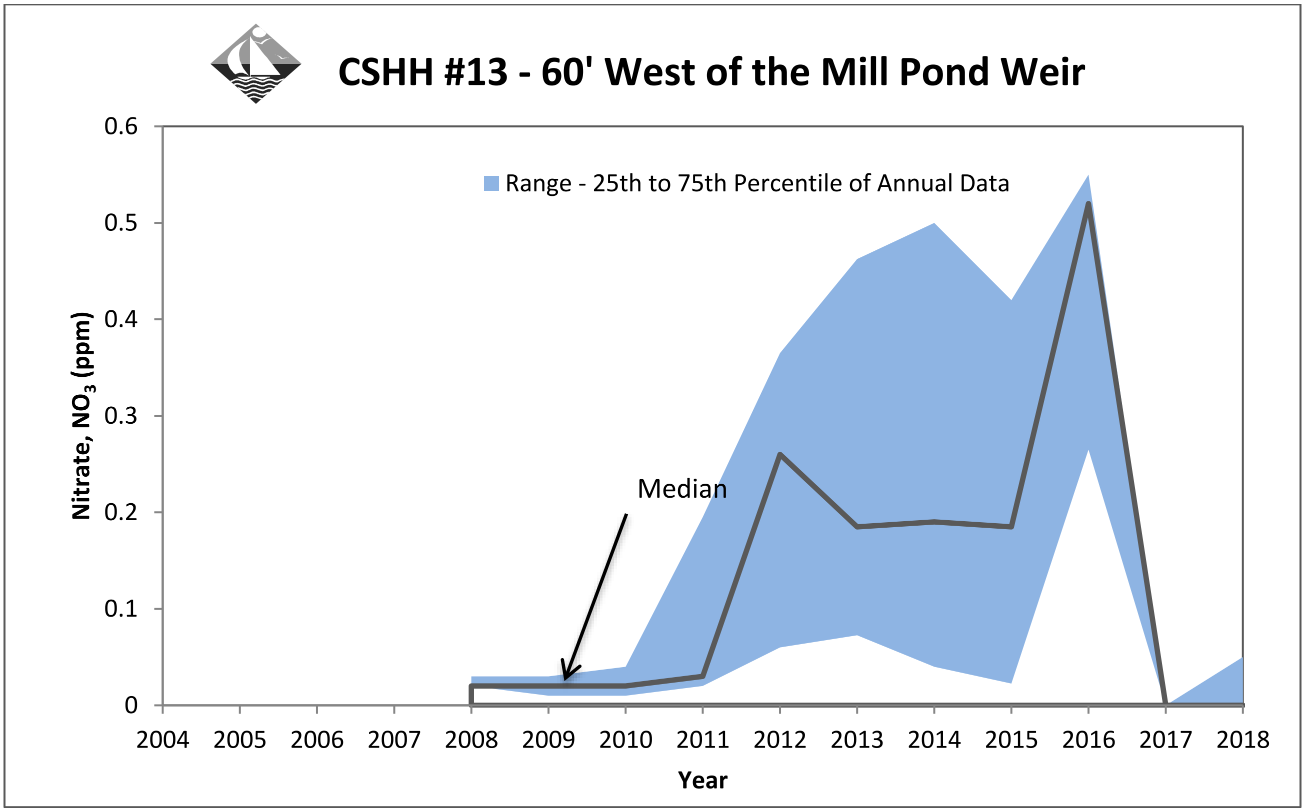
2004-2018 Nitrogen Range Graphs



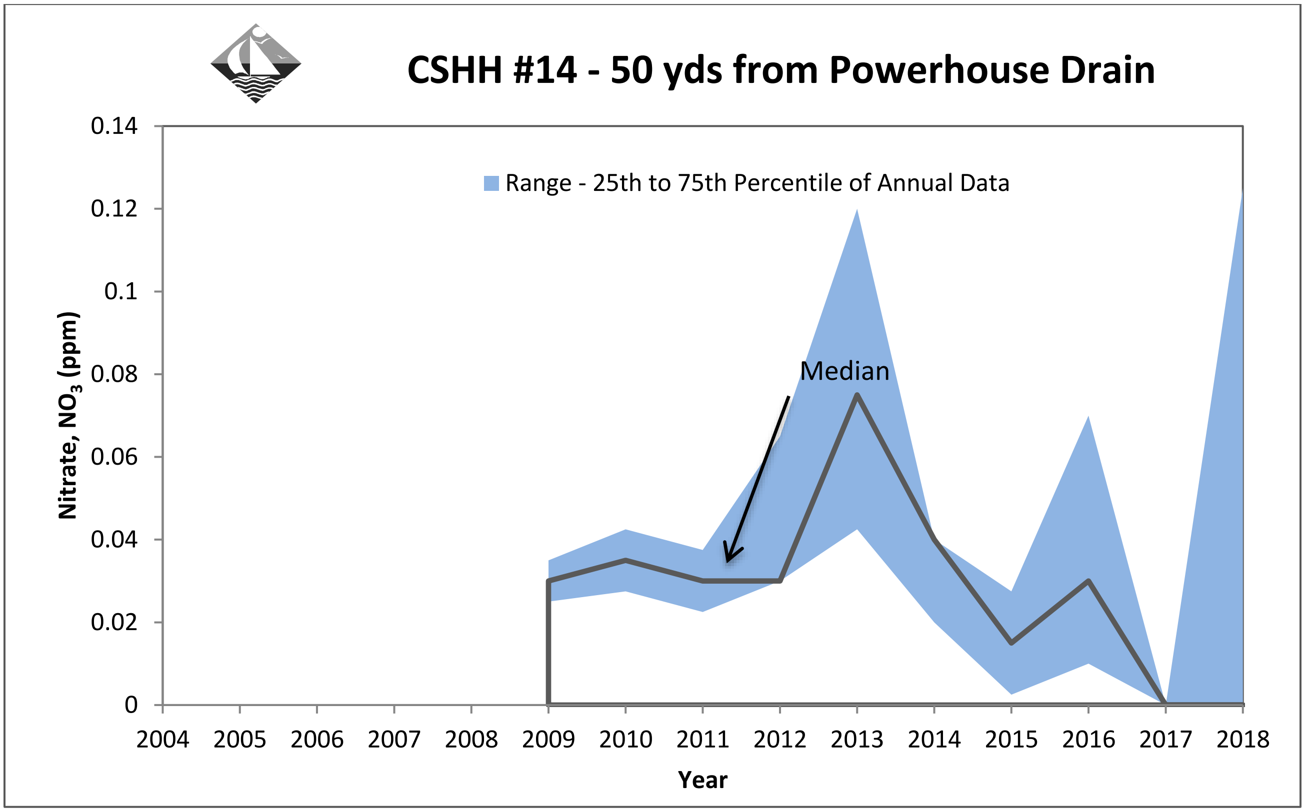


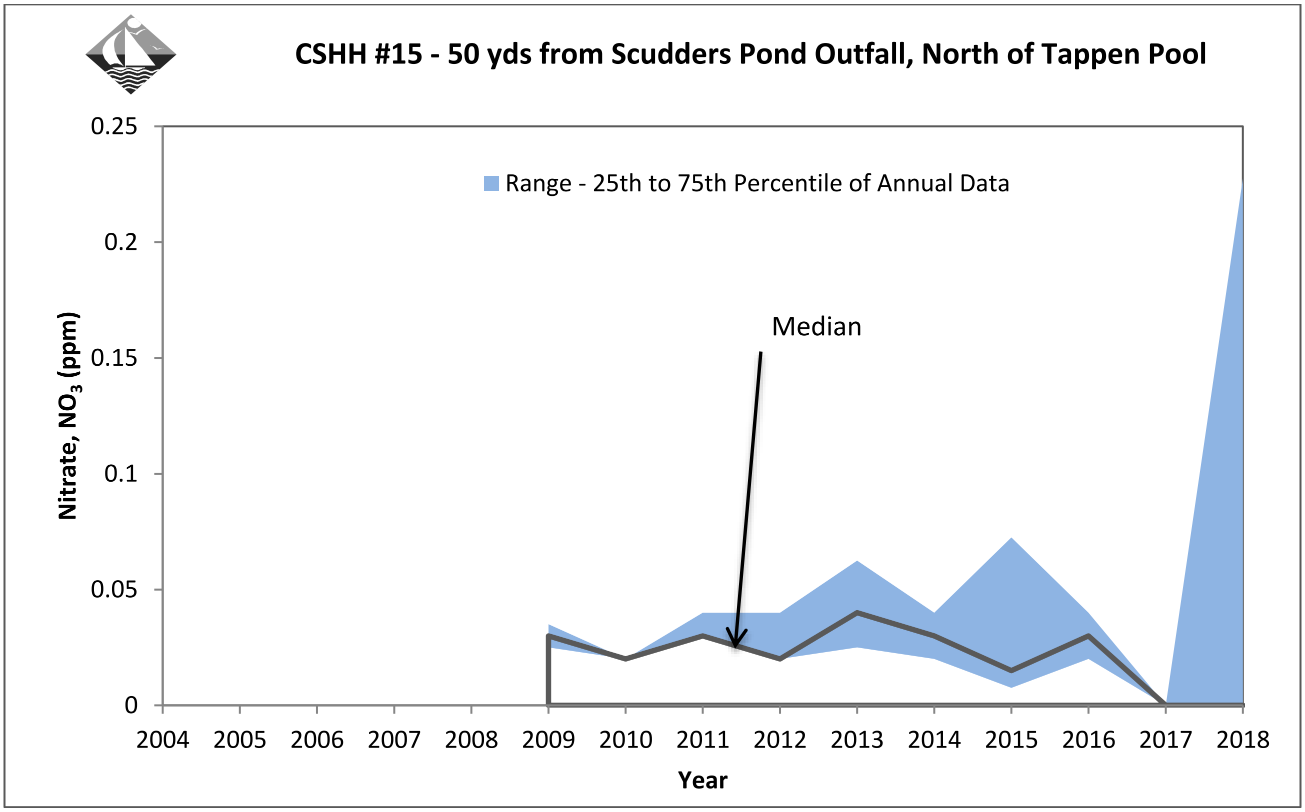
2004-2018 Nitrogen Range Graphs



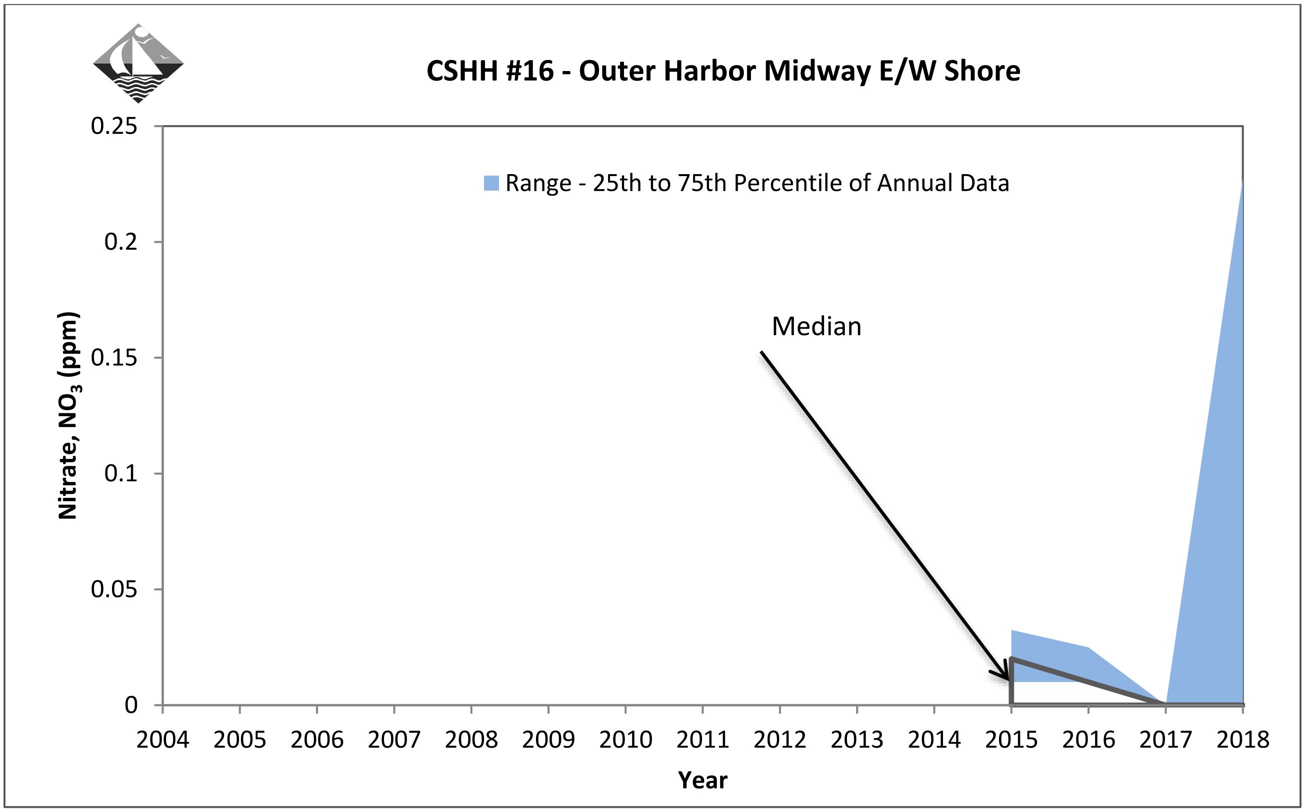


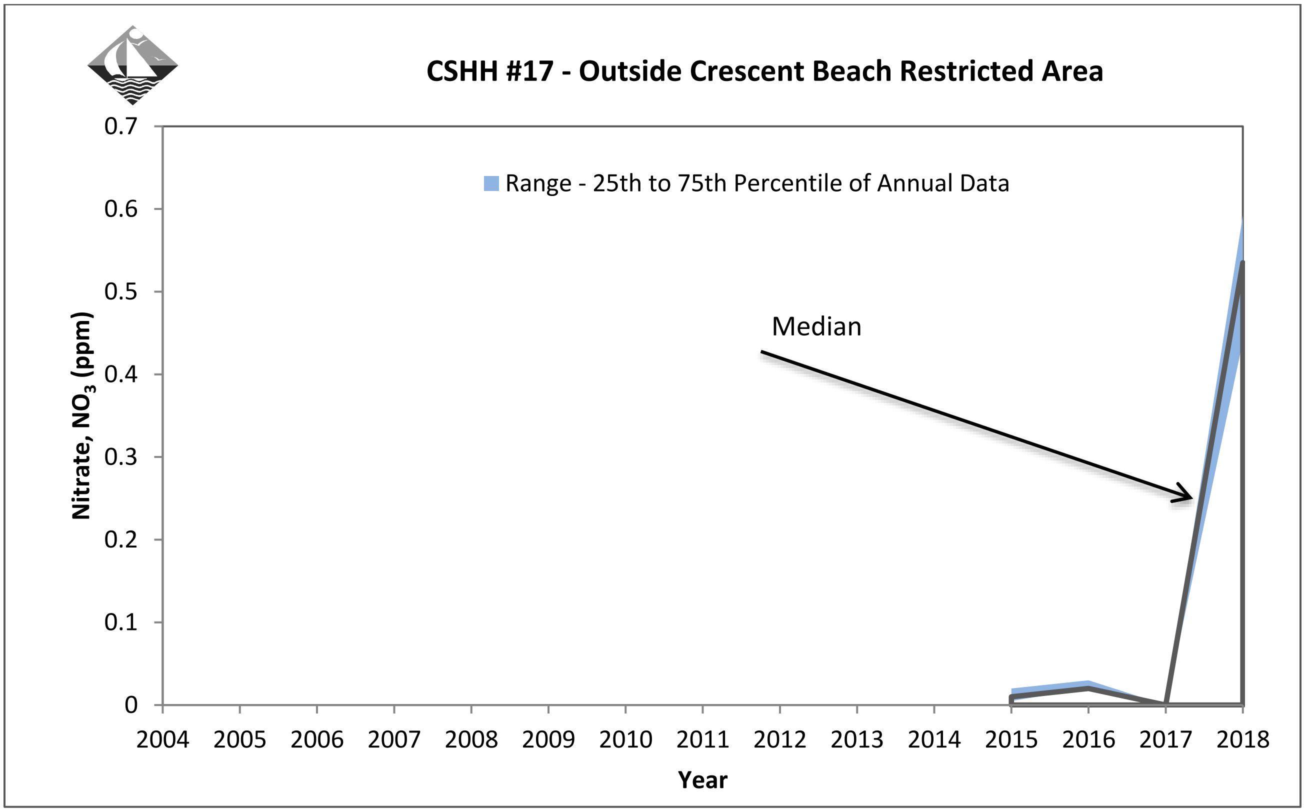
2004-2018 Nitrogen Range Graphs





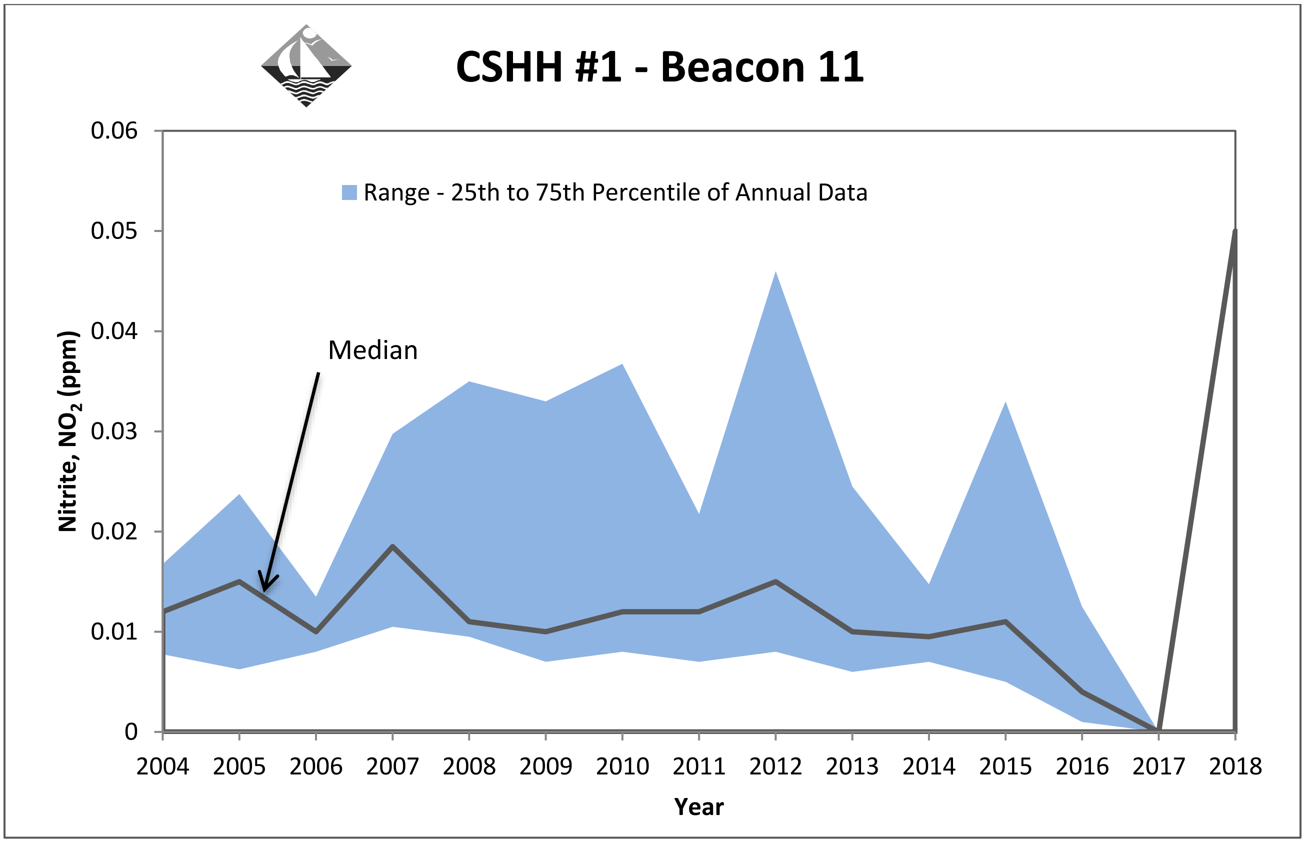
2004-2018 Nitrogen Range Graphs

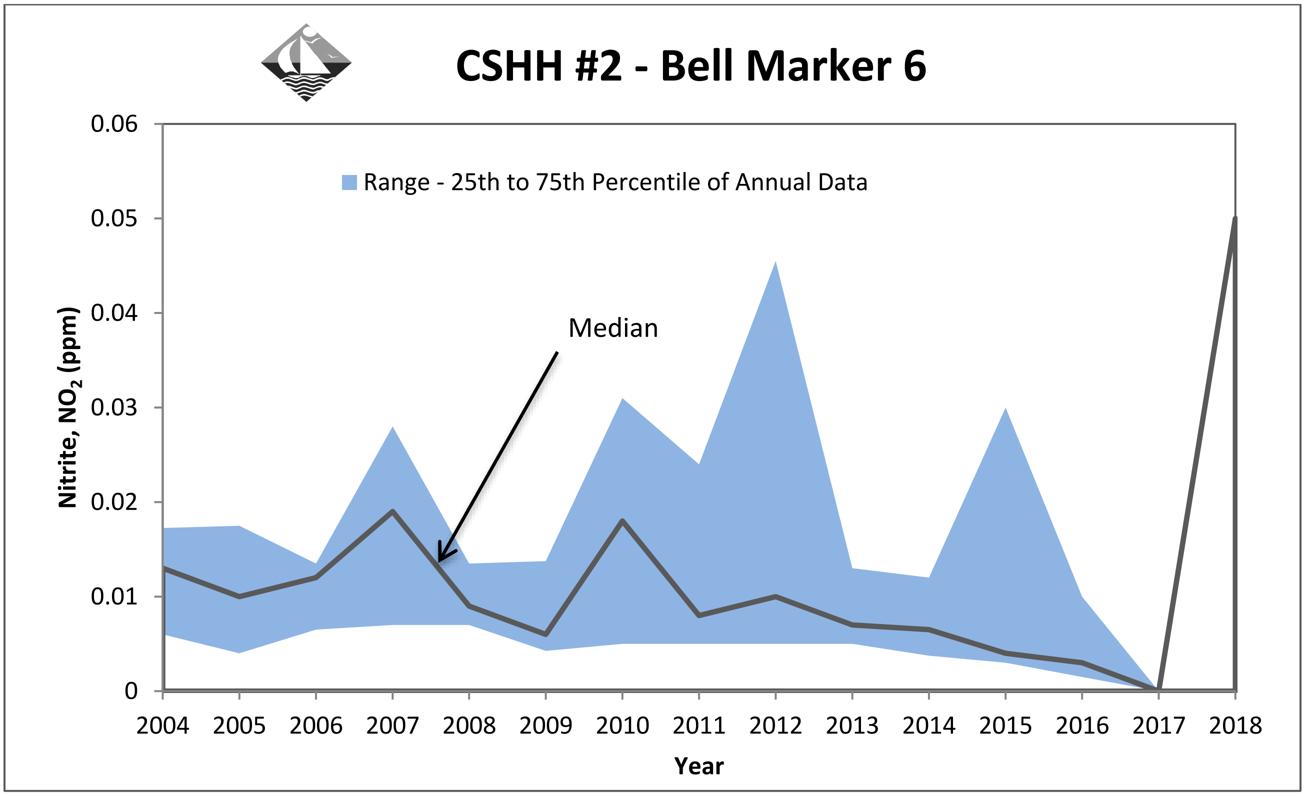




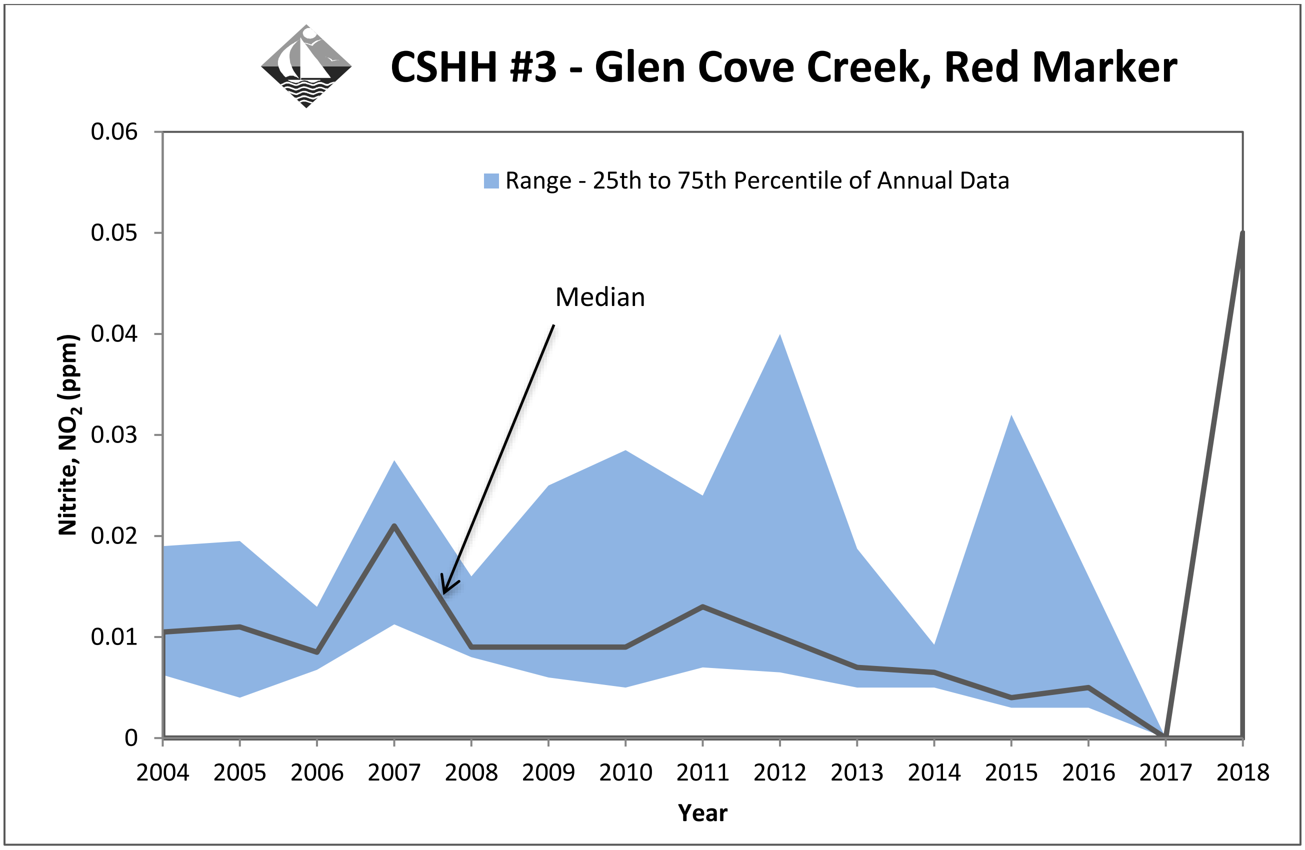
2004-2018 Nitrogen Range Graphs

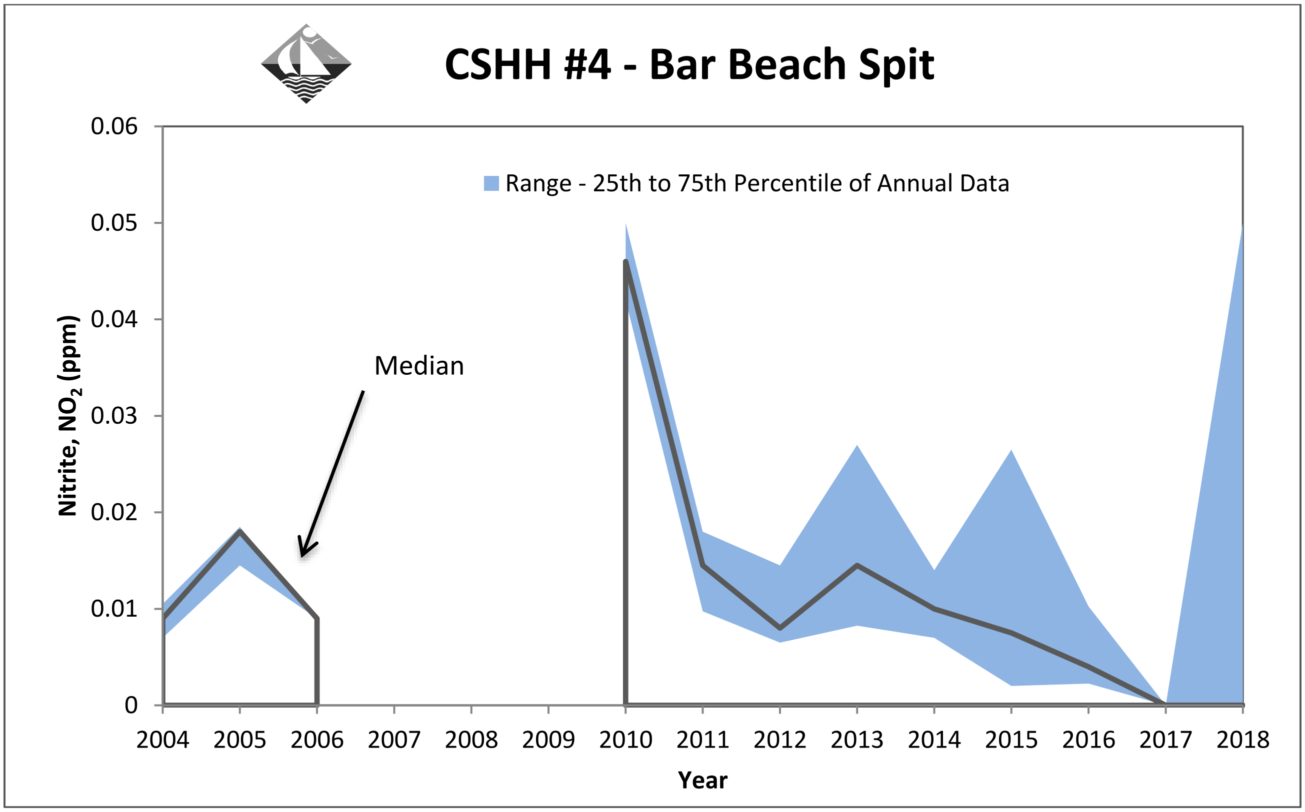
Nitrite



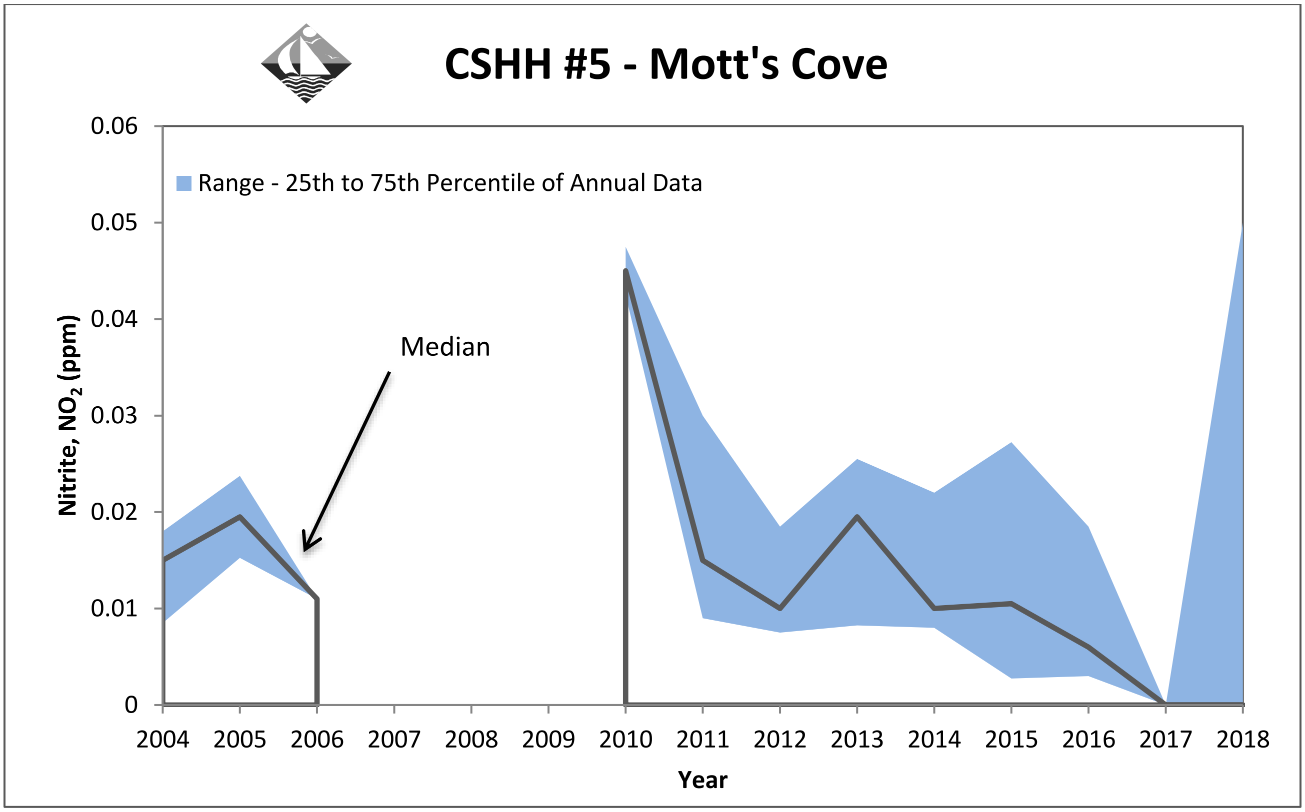


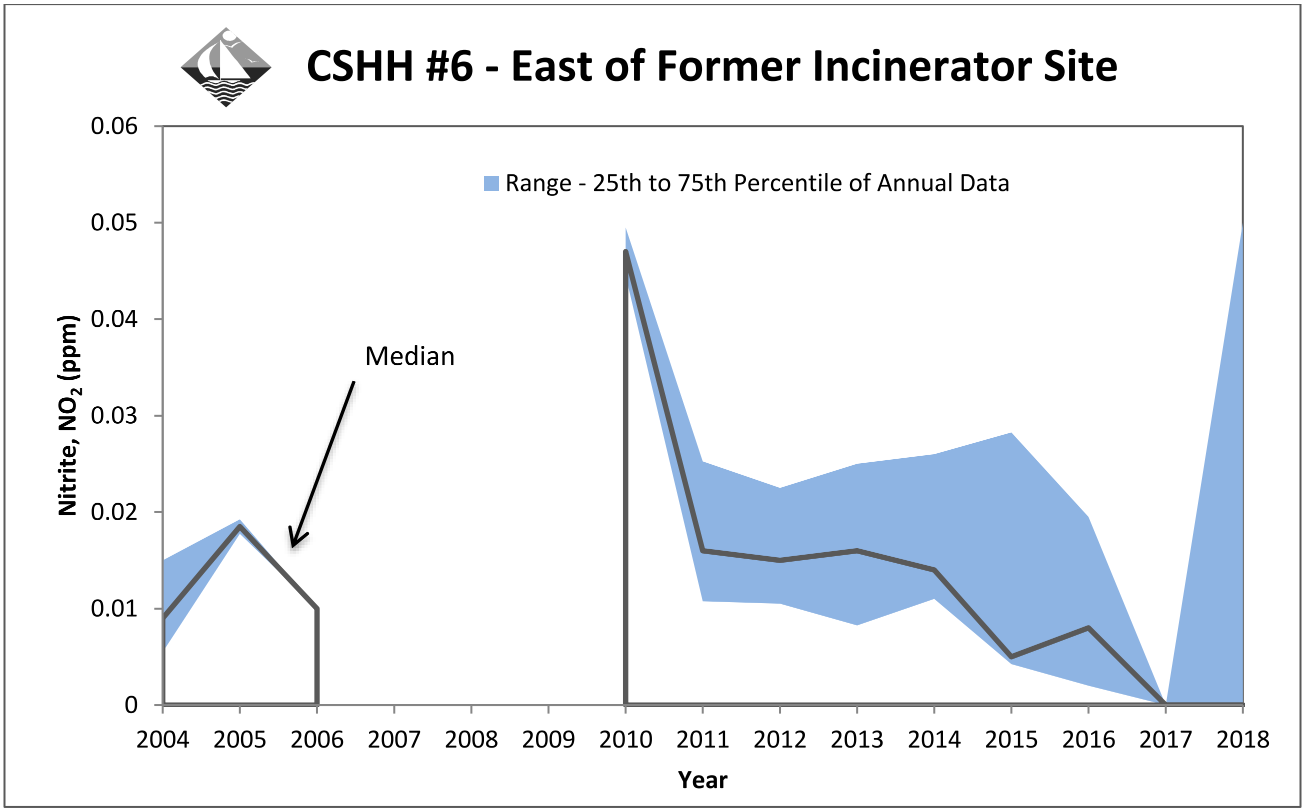
2004-2018 Nitrogen Range Graphs



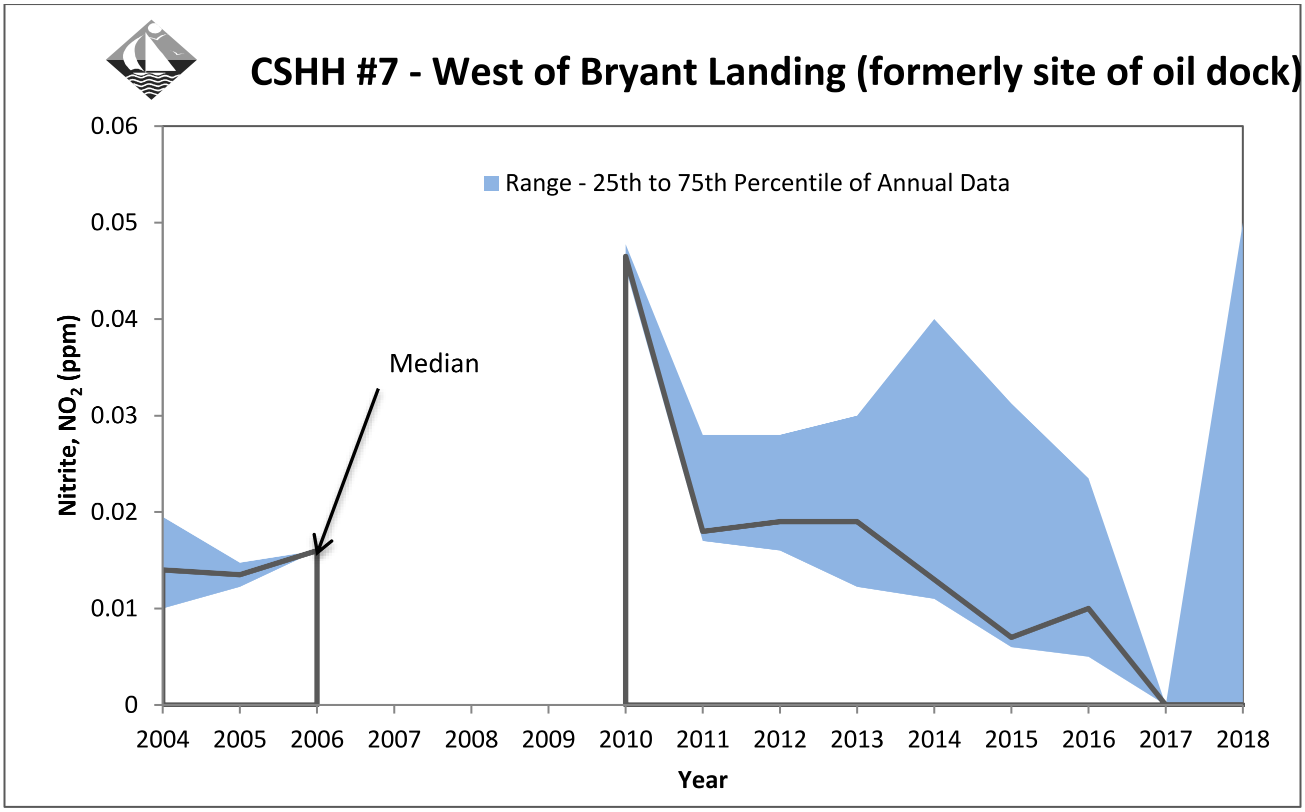


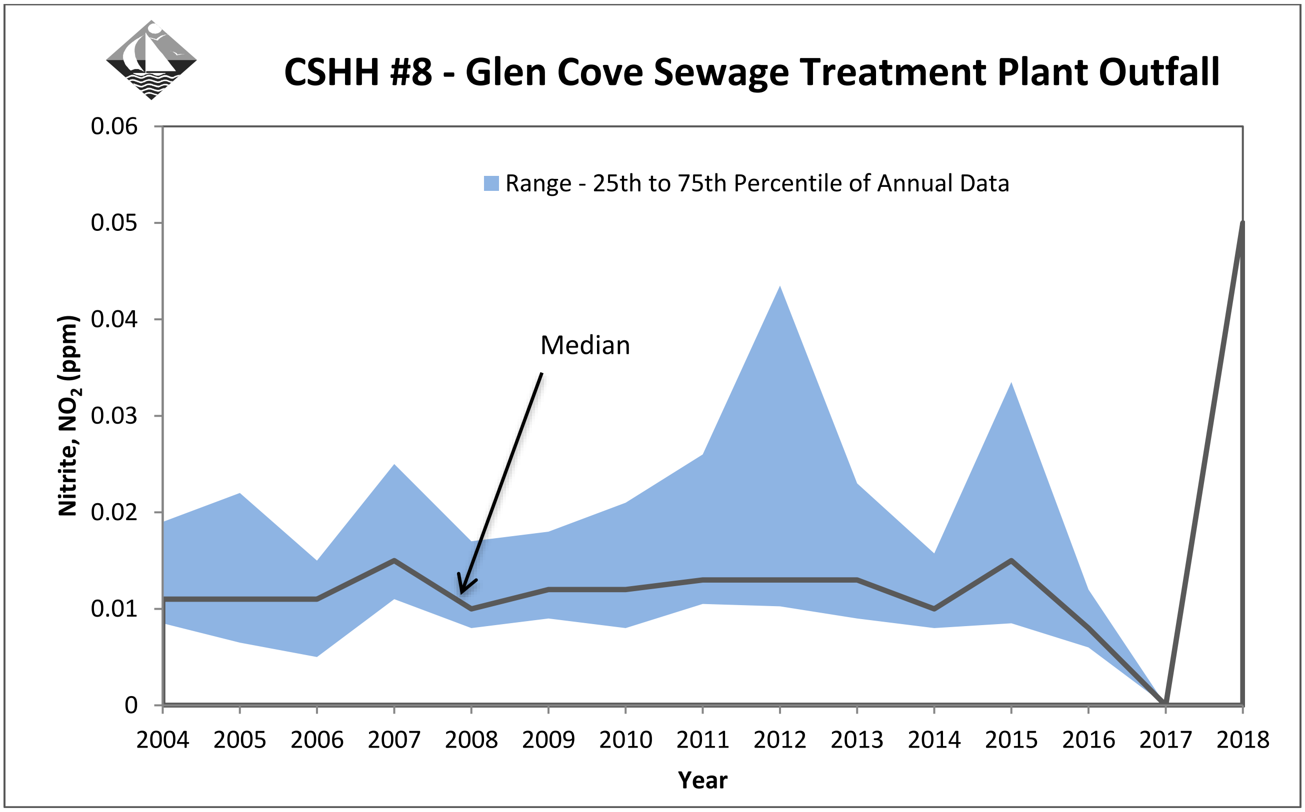
2004-2018 Nitrogen Range Graphs



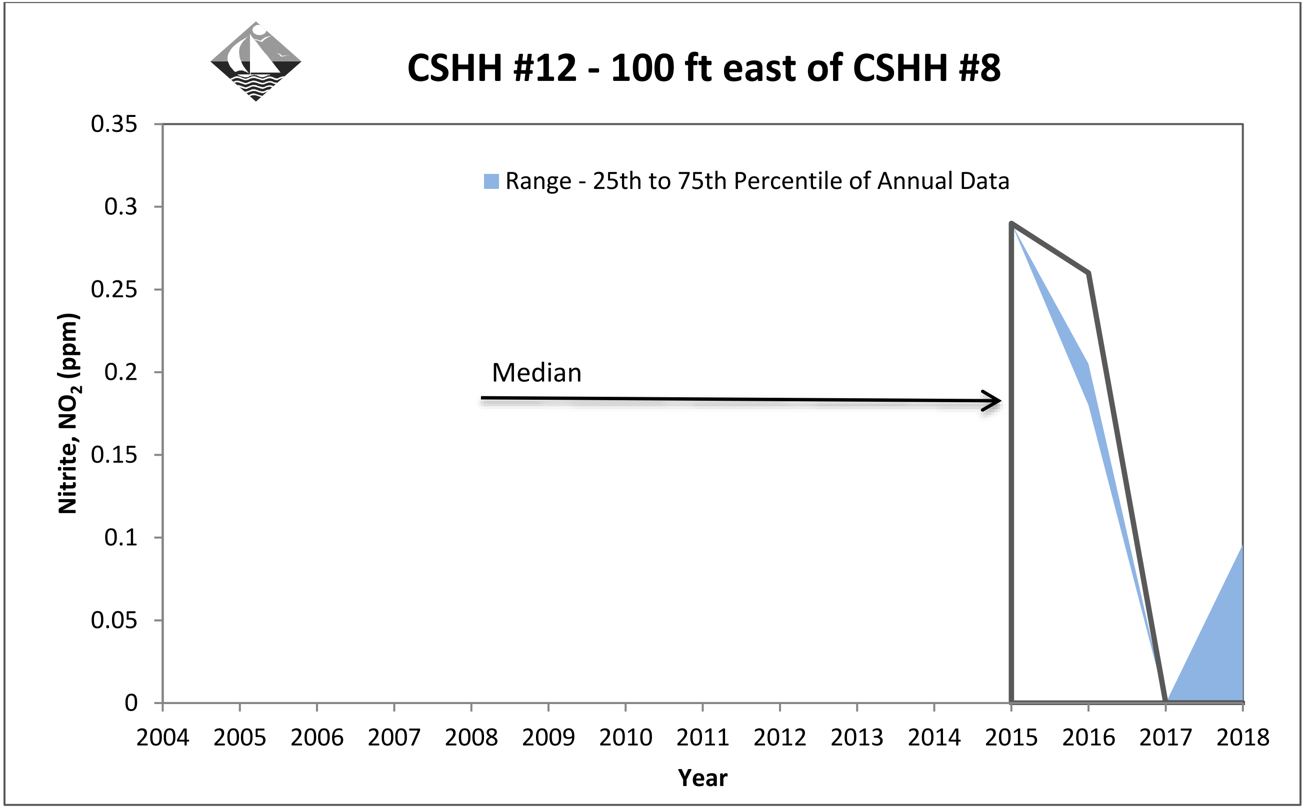


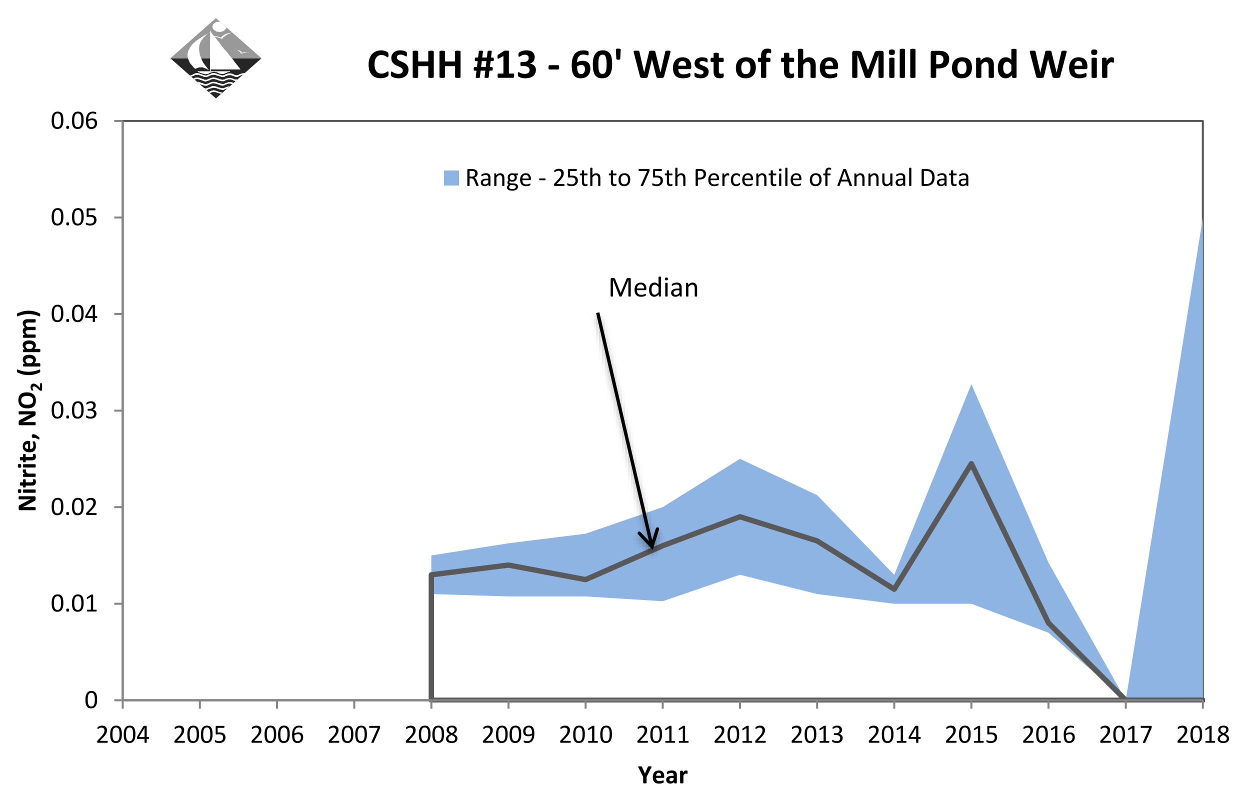
2004-2018 Nitrogen Range Graphs



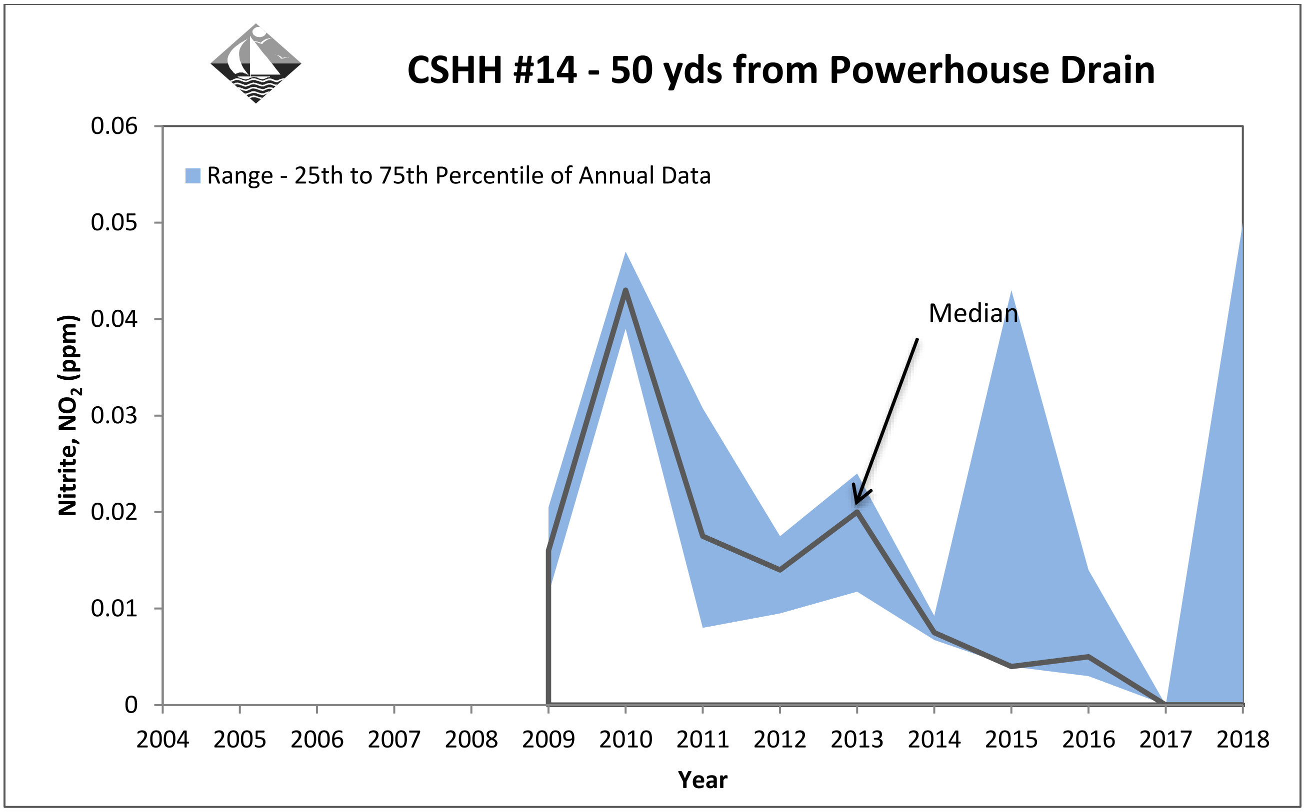


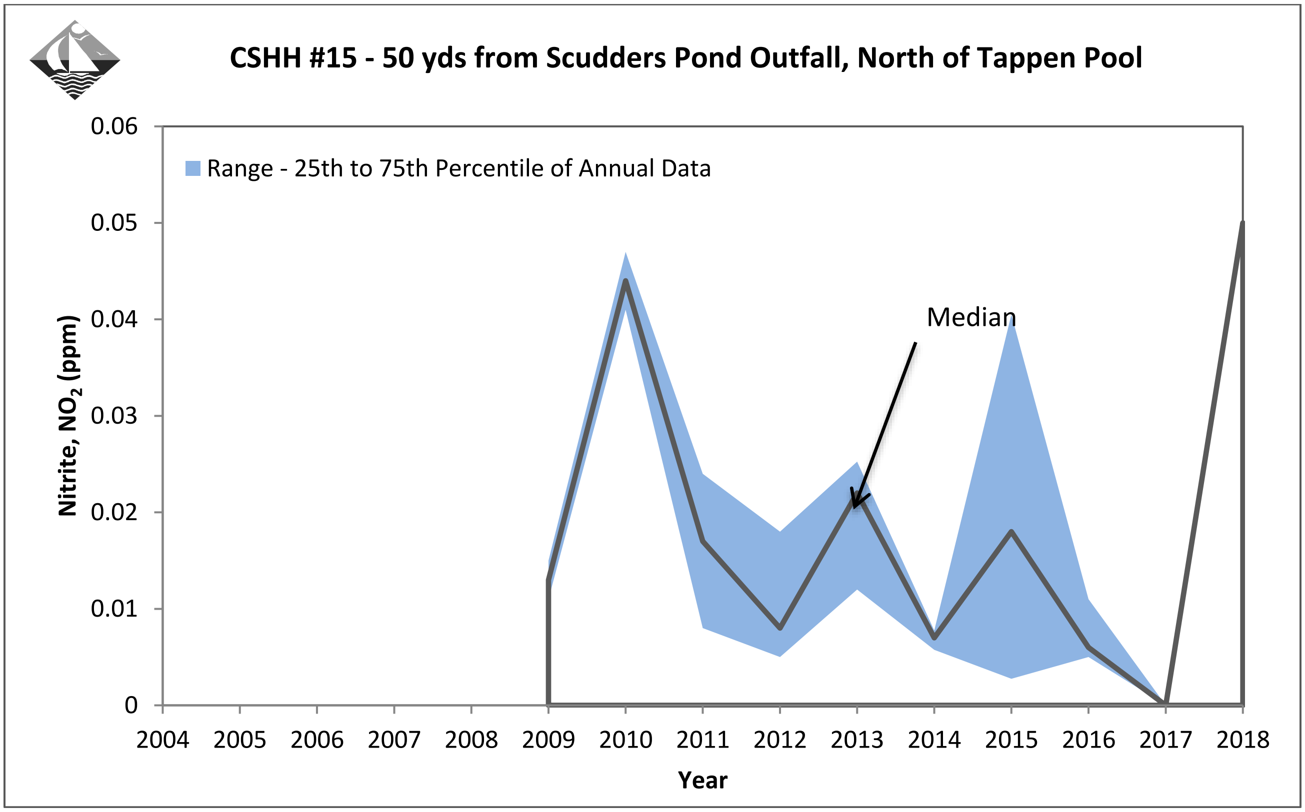
2004-2018 Nitrogen Range Graphs



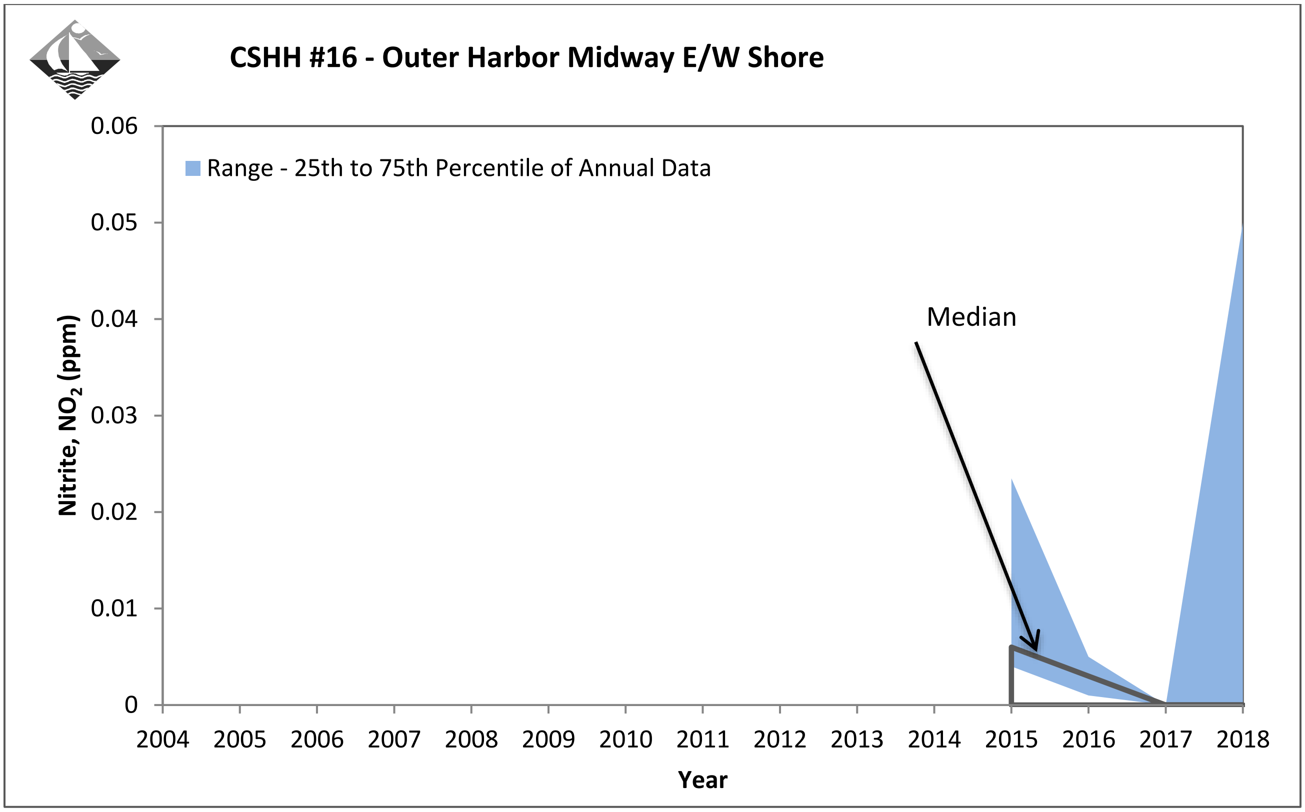


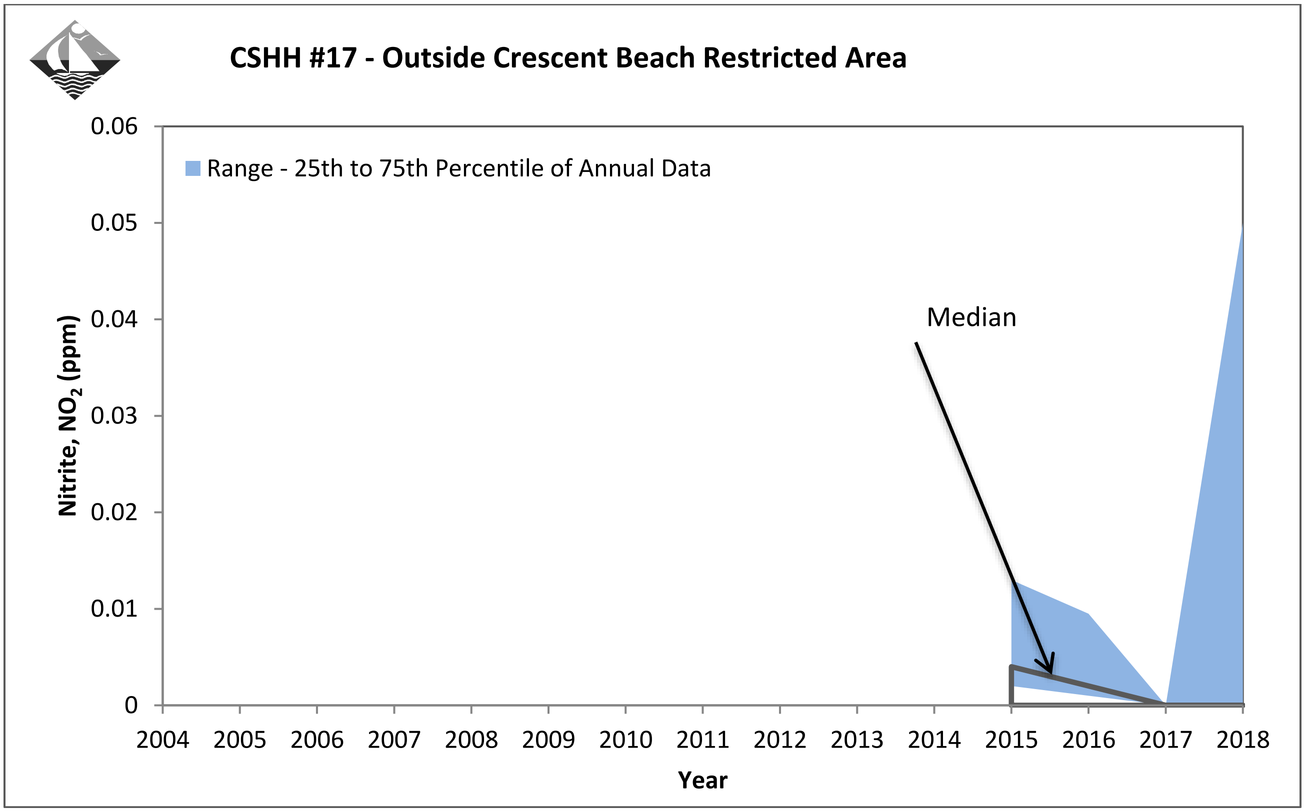
2004-2018 Nitrogen Range Graphs





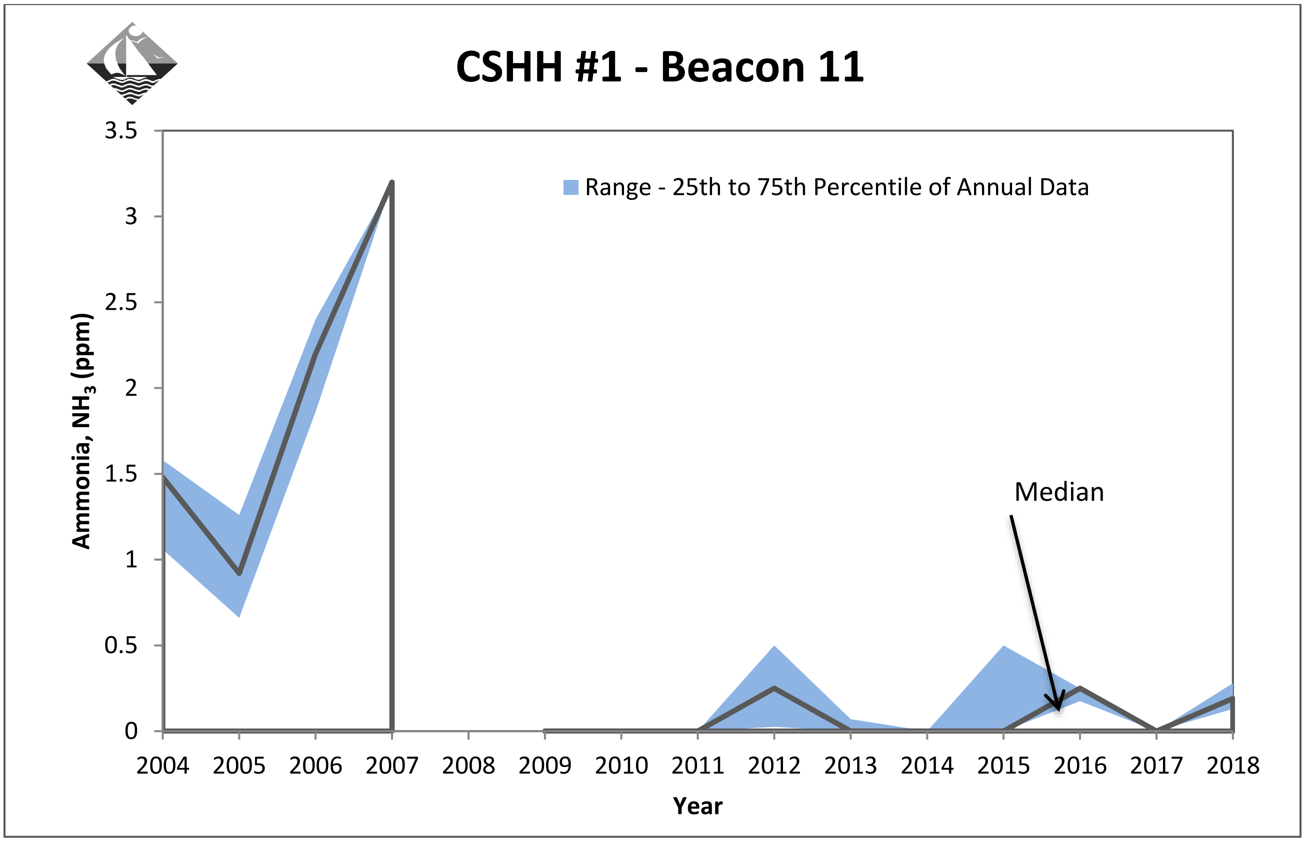
2004-2018 Nitrogen Range Graphs

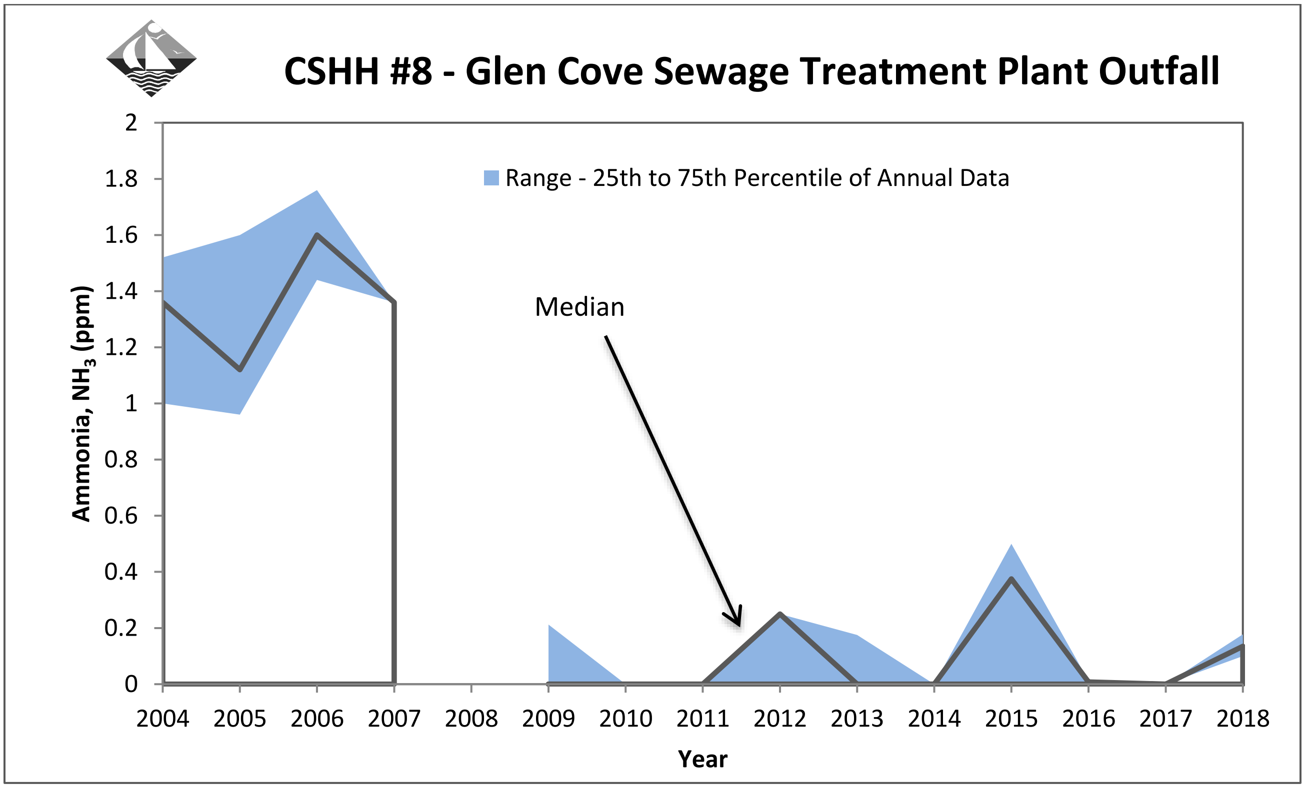




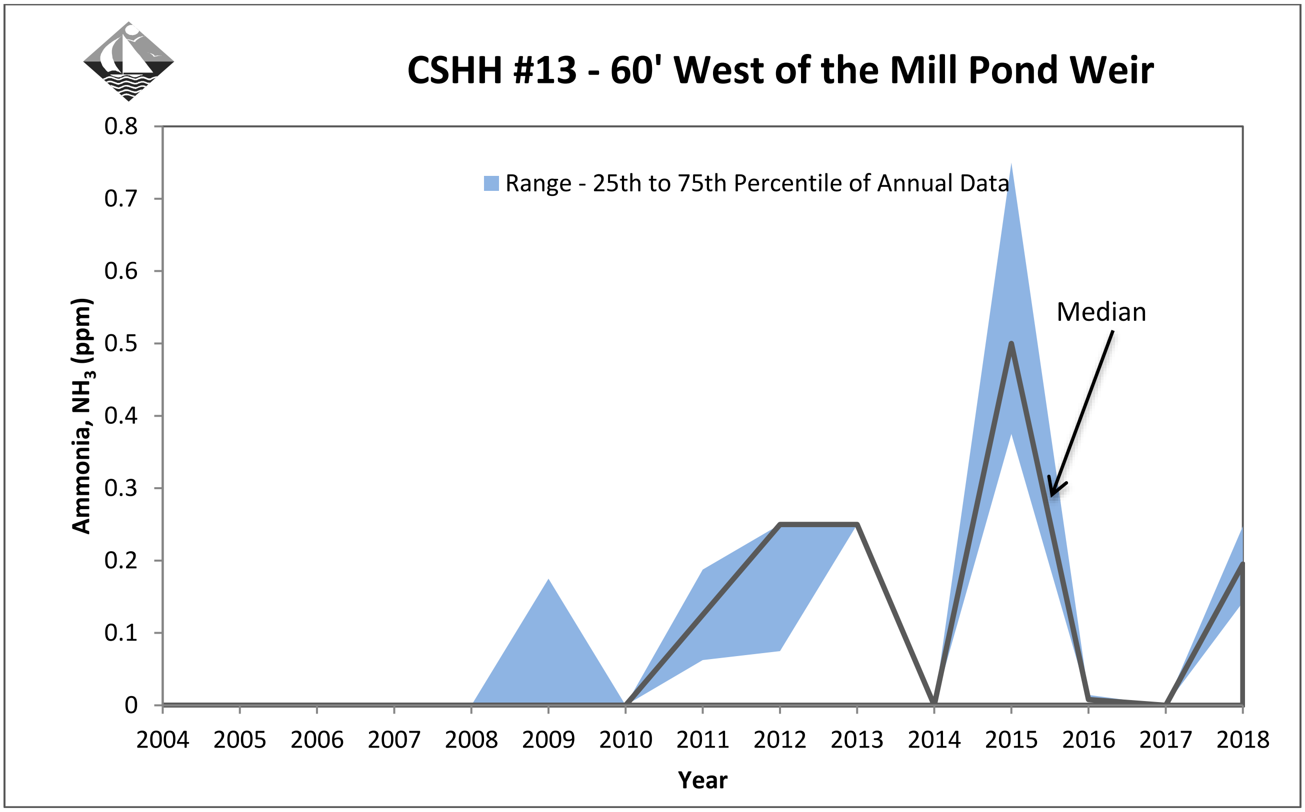
2004-2018 Nitrogen Range Graphs

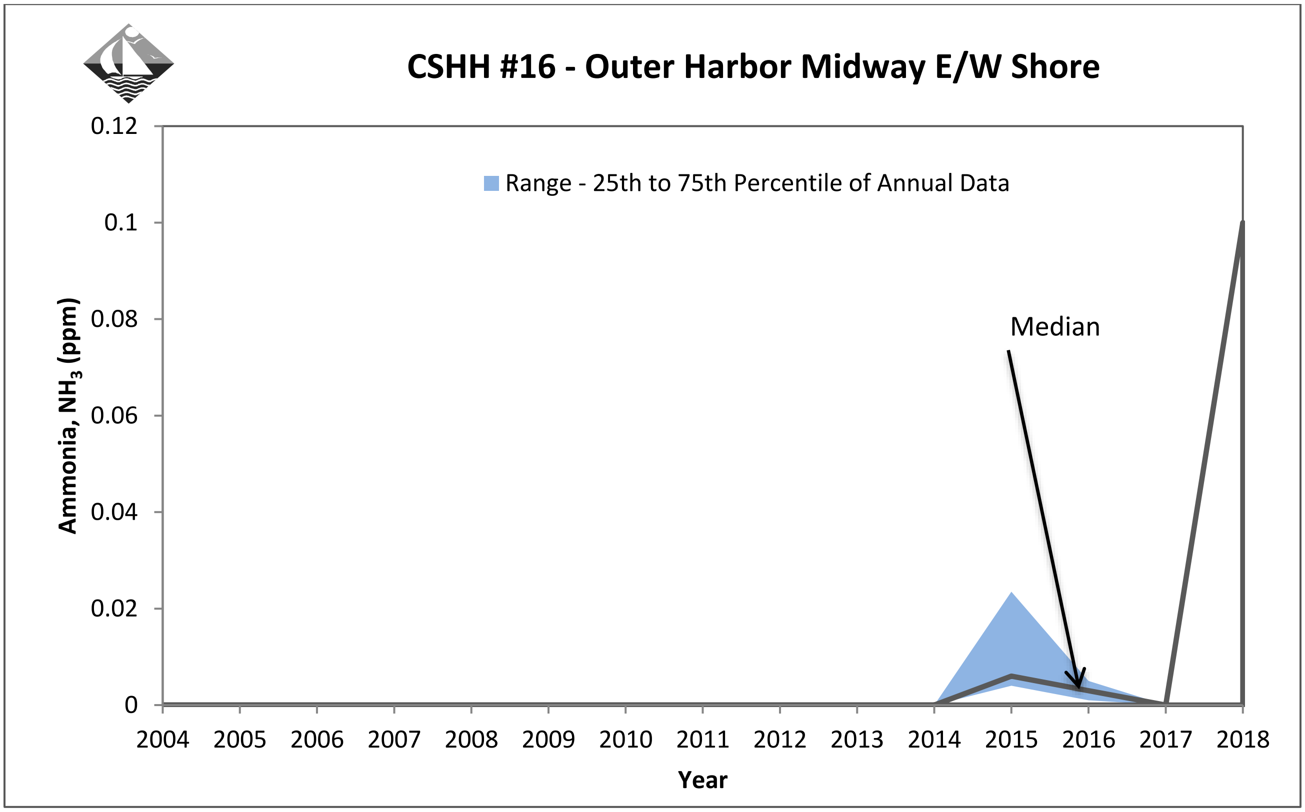
Ammonia



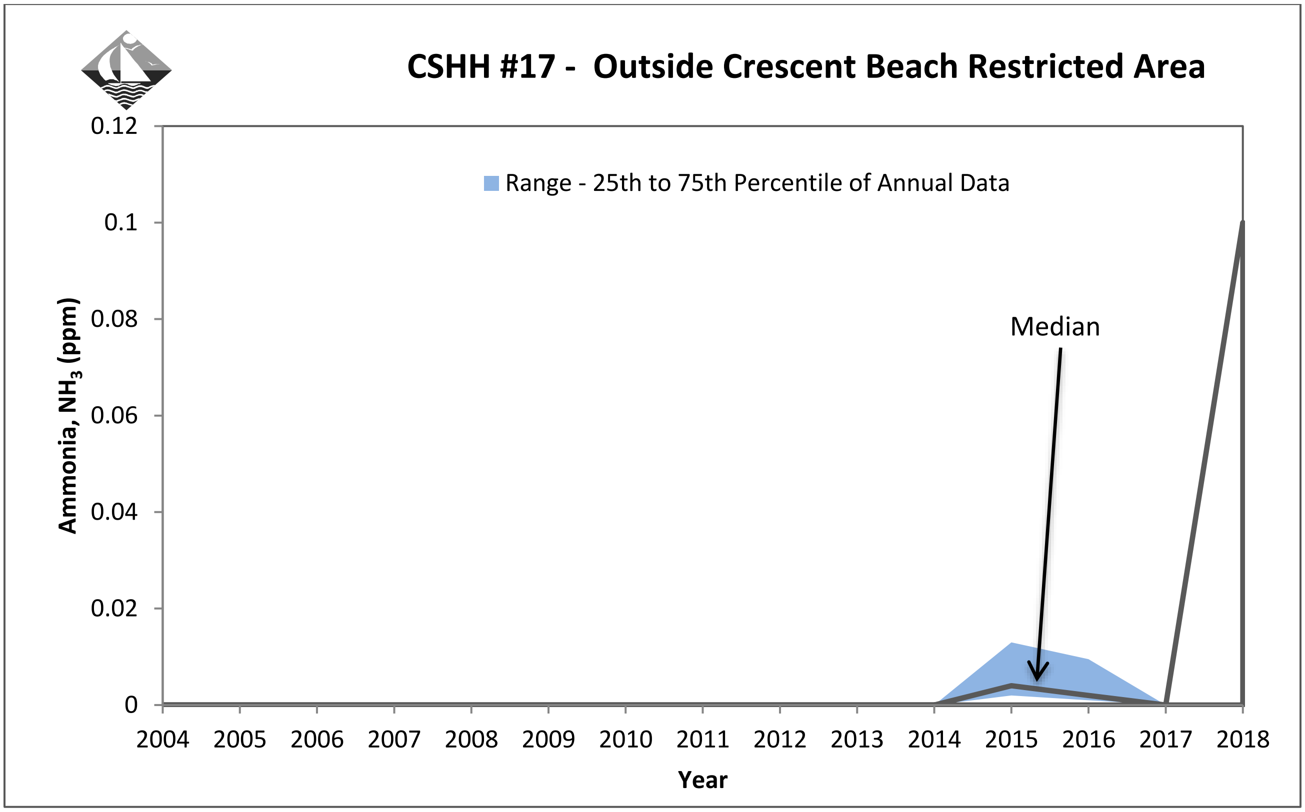


2004-2018 Nitrogen Range Graphs





2004-2018 Nitrogen Range Graphs



Appendix D

Comparison of Averaged Indicator Bacteria Data for Beaches
1995-2018 Water-Quality Data Summary
Seasonal Averages for Selected Water-Quality Parameters

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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	3.64	27.47	4.20	39.76	27.64	0.73	1.37
May	Enterococci	8.31	8.93	1.94	2.68	5.04	8.36	1.58
June	Enterococci	4.93	12.64	25.29	19.16	10.51	45.84	25.90
July	Enterococci	51.91	51.63	7.76	12.65	14.03	426.19	37.43
August	Enterococci	42.17	124.67	14.36	11.79	19.89	97.82	13.75
September	Enterococci	--	--	--	--	--	55.09	--
Season Averages*	*Enterococci*	*22.20*	*45.07*	*10.71*	*17.21*	*15.42*	*105.67*	*16.00*

*Averages of all of the data points collected during the monitoring season.

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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	3.38	11.57	10.17	10.05	1.90	32.03	1.40
May	Enterococci	14.46	14.68	37.80	13.24	20.26	29.94	7.96
June	Enterococci	17.01	56.89	10.51	35.02	19.53	40.48	42.08
July	Enterococci	95.13	71.90	44.78	105.84	14.89	259.23	18.52
August	Enterococci	11.33	12.02	15.10	18.27	52.28	164.89	178.44
September	Enterococci	--	--	--	59.75	--	65.33	--
Season Averages*	*Enterococci*	*30.36*	*34.44*	*24.73*	*44.25*	*24.63*	*111.43*	*60.41*

*Averages of all of the data points collected during the monitoring season.

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**	**Crescent Beach**	**Morgan Memorial Beach**
April	Enterococci	0.58	0.25	0.57	0.88	0.57	0.92	63.67
May	Enterococci	24.17	7.05	10.16	4.89	2.30	76.97	10.43
June	Enterococci	4.58	5.58	2.91	6.57	622.72 **	614.04	16.37
July	Enterococci	12.71	9.30	6.86	3.44	6.31	79.28	7.28
August	Enterococci	113.31	34.42	36.48	32.22	29.46	50.57	69.47
September	Enterococci	--	--	--	--	--	10.70	--
Season Averages*	*Enterococci*	*36.82*	*12.94*	*13.66*	*11.25*	*157.55*	*172.69*	*32.54*

*Averages of all of the data points collected during the monitoring season.
**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**	**Crescent Beach**	**Morgan Memorial Beach**
April	Enterococci	0.26	1.28	1.66	24.46	10.62	2.79	1.26
May	Enterococci	27.44	8.00	19.03	23.87	22.47	12.76	24.29
June	Enterococci	680.51	257.39	60.24	68.33	26.67	86.57	80.87
July	Enterococci	20.90	17.69	34.81	18.01	15.34	28.41	21.37
August	Enterococci	12.13	7.46	7.92	4.76	26.44	15.92	36.17
September	Enterococci	4.00*	11.00*	8.00*	0.10*	4.00*	6.47	1.00**
Season Averages*	*Enterococci*	*152.28*	*60.48*	*27.10*	*28.33*	*20.76*	*32.65*	*38.05*

*Averages of all of the data points collected during the monitoring season.
**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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	20.83	16.05	7.20	8.85	7.55	224.55	14.84
May	Enterococci	223.16	39.91	34.31	37.41	10.33	9.43	14.57
June	Enterococci	103.79	221.71	91.92	74.00	395.65	470.85	78.67
July	Enterococci	8.02	13.68	17.22	24.44	31.44	78.19	865.13
August	Enterococci	139.26	83.51	74.58	96.75	125.79	461.83	41.32
September	Enterococci	na	na	na	na	na	15.02	na
Season Averages*	*Enterococci*	*97.63*	*84.60*	*50.49*	*50.89*	*140.11*	*238.04*	*263.23*

*Averages of all of the data points collected during the monitoring season.

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	Crescent Beach	Morgan Memorial Beach
April	Enterococci	2.55	1.30	22.80	8.03	6.80	2.13	2.05
May	Enterococci	20.03	10.57	38.76	23.90	20.38	17.39	25.51
June	Enterococci	36.38	6.65	73.12	79.33	20.88	53.47	40.62
July	Enterococci	63.00	21.75	5.11	10.42	5.00	87.59	51.35
August	Enterococci	4.13	7.13	16.13	19.01	15.75	23.53	18.08
September	Enterococci	na	na	na	na	na	129.63	na
Season Averages*	*Enterococci*	*29.85*	*11.00*	*31.78*	*30.61*	*14.03*	*55.43*	*32.67*

*Averages of all of the data points collected during the monitoring season.

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**	**Crescent Beach**	**Morgan Memorial Beach**
April	Enterococci	2.73	9.48	3.63	9.90	12.17	142.11	16.33
May	Enterococci	568.26	21.00	11.13	16.78	12.14	391.34	5.37
June	Enterococci	148.00	72.14	98.01	60.26	76.88	122.06	37.58
July	Enterococci	81.38	26.01	8.89	8.64	6.40	271.13	12.85
August	Enterococci	737.67	199.56	53.22	24.67	50.79	134.05	32.01
Season Averages*	*Enterococci*	*334.27*	*73.59*	*36.22*	*24.42*	*32.64*	*223.67*	*21.65*

*Averages of all of the data points collected during the monitoring season.

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**	**Crescent Beach**	**Morgan Memorial Beach**
April	Enterococci	6.50	20.75	92.50	31.60	14.20	12.89	2.67
May	Enterococci	410.40	40.88	89.63	325.63	48.51	458.09	49.50
June	Enterococci	22.60	24.11	72.30	10.46	29.11	209.16	103.07
July	Enterococci	74.50	113.90	63.30	13.44	19.59	50.28	54.24
August	Enterococci	21.22	49.23	28.41	7.52	19.81	199.22	63.44
Season Averages*	*Enterococci*	*122.96*	*52.14*	*64.93*	*77.60*	*27.14*	*223.31*	*65.64*

*Averages of all of the data points collected during the monitoring season.

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**	**Crescent Beach**	**Morgan Memorial Beach**
April	Enterococci	6.82	9.42	12.44	22.60	2.24	24.22	0.10
May	Enterococci	17.88	14.50	8.14	30.89	23.65	338.19	42.01
June	Enterococci	94.37	12.48	17.02	14.01	56.85	78.69	87.34
July	Enterococci	65.00	19.22	14.11	88.23	54.55	286.52	76.10
August	Enterococci	104.34	89.23	77.12	44.13	159.64	113.02	86.84
September	Enterococci	na	7.00*	13.00*	1.00*	11.00*	369.83	0.10**
Season Averages *	*Enterococci*	*65.22*	*29.61*	*26.22*	*40.19*	*67.48*	*208.47*	*68.40*

na = not analyzed
*Averages of all of the data points collected during the monitoring season.
** 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**	**Crescent Beach**	**Morgan Memorial Beach**
April	Enterococci	2.20	1.52	1.53	2.52	9.70	4.03	3.73
May	Enterococci	6.78	5.16	4.14	4.03	5.78	20.29	3.74
June	Enterococci	104.24	47.22	290.88	247.31	21.46	634.65	23.86
July	Enterococci	31.03	102.89	206.46	23.24	26.62	231.47	46.34
August	Enterococci	84.00	86.24	16.82	7.37	70.36	282.44	79.14
September	Enterococci	4.00**	120*	90.00*	0.10*	11.00*	19.86	3.00
Season Averages *	*Enterococci*	*48.69*	*54.70*	*109.23*	*65.02*	*29.97*	*290.61*	*40.35*

*Averages of all of the data points collected during the monitoring season.
** 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*

[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	**8.82**	**14.22**	**12.42**	**89**	**5.64**
May	Enterococci	16.22	35.91	26.36	43.92	9.49
	Fecal	**29.36**	**157**	**84.68**	**49.89**	**17.8**
June	Enterococci	38.39	45.11	46.44	14.89	10.57
	Fecal	**27.38**	**438.56**	**219**	**130.67**	**73.33**
July	Enterococci	143.89	51.33	36.4	16.4	10.52
	Fecal	**890.25**	**877**	**581**	**519.6**	**193.70**
August	Enterococci	297	188.44	68.56	17.78	72.78
	Fecal	**166.11**	**1173**	**272.8**	**248.44**	**358.33**
Season Averages	*Enterococci*	*100.62*	*65.92*	*38.56*	*25.76*	*35.35*
	Fecal	***224.38***	***531.96***	***233.9***	***207.52***	***129.76***

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	**7**	**0.6**	**1**	**5**	**0.6**
May	Enterococci	7	16	35	333	73
	Fecal	**16**	**9**	**100**	**20**	**14**
June	Enterococci	6	27	30	33	12
	Fecal	**9**	**98**	**107**	**73**	**68**
July	Enterococci	68	46	40	35	47
	Fecal	**259**	**567**	**154**	**150**	**277**
August	Enterococci	120	46	76	11	65
	Fecal	**106**	**97**	**100**	**94**	**51**
Season Averages	*Enterococci*	*40*	*27*	*36*	*83*	*39*
	Fecal	***79***	***151***	***92***	***69***	***82***

2005

	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	Enterococci	1	5	33	12	1
	Fecal	**12**	**60**	**289**	**19**	**43**
May	Enterococci	8	29	33	19	13
	Fecal	**15**	**89**	**120.23**	**21**	**18**
June	Enterococci	9	20	9	5	3
	Fecal	**77**	**330**	**118**	**87**	**86**
July	Enterococci	17	26	6	15	39
	Fecal	**176**	**561**	**159**	**472**	**596**
August	Enterococci	186	50	79	20	18
	Fecal	**265**	**166**	**256**	**346**	**239**
Season Averages	*Enterococci*	*44.2*	*26*	*32*	*14.2*	*14.8*
	Fecal	***109***	***241***	***188***	***189***	***196***

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	57	76	36	265	161
	Fecal	**4**	**71**	**29**	**66**	**25**
May	Total	140	1137	1910	851	22029
	Fecal	**46**	**141**	**822**	**210**	**3859**
June	Total	168	1179	560	701	864
	Fecal	**44**	**615**	**167**	**557**	**298**
July	Total	146	2353	571	790	624
	Fecal	**43**	**460**	**341**	**301**	**222**
August	Total	634	993	445	414	727
	Fecal	**375**	**905**	**383**	**313**	**442**
September	Total	*700*	*22*	*17*	*80*	*230*
	Fecal	***500***	***17***	***11***	***80***	***130***
Season Averages	*Total*	*268*	*1582*	*701*	*682*	*3574*
	Fecal	***126***	***505***	***359***	***337***	***761***

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	13	140	159	155	19
	Fecal	**8**	**44**	**152**	**19**	**5**
May	Total	161	122	130	154	1277
	Fecal	**62**	**35**	**47**	**88**	**143**
June	Total	197	1747	478	724	915
	Fecal	**80**	**136**	**64**	**255**	**111**
July	Total	239	781	1237	517	1810
	Fecal	**65**	**539**	**874**	**203**	**304**
August	Total	347	678	804	2117	22364
	Fecal	**81**	**344**	**334**	**1904**	**3114**
September	Total	*6567*	*3500*	*1033*	*910*	*1820*
	Fecal	***977***	***1090***	***177***	***274***	***110***
Season Averages	*Total*	*632*	*949*	*816*	*1097*	*8735*
	Fecal	***126***	***370***	***421***	***809***	***1222***

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	160	326	157	728	163
	Fecal	**44**	**39**	**11**	**658**	**53**
May	Total	130	145	127	282	194
	Fecal	**76**	**124**	**78**	**169**	**46**
June	Total	560	674	431	1604	750
	Fecal	**123**	**559**	**168**	**1016**	**154**
July	Total	613	1921	964	2770	4779
	Fecal	**246**	**810**	**831**	**1367**	**210**
August	Total	4773	3277	6202	1625	1832
	Fecal	**2593**	**2971**	**2130**	**1278**	**839**
Season Averages	*Total*	*1226*	*1969*	*3096*	*1463*	*1626*
	Fecal	***605***	***1637***	***1133***	***1008***	***451***

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	26	239	68	194	86
	Fecal	**9**	**85**	**36**	**103**	**43**
May	Total	559	486	364	944	1689
	Fecal	**21**	**83**	**106**	**555**	**274**
June	Total	2373	974	1091	1045	494
	Fecal	**157**	**488**	**451**	**365**	**60**
July	Total	242	6025	11526	1308	1501
	Fecal	**44**	**3458**	**11297**	**566**	**399**
August	Total	2183	3360	2594	12230	24148
	Fecal	**124**	**1000**	**1872**	**10285**	**1623**
September	Total	468	348	570	1500	1100
	Fecal	**53**	**110**	**116**	**1308**	**300**
Season Averages	***Total***	***1143***	***2848***	***4187***	***4513***	***9080***
	Fecal	***75***	***1325***	***3754***	***3559***	***717***

1995-2018 Water-Quality Data Summary

CSHH #1–Beacon 11

	2018					2017				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp . (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.97	6.83	24.65	19.2	1.73	14.43	24.47	7.98	17.63	4.40
June	18.08	7.28	24.51	19.4	4.83	19.07	23.13	6.93	20.85	6.38
July	20.28	3.78	25.82	25.0	5.64	20.53	23.95	3.41	23.47	4.70
Aug.	23.54	2.99	26.24	25.3	3.86	22.73	24.67	2.99	22.76	3.78
Sept.	22.81	4.67	25.92	22.6	3.77	21.52	24.92	4.93	20.43	3.54
Oct.	16.87	7.28	23.49	11.48	3.81	19.14	24.67	6.44	12.80	4.61
Nov.	-	-	-	-	-	-	-	-	-	-

	2016					2015				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.57	7.94	25.77	16.33	1.89	13.23	9.87	25.64	16.60	2.10
June	18.22	6.22	26.46	20.92	3.20	16.75	6.19	26.15	19.70	3.08
July	22.30	4.10	27.13	23.92	3.04	21.36	4.06	26.38	23.78	3.01
Aug.	23.76	2.26	27.66	24.20	2.79	23.30	3.47	27.14	23.60	2.69
Sept.	22.86	4.34	27.81	22.58	2.72	23.33	3.44	27.35	23.30	3.20
Oct.	17.00	6.75	27.79	12.40	2.71	17.10	6.62	27.22	15.18	4.13
Nov.	-	-	-	-	-	14.30	7.36	27.20	13.30	1.53

	2014					2013				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	16.08	7.92	24.14	17.00	2.61	14.79	7.71	25.82	21.17	3.43
June	18.59	4.52	24.28	22.00	3.31	19.49	7.93	25.07	21.10	3.12
July	20.62	3.92	25.39	23.22	4.53	22.84	4.73	25.33	25.18	1.72
Aug.	22.65	2.96	25.77	21.65	2.78	22.64	4.10	26.31	22.88	1.95
Sept.	21.81	4.46	26.07	18.38	4.08	20.75	7.42	26.60	15.90	3.19
Oct.	17.73	6.05	26.20	17.75	2.73	17.40	6.83	26.81	12.68	1.49
Nov.*	12.15	8.55	27.02	15.00	1.88	11.92	7.61	26.19	9.50	1.24

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #1–Beacon 11

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	18.91	6.39	24.98	23.20	2.32	15.23	6.67	23.57	23.3	2.86
June	20.09	4.92	24.65	21.85	2.26	17.83	5.84	23.82	22.4	2.55
July	22.35	3.12	25.58	25.18	2.98	22.18	3.95	24.37	23.7	1.49
Aug.	23.92	2.58	26.20	23.92	2.74	23.05	4.60	24.56	24.7	2.74
Sept.	22.52	3.60	26.60	18.77	2.33	21.95	4.36	23.74	21.4	2.12
Oct.	17.36	6.32	26.46	13.85	1.09	17.99	7.08	23.81	14.4	2.85
Nov.*	9.26	8.51	26.43	6.80	1.52	12.84	9.16	23.82	6.9	1.21

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.02	8.50	24.11	18.10	1.50	14.15	8.33	24.54	14.37	1.95
June	18.21	6.68	24.94	21.46	2.70	17.93	7.29	24.00	18.73	2.11
July	22.13	3.48	26.06	27.43	2.35	21.06	5.67	23.99	23.30	1.88
Aug.	22.58	2.96	27.00	24.03	2.19	23.40	3.71	24.55	25.68	2.81
Sept.	21.81	5.45	26.65	22.30	2.19	21.33	5.31	24.80	19.24	3.46
Oct.	17.14	7.05	26.47	13.88	1.04	14.60	7.07	24.75	11.53	2.93
Nov.*	12.83	8.33	27.25	4.00	1.17	-	-	-	-	-

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	12.93	7.20	23.69	16.80	-	-	-	-	-
June	18.81	7.38	24.27	19.15	-	16.96	6.95	24.11	21.33
July	19.81	3.62	25.75	23.70	2.35	19.08	3.91	25.10	23.90
Aug.	23.25	4.52	25.28	22.00	3.83	22.67	3.61	25.92	21.70
Sept.	22.49	4.86	25.54	20.70	2.68	21.84	5.02	26.26	19.18
Oct.	16.37	6.21	25.96	12.08	2.77	19.3	4.65	26.99	16.64
Nov.*	12.60	7.06	25.85	14.80	1.89	-	-	-	-

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #1–Beacon 11

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.35	6.81	25.22	22.42	17.19	4.5	22.94	20.22
July	20.78	3.77	25.79	24.18	23.19	4.22	24.52	24.3
Aug.	23.64	3.29	25.64	23.78	23.73	1.85	25.36	24.4
Sept.	20.58	7.28	25.4	18.9	22.54	4.85	26.49	23.6
Oct.	16.41	7.98	25.56	14.78	16.3	7.36	25.09	13.3

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.3	5.38	25	23.6	17	5.82	23.67	24.6
July	20.87	4.28	25.9	24	18.74	3.6	24.97	21.9
Aug.	22.33	3.86	26.31	24	21.75	2.1	25.79	23.6
Sept.	22.14	3.67	26.15	20.4	21.6	4.32	26.4	22.2
Oct.	16.53	7.66	25.21	12.9	16.49	6.73	25.23	12.8

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.85	4.82	26.42	24.1	20.31	6.62	24.78	24.1
July	21.28	2.31	26.55	25	19.4	3.8	25.68	25.2
Aug.	24.02	2.91	26.89	25	23.25	2.96	26.19	25.4
Sept.	21.98	5.7	26.5	20.3	22.56	5.45	26.7	20.5
Oct.	17.12	7.13	26.38	13.5	17.05	7.86	26.79	15.8

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #1–Beacon 11

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.1	5.63	24.43	22.2	19.66	7.07	24.89	23
July	21.8	5.27	25.03	22.2	21.72	3.42	25.78	30
Aug.	22.53	6.41	24.7	24.2	24.35	4.6	25.99	25
Sept.	20.99	4.9	25.07	20.9	21.9	5.57	25.72	22
Oct.	16.78	6.02	25.24	13.2	17.76	8.29	24.7	12

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.24	6.24	24.18	21.33	18.1	7.01	23.71	24.33
July	21.23	4.89	24.66	24.6	20.83	4.34	24.78	23.5
Aug.	23.95	3.66	24.84	24.5	21.85	1.96	25.96	21.5
Sept.	22.02	4.57	25.48	20.5	22.13	3.26	25.81	19.5
Oct.	17.19	6.84	25.27	13.75	17.45	5.83	26.06	13.67

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19	8.35	N/A	23.25	17.78	5.3	26.27	19.67
July	20.04	3.74	24.66	22.75	20.77	2.66	26.53	25.25
Aug.	21.75	2.88	25.13	22.25	23.78	4.56	27.56	24.7
Sept.	21.7	5.14	25.48	19.83	21.72	4.34	28.05	20.5
Oct.	17.34	9.21	24.97	15.25	17.71	6.9	27.34	16.5

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2018					2017				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.15	8.42	25.22	18.8	1.32	13.77	25.58	8.13	18.57	4.50
June	16.93	7.48	24.90	20.1	6.31	16.53	23.57	5.24	21.48	17.62
July	18.36	5.26	26.36	25.6	6.72	19.68	25.53	4.69	24.03	2.76
Aug.	22.91	3.93	26.63	27.5	4.76	22.45	25.55	3.67	23.33	2.25
Sept.	22.85	5.61	26.48	23.8	5.49	21.09	25.43	6.58	20.60	2.24
Oct.	18.28	7.24	25.11	15.5	2.89	19.53	25.44	6.79	15.63	1.68
Nov.*	-	-	-	-	-	-	-	-	-	-

	2016					2015				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	12.47	8.11	26.46	18.20	0.48	10.90	8.07	26.48	18.97	1.12
June	17.18	6.41	26.91	21.82	1.76	16.00	6.07	26.44	19.53	1.78
July	20.10	2.17	27.78	24.36	1.69	20.38	3.59	26.87	24.90	2.21
Aug.	23.58	3.22	28.09	24.20	2.21	23.00	4.02	27.56	24.08	1.66
Sept.	23.20	4.97	28.29	24.13	1.85	23.20	3.89	27.74	25.37	2.49
Oct.	17.70	7.61	28.29	18.35	0.98	16.45	7.47	27.80	16.70	1.91
Nov.*	-	-	-	-	-	14.30	7.56	27.52	14.80	0.91

	2014					2013				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.88	8.23	24.64	16.35	1.60	14.36	8.97	26.16	22.27	2.52
June	17.48	4.80	24.86	17.03	1.57	17.96	6.51	25.77	20.88	1.73
July	20.16	3.15	25.97	24.98	2.11	22.49	3.10	25.89	26.33	1.09
Aug.	22.53	3.73	26.58	23.48	1.83	22.51	4.18	26.87	26.45	1.33
Sept.	22.04	4.41	26.85	19.35	2.16	21.42	6.86	27.70	18.27	2.50
Oct.	18.00	6.59	26.97	18.88	1.55	17.17	7.63	27.29	15.30	0.97
Nov.*	13.10	8.65	27.75	17.60	1.99	12.81	7.05	27.27	12.40	0.87

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	18.08	5.53	25.06	22.30	1.62	14.70	7.64	23.34	19.6	0.57
June	19.32	5.02	25.20	21.90	1.03	16.95	4.95	24.11	22.8	1.18
July	21.94	2.99	26.03	25.30	1.92	19.88	3.39	24.79	24.8	0.83
Aug.	23.26	2.11	26.91	25.72	1.66	22.03	2.86	25.59	23.3	1.93
Sept.	22.92	4.20	27.41	21.10	1.40	21.47	3.91	24.38	22.3	1.48
Oct.	17.68	5.57	27.31	15.25	0.88	18.11	6.93	24.35	16.2	1.71
Nov.*	9.30	9.19	27.33	8.55	1.10	13.75	8.15	24.42	7.2	-

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.07	8.76	24.34	23.80	1.21	12.90	7.94	25.16	16.40	1.88
June	16.88	5.89	25.51	21.60	1.78	16.79	6.58	24.73	19.50	2.45
July	20.21	1.84	26.59	27.95	1.54	18.93	3.80	24.90	23.84	1.39
Aug.	22.09	2.66	27.21	24.70	1.54	21.43	1.34	25.28	25.78	1.94
Sept.	21.69	5.39	27.07	23.22	2.37	21.70	6.17	25.16	21.53	2.38
Oct.	16.82	7.54	27.06	15.00	0.78	14.66	7.90	25.64	12.47	1.58
Nov.*	12.66	10.14	27.43	9.6	1.05	-	-	-	-	-

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	12.13	8.72	*24.22*	14.20	-	-	-	-	-
June	16.03	6.35	*25.29*	20.80	-	16.03	6.92	24.66	22.53
July	18.69	3.37	*26.06*	25.58	2.62	17.62	4.49	25.88	24.67
Aug.	22.12	4.27	*26.09*	25.13	1.82	21.65	3.28	26.36	22.77
Sept.	22.19	5.34	*26.13*	20.68	2.11	21.55	5.43	26.78	21.48
Oct.	16.30	5.87	*26.55*	13.60	2.50	19.32	5.07	27.65	17.08
Nov.*	12.64	7.98	*26.32*	15.10	1.28	-	-	-	-

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.93	7.74	25.89	22.72	16.8	5.22	23.21	21.9
July	18.67	3.99	26.51	25.5	21.78	4.59	23.03	24.4
Aug.	21.91	1.91	26.42	26.53	23.13	2.07	25.58	26.6
Sept.	20.41	5.98	26.24	20.33	22.8	2.98	27.01	24.2
Oct.	17.66	7.3	26.32	18.89	17.01	6.84	25.91	13.9

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.38	5.92	25.41	22.5	15.58	6.35	24.26	22.4
July	19.82	5.11	26.24	24.8	17.16	2.93	25.35	22.9
Aug.	21.47	3.04	26.62	24.1	21.01	1.74	26.14	23.6
Sept.	21.96	6.17	26.33	20.7	21.2	5.38	26.55	22
Oct.	17.37	8.16	25.63	14.3	17.19	6.47	26.03	15

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.06	6.13	26.55	23.4	16.67	4.97	25.36	23.2
July	19.91	1.81	26.87	27.4	18.45	5.32	26	26.2
Aug.	22.85	3.08	27.23	25.4	22.33	3.83	26.46	26
Sept.	21.97	5.84	26.89	21.4	21.88	5.8	27.07	21.1
Oct.	17.74	7.68	27.25	13.9	16.94	8.55	27.24	15.9

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #2–Bell Marker 6

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.45	6.29	24.77	22.4	17.13	6.41	25.42	23
July	20.19	4.8	25.38	22.7	19.62	2.87	26.23	27
Aug.	22.08	6.46	24.95	24.7	22.88	4.29	26.8	25
Sept.	20.89	6.08	25.54	22.3	22.15	5.75	26.84	26
Oct.	16.86	7.18	26.07	16.3	17.18	8.46	26.3	13

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	16.39	6.9	24.45	21.33	16.7	9.12	24.14	24.5
July	19.88	4.78	25.13	24.6	18.32	3.12	25.33	23.25
Aug.	22.88	3.3	25.27	24.5	21.12	2.86	26.41	21.37
Sept.	21.62	6.03	25.82	20.5	21.33	3.18	26.79	19.75
Oct.	17.18	6.9	26.27	13.75	18.02	5.22	26.59	14.5

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.5	7.8	N/A	22	17.61	7.78	26.5	21.25
July	19.15	5.17	24.92	24.5	20.09	4.19	26.93	24.87
Aug.	21.1	4.29	24.99	23.17	22.9	4.87	27.77	25.12
Sept.	22.05	8	25.73	20.17	21.73	5.27	28.44	21.5
Oct.	16.95	9.11	25.34	15.75	17.48	7.72	27.8	15.83

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2018					2017				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.61	8.49	25.14	20.6	0.32	14.41	25.27	8.78	19.00	3.33
June	17.63	8.01	24.71	22.0	5.21	18.07	23.57	7.13	22.43	18.58
July	19.92	6.01	26.06	26.4	6.47	20.59	25.17	5.37	24.80	2.51
Aug.	23.63	5.64	26.41	25.8	4.07	22.66	24.97	4.24	22.48	2.69
Sept.	22.91	6.12	26.35	24.4	5.35	21.47	25.44	5.83	21.83	3.21
Oct.	18.16	7.73	24.85	17.6	1.82	19.40	24.98	7.08	15.13	2.77
Nov.*	-	-	-	-	-	-	-	-	-	-

	2016					2015				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.63	8.83	26.19	18.60	1.08	12.50	9.45	26.21	19.33	1.89
June	18.30	7.25	26.74	21.10	2.51	16.88	7.04	26.30	20.85	2.41
July	21.60	3.93	27.54	25.76	2.54	21.34	5.06	26.64	26.04	2.56
Aug.	23.90	3.65	27.86	25.06	2.40	23.33	5.10	27.47	26.10	2.03
Sept.	23.08	5.76	28.05	23.62	2.33	23.50	4.56	27.61	26.30	3.41
Oct.	17.30	7.28	28.19	15.58	1.67	17.22	7.28	27.41	17.34	2.84
Nov.*	-	-	-	-	-	14.40	7.98	27.31	17.40	0.84

	2014					2013				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	15.88	9.35	24.17	16.45	2.01	15.04	8.06	26.04	21.87	2.52
June	18.83	6.29	24.36	22.55	2.53	19.69	9.74	25.28	19.45	1.69
July	21.04	4.65	25.64	25.10	3.05	23.37	6.93	25.65	27.18	1.32
Aug.	22.89	4.22	26.10	24.33	2.12	22.87	5.98	26.52	27.10	1.78
Sept.	22.14	4.73	26.42	20.40	2.65	21.25	6.62	27.42	18.07	2.68
Oct.	17.86	6.57	26.50	18.98	1.94	17.62	7.37	27.06	15.72	1.14
Nov.*	12.30	8.54	27.27	16.80	1.15	12.57	6.77	26.83	13.40	0.74

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* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	19.39	7.39	24.87	22.60	1.93	15.51	8.16	23.28	23.7	0.16
June	19.63	5.94	24.72	22.30	2.06	19.01	8.17	23.90	25.0	1.39
July	22.64	3.02	25.78	26.13	2.19	21.53	5.81	24.55	24.6	1.31
Aug.	23.91	3.82	26.56	25.50	1.95	22.60	4.10	25.13	24.1	2.18
Sept.	22.92	5.37	26.93	21.23	1.44	21.78	6.55	23.69	23.3	2.02
Oct.	17.56	8.06	26.78	15.88	0.59	17.91	8.16	23.96	12.8	1.96
Nov.*	9.64	9.29	27.19	8.30	1.28	13.04	9.20	24.03	9.3	0.91

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	13.39	8.91	24.18	24.70	0.70	14.10	9.22	24.71	17.40	2.00
June	18.52	7.60	25.25	22.68	1.85	17.60	7.83	24.38	20.40	1.68
July	21.60	3.98	26.29	29.30	1.61	20.50	5.56	24.46	24.54	1.80
Aug.	22.82	4.62	26.80	25.30	1.64	23.13	5.62	24.76	26.83	2.64
Sept.	21.83	5.96	26.88	23.56	2.09	21.27	5.54	25.10	19.64	3.13
Oct.	16.80	8.26	26.62	15.90	0.59	14.98	7.76	25.27	13.80	2.28
Nov.*	12.72	10.25	27.29	9.10	0.80	-	-	-	-	-

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	12.82	8.58	23.69	15.15	-	-	-	-	-
June	18.23	7.53	24.89	21.60	-	16.82	8.47	24.15	21.98
July	19.39	3.83	25.89	26.33	1.62	19.19	4.75	25.40	24.25
Aug.	23.12	6.08	25.68	24.15	-	22.67	5.98	26.16	23.20
Sept.	22.47	5.74	25.93	21.45	-	21.87	5.18	26.63	22.13
Oct.	16.43	7.25	26.17	13.58	1.67	19.31	4.7	27.59	17.7
Nov.*	12.60	7.49	26.36	15.60	-	-	-	-	-

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.37	8.35	25.6	23.38	17.46	5.46	23.08	22.32
July	20.32	4.51	25.98	25.25	22.32	4.29	24.82	24.8
Aug.	23.19	5.13	26.13	25.46	23.53	2.16	25.67	25.3
Sept.	20.58	7.5	26	19.85	22.76	5.23	26.8	24.8
Oct.	16.91	8.55	26.17	16.03	16.66	8.14	25.58	14.3

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.67	7.36	25.23	23.4	16.47	7.02	23.97	23.9
July	20.39	4.96	26.15	25.1	18.41	4.25	25.08	22.8
Aug.	22	4.3	26.48	22.8	21.26	3.74	25.92	23.6
Sept.	22.02	4.66	26.34	21.3	21.48	4.81	26.49	22.4
Oct.	16.86	7.62	25.97	13.1	16.97	6.58	25.61	15.6

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.05	6.36	26.48	23.7	18.45	7.63	25.23	24.4
July	20.71	2.61	26.69	25.4	18.55	4.53	25.92	26
Aug.	23.36	2.49	27.1	26.9	23.09	4.83	26.34	27.7
Sept.	21.78	6.49	26.71	22	22.1	6.92	26.88	21.3
Oct.	17.7	7.98	27.05	14.7	17.02	9.01	27.12	16.3

* Average based on less than full month

1995-2018 Water-Quality Data Summary

CSHH #3–Glen Cove Creek

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.69	6.6	24.35	21.6	18.43	6.32	25.09	23
July	21.16	5.87	25.26	23	21.57	5.02	25.89	30
Aug.	22.66	6.44	24.68	23.5	23.82	4.87	26.44	26
Sept.	21.45	6.13	24.99	20.5	21.8	6.16	26.25	23
Oct.	16.69	7.5	25.52	16.7	16.74	8.7	25.81	14

	1998				1997			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	17.23	7.25	24.27	21.33	17.36	8.32	24.11	26.5
July	21.03	6.34	24.76	24.6	20.2	6.21	25.07	23.37
Aug.	23.39	3.87	25.14	24.5	21.34	2.29	26.29	21.5
Sept.	21.88	5.76	25.75	20.5	21.61	3.12	26.67	20
Oct.	16.9	7.79	25.88	13.75	17.12	5.69	26.69	13.67

	1996				1995			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.25	9.35	N/A	22.12	17.82	5.4	26.58	21.5
July	20.32	7.1	24.46	23.67	20.74	4.5	26.87	25
Aug.	21.45	3.2	25.29	22.87	23.24	4.79	27.94	24.7
Sept.	22.09	6.85	25.69	20.83	21.61	4.78	28.22	21
Oct.	16.61	9.88	25.12	15.4	17.4	7.54	27.57	16.5

* Average based on less than full month

1999-2018 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2018					2017				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	15.19	7.75	24.85	24.2	6.92	15.39	24.68	8.98	21.60	12.48
June	18.59	8.92	24.28	21.9	4.64	17.83	22.78	6.44	18.65	33.21
July	21.16	6.56	25.81	27.77	8.53	21.30	25.00	5.50	26.20	3.74
Aug.	24.37	6.19	26.07	26.5	4.84	23.15	24.66	4.33	24.12	3.47
Sept.	23.24	5.64	26.07	25.5	5.66	21.79	25.19	6.01	22.75	5.75
Oct.	16.79	7.27	24.04	15.9	5.50	19.45	24.65	6.24	14.93	3.78
Nov.*	-	-	-	-	-	-	-	-	-	-

	2016					2015				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.20	8.15	25.88	19.87	2.05	13.70	9.08	26.00	21.13	2.60
June	19.23	5.94	26.36	23.43	2.52	17.53	6.68	25.98	23.03	4.40
July	22.67	4.48	27.20	26.60	2.54	22.04	4.64	26.28	27.14	3.59
Aug.	24.55	4.79	27.31	26.48	2.88	23.67	4.31	27.19	26.43	2.61
Sept.	23.10	5.34	27.57	25.83	3.01	24.85	4.37	27.31	28.75	2.85
Oct.	17.25	6.84	27.76	16.78	2.93	17.16	6.01	26.72	18.06	8.81
Nov.*	-	-	-	-	-	14.60	7.05	26.88	18.50	1.44

	2014					2013				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	16.70	9.43	21.84	18.40	2.61	15.85	8.59	22.92	24.20	3.51
June	19.53	5.58	23.45	23.78	3.47	20.19	8.64	20.44	23.45	2.78
July	21.77	3.64	21.98	26.34	4.35	23.58	7.08	24.14	28.55	2.36
Aug.	23.13	5.17	23.73	24.50	3.19	23.28	5.52	25.81	25.78	1.91
Sept.	22.35	5.52	25.09	20.73	2.96	21.16	7.47	26.29	18.60	3.34
Oct.	17.83	6.07	24.18	19.05	3.25	17.91	6.85	26.27	16.24	1.05
Nov.*	12.70	8.54	24.02	17.80	1.23	11.40	7.46	25.31	8.05	1.29

* Average based on less than full month

1999-2018 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2012					2011				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	20.17	6.16	24.14	24.50	3.14	16.64	8.22	22.95	26.1	0.26
June	20.21	5.00	22.43	23.83	2.28	18.75	7.56	23.51	25.5	2.08
July	23.36	4.90	23.87	27.50	2.26	21.96	3.66	24.38	26.0	2.30
Aug.	24.16	4.29	24.44	26.73	2.44	22.99	3.50	24.78	24.9	2.62
Sept.	23.07	4.54	24.95	22.43	2.97	22.17	5.48	23.40	23.6	2.59
Oct.	17.72	5.99	23.93	17.33	1.31	18.01	7.68	23.74	17.2	2.09
Nov.*	9.86	9.18	26.36	8.55	2.01	13.14	9.70	23.86	9.4	1.46

	2010					2009				
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)
May*	14.40	8.87	23.67	26.10	2.07	14.49	8.46	24.62	19.37	2.78
June	19.11	8.14	25.06	23.90	2.54	18.08	7.71	24.22	20.85	1.74
July	22.78	4.22	26.07	29.90	2.28	21.12	5.23	24.26	25.86	2.58
Aug.	23.35	3.78	26.68	26.10	2.34	24.01	6.65	24.44	28.20	4.27
Sept.	22.25	5.67	26.47	23.90	2.40	21.38	6.21	24.74	20.46	3.15
Oct.	16.68	7.88	26.29	16.40	1.66	15.14	7.03	25.00	14.08	2.88
Nov.*	12.85	9.82	26.96	10.00	1.22	-	-	-	-	-

	2008					2007			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Turbidity (NTUs) (0.5 m)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
May*	13.22	6.81	23.67	19.30	-	-	-	-	-
June	19.08	8.34	24.55	23.80	4.75	17.69	8.75	24.03	22.83
July	20.53	4.83	25.64	28.80	3.02	19.76	4.46	25.26	26.50
Aug.	23.23	4.49	25.46	24.13	2.89	22.76	5.27	25.84	24.33
Sept.	22.67	4.04	25.84	20.80	2.74	22.17	6.05	26.27	21.75
Oct.	16.68	6.67	26.17	13.38	2.14	19.3	5.13	27.59	17.76
Nov.*	12.47	6.34	25.96	15.80	1.53	-	-	-	-

* Average based on less than full month

1999-2018 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2006				2005			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.21	7.98	25.27	24.52	18.9	7.1	22.25	23.72
July	21.43	5.08	25.51	26.33	23.07	5.48	24.5	25.5
Aug.	24	8.85	25.71	25.18	24.32	3.45	25.32	27.2
Sept.	20.65	8.25	25.36	20.2	23.24	5.07	26.42	25.2
Oct.	17.12	8.18	25.97	15.57	16.98	7.31	25.28	14

	2004				2003			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.38	8.14	24.8	26.3	17.01	5.92	23.7	25.7
July	21.26	4.52	25.39	27	18.94	4.03	24.94	24.4
Aug.	22.78	5.98	25.89	24.4	22.51	5.23	25.51	26.1
Sept.	22.22	4.66	25.62	22.1	21.58	4.87	25.99	23.5
Oct.	16.6	7.79	25.72	13.4	16.49	6.49	25.1	14.6

	2002				2001			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	19.89	7.65	26.12	25.5	20.11	7.61	24.57	26.6
July	22.13	4.33	26.27	26.8	20.18	5.56	25.31	27.1
Aug.	24.64	4.85	26.67	27.7	23.82	6.16	25.86	29.2
Sept.	21.91	6.01	26.41	23	22.45	5.74	26.58	22.1
Oct.	17.67	7.69	26.77	16.4	16.67	9.56	26.54	16.7

* Average based on less than full month

1999-2018 Water-Quality Data Summary

CSHH #8–Glen Cove Creek STP Outfall

	2000				1999			
	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)	Avg. Water Temp. (°C) (Bottom)	Avg. DO (ppm) (Bottom)	Avg. Salinity (ppt) (Bottom)	Avg. Air Temp. (°C)
June	18.66	7.13	23.59	23.8	19.99	9.11	24.71	23
July	21.99	6.51	24.93	24.1	22.7	6.03	25.53	30
Aug.	23.58	7.75	24.18	24.5	24.28	5.32	26.19	26
Sept.	21.17	8.63	24.81	23.6	21.78	6.14	25.84	24
Oct.	17.25	7.17	24.87	15.3	16.63	8.63	25.53	15

* Average based on less than full month

Seasonal Averages for Selected Water-Quality Parameters

Salinity Averages (ppt)

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2018	24.95	25.67	25.41	23.95
2017	23.97	25.00	24.62	23.83
2016	26.98	27.49	27.32	25.46
2015	26.43	26.99	26.74	24.01
2014	25.48	26.22	25.72	23.48
2013	26.01	26.59	26.34	24.45
2012	25.90	26.56	26.19	24.15
2011	23.71	24.27	23.99	23.18
2010	25.77	26.32	26.00	24.94
2009	24.22	24.87	24.54	23.68
2008	25.01	25.78	25.28	24.29
2007	25.41	26.07	25.62	24.30
2006	25.3	26.0	25.6	24.3
2005	24.60	24.95	24.71	23.66
2004	25.73	26.06	26.04	25.50
2003	25.25	25.70	25.45	25.09
2002	26.56	26.99	26.83	26.47
2001	26.02	26.41	26.27	25.76
2000	24.87	25.28	24.94	24.40
1999	24.15	26.21	25.49	25.49
1998	24.88	25.40	25.16	N/A
1997	25.20	25.69	25.66	N/A

Bottom Dissolved Oxygen Averages (ppm)

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2018	5.69	6.17	6.73	7.00
2017	5.32	5.71	6.25	5.90
2016	5.02	4.94	5.82	5.89
2015	5.66	5.55	6.46	6.04
2014	4.83	4.96	5.74	5.62
2013	6.42	6.28	7.49	7.29
2012	4.46	4.31	5.54	5.28
2011	5.64	4.77	6.87	6.14
2010	5.55	5.16	6.41	6.26
2009	6.09	5.30	6.72	6.73
2008	5.50	5.31	6.35	5.73
2007	4.99	5.37	6.02	5.93
2006	5.80	5.30	6.80	7.00
2005	4.59	4.63	5.09	5.76
2004	4.94	5.57	5.76	6.22
2003	4.63	4.55	5.21	5.28
2002	4.64	5.11	5.20	6.11
2001	5.16	5.46	6.47	6.82
2000	5.64	6.10	6.54	7.35
1999	5.85	5.44	6.32	7.14
1998	5.17	5.45	6.48	N/A
1997	4.39	4.54	5.15	N/A
1996	5.90	7.11	7.45	N/A

Seasonal Averages for Selected Water-Quality Parameters

Turbidity at 0.5m Averages (ntu)

	Beacon 11 CSHH #1	Bell 6 CSHH #2	Red Channel Marker, Near Glen Cove Creek, CSHH #3	Glen Cove STP Outfall, CSHH #8
2018	4.31	4.79	4.10	5.75
2017	4.57	5.83	5.75	8.13
2016	2.78	1.61	2.12	2.68
2015	3.05	1.84	2.46	4.30
2014	3.39	1.84	2.36	3.27
2013	2.32	1.61	1.71	2.26
2012	2.23	1.37	1.70	2.29
2011	2.33	1.41	1.61	1.61
2010	2.04	1.61	1.51	2.16
2009	2.58	1.93	2.30	2.19
2008	2.87	2.18	1.64	2.81
2007	N/A	N/A	N/A	N/A
2006	N/A	N/A	N/A	N/A
2005	N/A	N/A	N/A	N/A
2004	N/A	N/A	N/A	N/A
2003	N/A	N/A	N/A	N/A
2002	N/A	N/A	N/A	N/A
2001	N/A	N/A	N/A	N/A
2000	N/A	N/A	N/A	N/A
1999	N/A	N/A	N/A	N/A
1998	N/A	N/A	N/A	N/A
1997	N/A	N/A	N/A	N/A
1996	N/A	N/A	N/A	N/A

Seasonal Averages for Selected Water-Quality Parameters

Water Temperature Averages (ºC)

	Beacon 11 CSHH #1	**Bell 6 CSHH #2**	**Red Channel Marker, Near Glen Cove Creek, CSHH #3**	**Glen Cove STP Outfall, CSHH #8**
2018	19.33	19.95	20.68	20.36
2017	20.07	19.59	20.15	20.79
2016	20.36	20.27	20.62	20.57
2015	19.00	18.68	19.25	19.4
2014	19.60	19.41	19.84	20.26
2013	19.39	18.84	19.58	19.66
2012	20.32	20.03	20.43	20.32
2011	19.92	19.70	20.04	20.25
2010	19.90	19.68	20.15	20.60
2009	19.31	18.75	19.27	19.68
2008	19.25	19.15	19.32	19.63
2007	19.9	19.4	19.96	20.53
2006	20.2	19.8	20.1	20.63
2005	20.24	19.63	20.19	21.1
2004	19.55	19.14	19.41	N/A
2003	18.94	18.37	18.9	N/A
2002	20.67	20.13	20.53	N/A
2001	20.90	19.58	20.23	N/A
2000	19.49	19.03	19.59	N/A
1999	21.01	19.67	20.2	N/A
1998	20.52	19.66	20.28	N/A
1997	20.1	19.12	19.55	N/A
1996	19.87	19.2	19.43	N/A
1995	20.8	20.3	20.59	N/A

Seasonal Averages for Selected Water-Quality Parameters

Air Temperature Averages (ºC)

	Beacon 11 CSHH #1	**Bell 6 CSHH #2**	**Red Channel Marker, Near Glen Cove Creek, CSHH #3**	**Glen Cove STP Outfall, CSHH #8**
2018	20.8	22.0	23.0	23.1
2017	19.71	20.79	20.93	21.52
2016	20.62	22.49	22.14	23.14
2015	20.04	21.40	22.36	23.4
2014	20.18	20.57	21.68	22.44
2013	19.20	20.80	20.85	21.47
2012	20.00	21.12	21.38	20.0
2011	20.18	21.15	20.64	22.42
2010	20.81	22.40	23.18	23.9
2009	19.18	20.52	20.69	21.7
2008	18.88	20.68	20.27	21.20
2007	20.22	21.24	21.69	22.31
2006	21	23.4	22.2	22.92
2005	21.1	21.91	22.28	23.2
2004	19.24	19.8	19.48	N/A
2003	20.4	21.1	21.8	N/A
2002	21.1	21.5	22.1	N/A
2001	22.5	22.8	23.6	N/A
2000	20.4	21.8	20.9	N/A
1999	22.22	22.73	23.04	N/A
1998	21.1	21.1	21.1	N/A
1997	20.81	21.37	21.25	N/A
1996	20.71	20.53	20.55	N/A
1995	21.84	22.16	22.18	N/A

Appendix E

2018 UWS Monitoring Data

2018 UWS Monitoring Data

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital -Dissolved Oxygen (mg/L)	digital -Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM01	6/12/2018	2.8	16.51	25.4	74	6.25	25.41		59.54	7.21
HEM02	6/12/2018	2.8	16.51	25.4	74	6.25	25.41		59.54	7.21
HEM03	6/12/2018	3.34	16.14	25.4	82.3	6.89	24.4		57.16	10.02
HEM04	6/12/2018	6.88	15.52	25.55	100.2	8.62	17.65		41.23	5.11
HEM05	6/12/2018	9.29	15.35	25.57	81.4	7.02	18.74		43.81	16.12
HEM06	6/12/2018	6.97	16.16	25.37	77.3	6.55	22.15		51.85	6.2
HEM01	6/26/2018	2.59	20.27	25.02	98.5	7.76	31.49		12.56	9.76
HEM02	6/26/2018	4.5	19.24	25.43	77.4	6.2	48.2		19.26	9.67
HEM03	6/26/2018	3.55	19.59	25.55	108.1	8.61	26.6		10.60	13.35
HEM04	6/26/2018	5.8	18.67	25.86	79.8	6.45	10.57		4.17	6.19
HEM05	6/26/2018	8.98	18.48	25.91	81.6	6.62	13.61		5.39	10.08
HEM06	6/26/2018	6.86	19.04	25.81	86.1	6.91	18.6		7.39	5.46
HEM01	7/10/2018	3.56	19.02	23.33	77.4	6.21	55.3		22.64	11.08
HEM02	7/10/2018	4.18	18.59	23.38	73.1	5.9	44.16		17.85	12.19
HEM03	7/10/2018	4.23	16.89	23.41	92	7.4	51.98		21.22	8.01
HEM04	7/10/2018	7.6	18.92	23.35	95.3	7.7	37.45		14.96	2.83
HEM05	7/10/2018	10.5	16.73	23.81	50.5	4.15	18.28		6.71	6.61
HEM06	7/10/2018	7.83	18.06	23.6	80.2	6.52	26.46		10.23	5.76
HEM01	7/27/2018	2.44	22.51	26.3	69	5.02	20.15		8.85	3.81
HEM02	7/27/2018	3.68	22.51	26.3	70.8	5.23	20.96		9.22	8.04
HEM03	7/27/2018	2.95	23.04	26.25	102.8	7.58	32.86		14.57	2.87
HEM04	7/27/2018	6.88	21.85	26.56	68.8	5.11	19.25		8.45	9.87
HEM05	7/27/2018	8.71	22.01	26.5	81.4	6.04	13.91		6.05	8.74
HEM06	7/27/2018	6.4	22.4	26.47	92.7	6.78	14.38		6.26	5.35
HEM01	8/7/2018	4.4	23.11	26.66	42.9	3.01	39.15		16.37	3.44
HEM02	8/7/2018	5.78	22.05	27.2	14.8	1.08	11.8		4.83	1.77
HEM03	8/7/2018	4.96	22.93	26.88	67.7	4.93	25.87		2.20	10.77
HEM04	8/7/2018	9.11	21.84	27.09	54.4	3.77	12.69		5.21	3.31
HEM05	8/7/2018	11.06	20.84	27.09	21.8	1.64	5.4		2.13	5.56
HEM06	8/7/2018	8.51	20.81	27.52	49.9	3.69	4.23		1.64	6.28
HEM01	8/21/2018	4.38	23.46	26.36	58.2	4.21	8.27		3.75	4.08
HEM02	8/21/2018	6.26	23.41	26.29	38	2.79	6.26		2.77	6.19
HEM03	8/21/2018	4.87	23.39	26.37	64.4	4.74	5.2		2.27	8.28
HEM04	8/21/2018	7.6	23.27	26.38	55.8	4.11	5.86		2.58	3.67
HEM05	8/21/2018	11.05	23.05	26.47	44.5	3.29	33.55		15.69	5.77
HEM06	8/21/2018	8.77	23.08	26.4	44.2	3.25	5.4		2.36	8.88

2018 UWS Monitoring Data

Bottom samples (0.5m off bottom)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital -Dissolved Oxygen (mg/L)	digital -Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM01	9/4/2018	4.47	24.24	26.62	77.9	5.65	30.62		12.46	2.11
HEM02	9/4/2018	4.47	24.24	26.62	77.9	5.65	30.62		12.46	2.11
HEM03	9/4/2018	5.75	24.05	26.59	74.1	5.39	20.95		8.17	1.66
HEM04	9/4/2018	4.96	24.65	26.47	94.7	6.76	36.88		15.24	2.32
HEM05	9/4/2018	10.38	23.99	26.66	66.8	4.77	8.99		2.86	4.28
HEM06	9/4/2018	8.12	23.97	26.74	75.8	5.53	11.78		4.10	4.55
HEM01	9/20/2018	5.12	23.09	25.87	63.1	4.67	13.69		5.69	5.8
HEM02	9/20/2018	5.12	23.09	25.87	63.1	4.67	13.69		5.69	5.8
HEM03	9/20/2018	5.93	22.72	26.14	50.3	3.69	7.03		2.72	5.53
HEM04	9/20/2018	5.16	22.9	26.01	72.5	5.23	8.68		3.46	3.77
HEM05	9/20/2018	10.81	22.55	26.49	81.6	6.01	4.8		1.72	5.84
HEM06	9/20/2018	8.45	22.58	26.4	60.5	4.32	5.22		10.43	1.91
HEM01	10/2/2018	4.15	20.92	25.75	91.6	7.1	26.92		5.84	2.94
HEM02	10/2/2018	5.3	20.88	25.9	96.1	7.39	19.88		4.26	3.71
HEM03	10/2/2018	4.38	20.87	25.86	98.9	7.64	24.17		5.22	3.11
HEM04	10/2/2018	4.38	20.87	25.86	98.8	7.64	24.17		5.22	3.11
HEM05	10/2/2018	10.16	20.88	25.95	108.2	8.35	13.39		2.81	9.32
HEM06	10/2/2018	7.02	20.88	25.98	98.5	7.6	12.57		2.62	3.47
HEM01	10/19/2018	4.48	15.13	24.57	125.6	10.97	15.74		4.57	2.85
HEM02	10/19/2018	5.87	15.64	24.62	94.4	8.17	13.85		4.02	1.74
HEM03	10/19/2018	4.58	15.72	24.63	98.4	8.45	10.99		3.17	1.31
HEM04	10/19/2018	9.25	15.59	24.56	94.7	8.22	11.26		3.25	5.32
HEM05	10/19/2018	10.77	16.37	24.51	91.2	7.78	12.58		3.64	2.85
HEM06	10/19/2018	7.6	17.05	24.99	96.2	8.01	10.11		2.91	1.97

2018 UWS Monitoring Data

Surface Samples (0.5m below surface)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital -Dissolved Oxygen (mg/L)	digital -Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM01	6/12/2018	0.5	18.48	24.58	98.8	8.09	53.82		126.55	3.75
HEM02	6/12/2018	0.5	18.48	24.58	98.8	8.09	53.82		126.55	3.75
HEM03	6/12/2018	0.5	17.92	24.84	123.8	10.2	37.63		88.36	11.31
HEM04	6/12/2018	0.5	17.16	25.14	101	8.44	22.6		52.91	0.78
HEM05	6/12/2018	0.5	17.52	25	115.7	9.6	23.8		55.74	1.29
HEM06	6/12/2018	0.5	17.48	25.03	111.6	9.27	16.53		38.59	1.6
HEM01	6/26/2018	0.5	20.36	24.76	90.1	7.1	47.49		18.98	8.39
HEM02	6/26/2018	0.5	20.03	25.09	91.7	7.3	68.26		27.31	4.81
HEM03	6/26/2018	0.5	19.7	25.13	109.9	8.78	33.32		13.30	2.89
HEM04	6/26/2018	0.5	19.9	25.71	99.7	7.88	20.5		8.15	1.99
HEM05	6/26/2018	0.5	19.44	24.79	92.8	7.39	18.93		7.53	2.95
HEM06	6/26/2018	0.5	19.26	25.8	88.8	7.13	14.87		5.90	3.21
HEM01	7/10/2018	0.5	20.53	22.83	73.9	5.86	45.9		18.60	4.09
HEM02	7/10/2018	0.5	20.49	23	82.1	6.56	54.49		22.30	3.69
HEM03	7/10/2018	0.5	20.39	23	88.7	7.06	44.39		17.95	2.95
HEM04	7/10/2018	0.5	20.04	23	96.6	7.67	41.88		16.87	3.19
HEM05	7/10/2018	0.5	20.44	23.1	115.6	9.1	18.79		6.93	2.15
HEM06	7/10/2018	0.5	20.87	23.1	90.4	7.11	11.51		3.79	2.41
HEM01	7/27/2018	0.5	22.66	25.87	52.9	3.93	16.75		7.33	2.91
HEM02	7/27/2018	0.5	22.62	25.96	59.1	4.37	28.71		12.70	2.94
HEM03	7/27/2018	0.5	23.31	25.85	103	7.8	40.74		18.11	2.13
HEM04	7/27/2018	0.5	22.87	26.42	84.2	6.54	75.96		33.94	3.96
HEM05	7/27/2018	0.5	22.89	26.35	95.9	7.23	39.29		17.46	1.76
HEM06	7/27/2018	0.5	23.43	26.27	125.5	9.26	50.61		22.54	2.12
HEM01	8/7/2018	0.5	24.62	26	48.1	3.48	76.69		32.20	3.53
HEM02	8/7/2018	0.5	24.38	26.44	39.6	2.94	97.82		41.11	4.73
HEM03	8/7/2018	0.5	24.55	26.35	76.7	5.57	68.5		28.74	3.65
HEM04	8/7/2018	0.5	24.05	26.53	50.1	3.84	60.35		25.31	2.67
HEM05	8/7/2018	0.5	24.38	26.51	62.5	4.81	52.58		22.03	2.75
HEM06	8/7/2018	0.5	25.02	26.5	81	5.87	39.46		16.49	2.32
HEM01	8/21/2018	0.5	23.46	25.38	47.3	3.47	18.49		8.56	3.24
HEM02	8/21/2018	0.5	23.49	25.71	43.6	3.28	12.04		5.51	2.06
HEM03	8/21/2018	0.5	23.6	25.69	52	3.85	11.27		5.14	10.48
HEM04	8/21/2018	0.5	23.21	26.16	60.8	4.55	8.18		3.68	1.54
HEM05	8/21/2018	0.5	23.39	26.05	75.4	5.56	8.87		4.00	1.73
HEM06	8/21/2018	0.5	23.41	26.01	52.1	3.9	7.79		3.49	1.74

2018 UWS Monitoring Data

Surface Samples (0.5m below surface)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital -Dissolved Oxygen (mg/L)	digital -Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM01	9/4/2018	0.5	25.04	26.27	76.2	5.58	105.61		45.73	4.53
HEM02	9/4/2018	0.5	25.04	26.27	76.2	5.58	105.61		45.73	4.53
HEM03	9/4/2018	0.5	24.97	26.24	73.1	5.3	84.2		36.23	2.67
HEM04	9/4/2018	0.5	25.16	26.29	95.5	6.85	56.14		23.78	2.42
HEM05	9/4/2018	0.5	25.03	26.45	102.7	7.46	35.34		14.56	1.77
HEM06	9/4/2018	0.5	25.36	26.48	87.6	6.34	30.81		12.55	2.18
HEM01	9/20/2018	0.5	23.36	25.01	65	4.92	33.48		14.53	3.17
HEM02	9/20/2018	0.5	23.36	25.01	65.4	4.92	33.48		14.53	3.17
HEM03	9/20/2018	0.5	23.24	25.2	60.8	4.69	29.06		12.56	3.35
HEM04	9/20/2018	0.5	23.08	25.28	65.2	5.11	22.85		9.78	2.05
HEM05	9/20/2018	0.5	23.01	25.67	77.2	5.8	16.39		6.90	1.57
HEM06	9/20/2018	0.5	22.79	25.94	57.6	4.51	7.71		3.02	2.06
HEM01	10/2/2018	0.5	20.85	25.36	84.9	6.61	16.95		3.60	1.07
HEM02	10/2/2018	0.5	20.81	25.5	95.7	7.51	31.62		6.89	1.97
HEM03	10/2/2018	0.5	20.95	25.23	101.2	7.9	10.19		8.81	2.74
HEM04	10/2/2018	0.5	20.95	25.23	101.2	7.9	40.19		8.81	2.74
HEM05	10/2/2018	0.5	20.95	25.7	96.1	7.46	12.14		2.53	1.31
HEM06	10/2/2018	0.5	20.94	25.72	96.6	7.57	17.59		3.75	1.79
HEM01	10/19/2018	0.5	14.84	24.43	104.3	9.13	12.46		3.61	1.49
HEM02	10/19/2018	0.5	15.66	24.65	91.3	7.91	13.7		3.97	1.65
HEM03	10/19/2018	0.5	15.74	24.61	91.9	7.93	9.62		2.77	1.47
HEM04	10/19/2018	0.5	16.42	24.55	92.2	7.82	10.11		2.91	1.2
HEM05	10/19/2018	0.5	16.88	24.65	90.6	7.67	10097		3.17	1.1
HEM06	10/19/2018	0.5	16.8	24.79	90.2	7.63	6.71		1.91	1.15

2018 UWS Monitoring Data

Mid-Depth Samples (if total depth > 10m)

Station	Date	Sample Depth (m)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	digital -Dissolved Oxygen (mg/L)	digital -Chlorophyll-a (ug/L)	filtered - Chlorophyll-a (ug/L)	Corrected Chlorophyll-a (ug/L)	Turbidity (NTU)
HEM04	6/12/2018	5	14.41	24.73	107.3	9.42	15.79		3.86	1.72
HEM05	6/12/2018	5.42	20.08	23.23	93.5	7.41	44.19		17.86	1.81
HEM04	6/12/2018	5.19	17.98	25.72	78.6	6.4	17.26		3.86	1.78
HEM05	6/12/2018	5.75	22.12	27.1	57.3	4.15	15.52		6.40	1.23
HEM05	6/12/2018	5.52	23.39	26.2	77.2	5.7	10.24		4.65	1.28
HEM05	6/12/2018	5.44	24.82	26.57	78.9	5.76	27.67		11.15	1.36
HEM05	6/26/2018	5.68	22.79	26.1	69.4	5.14	7.45		2.91	1.64
HEM05	6/26/2018	5.28	20.92	25.75	94.7	7.32	13.8		2.90	1.3
HEM05	6/26/2018	5.67	16.88	24.68	90.4	7.64	11.54		3.33	1.42

Appendix F

2018 Data Usability Assessment

Hempstead Harbor Water-Quality Monitoring
Data Usability Review
2018 Monitoring Season

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 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 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 the municipal members of the Hempstead Harbor Protection Committee to:

- Identify and study seasonal-scale trends in water quality
- Monitor aquatic habitats
- Identify causes for negative events (e.g., algal blooms and fish kills)
- Investigate long-term trends in water-quality parameter levels
- Guide municipal, county, and state-level 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
- Determine whether the opening of additional shellfish-harvesting areas within the harbor is feasible
- Identify pathogen sources for targeting pathogen-load reduction efforts

1.2 Planning – Quality Assurance Project Plan

CSHH conducted water-quality monitoring under an EPA-approved Quality Assurance

Project Plan (QAPP) for the 2018 water-quality monitoring season, which served as the main quality assurance planning project document. The QAPP was originally prepared in 2011 and last revised in 2014. 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 regarding the monitoring program. Individuals who conducted sampling received formal training, which included review and discussion of the QAPP and sampling SOPs (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/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. Aside from missing sampling events due to weather or other events, there were no deviations of consequence. Information from field data sheets was recorded electronically following sampling events – two CSHH members conducted and verified data entry while the Quality Assurance Officer also compared field data forms with electronic records to ensure accuracy. 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 the day 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. Grab samples were taken at up to 21 stations weekly and were used to analyze fecal coliform and enterococci as well as total Kjeldahl nitrogen, ammonia, nitrite, and nitrate. Two NYS DOH ELAP certified laboratories were used for sample analysis – the Pace Analytical Services, LLC laboratory for nitrogen testing and the Nassau County Department of Health for bacterial analysis. Prior to collection, laboratory quality-control protocols were discussed with CSHH to ensure sample usability. Vertical profiles were taken at applicable stations to measure the following field parameters: dissolved oxygen, water temperature, salinity, pH, water clarity, chl a (for frame of reference purposes), and turbidity. Results were not confirmed by a fixed laboratory, but a LaMotte 7414 kit (Winkler Titration), a LaMotte 2218 reagent kit, and a calibrated thermometer were used at one location per sampling event to confirm the validity of the Eureka Manta+ 35 results for dissolved oxygen (bottom), pH, and water temperature, respectively.

1.4 Analysis

Analytical procedures were adhered to as outlined in the project planning documents. The Quality Assurance Officer completed data review during or soon after monitoring events and unusual values were flagged (e.g., missing values, unexpectedly large or small values, etc.) 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 Project Manager/Field Team Leader was also responsible for validating results from field monitoring, including field monitoring sheets and laboratory results. 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 periodically by the Quality Assurance Officer to ensure accuracy. Laboratory data deliverables were reviewed by the Project Manager/Field Team Leader for adherence to the project measurement 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. However, split samples and duplicates were performed by participating laboratories which followed lab-specified QC procedures. Proper sample handling and custody procedures were followed for delivery of samples to the labs. Laboratory-reported results for primary 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)	Approximate Expected Range	Sensitivity
Depth (calibrated line)	meters (m)	± 0.1 m	10%	0 – 12 m	0.1 m
Depth (Eureka Manta+ 35)	meters (m)	0 to 10 m ±0.02 (±0.2% of FS) 0 to 25 m ±0.05 (±0.2% of FS) 0 to 50 m ±0.1 (±0.2% of FS)	10%	0 – 12 m	0.01m 0.01m 0.1 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)	pss/ppt	±1% of reading ±0.1 ppt	10%	5 – 30 ppt	4 digits
Dissolved Oxygen (Winkler titration method)	milligrams per liter (mg/L) = parts per million (ppm)	0.2 ppm	10%	0 -14 ppm	0 ppm
Dissolved Oxygen (Eureka Manta+ 35)	milligrams per liter (mg/L) = parts per million (ppm); percent saturation (% sat.)	0 to 20 mg/l ± 0.2 mg/l 20 to 50 mg/l ± 10% reading 0 to 200% sat. ±1% of reading or ±0.1 % sat. 200 to 500% sat. ±10% of reading	10%	0 – 14 ppm 0 – 120 % sat.	0.1 ppm 0.1 % sat.
Turbidity (Eureka Manta+ 35)	NTU	0 to 400 NTU ± 1% of reading ± 1 count	10%	0 – 30 NTU	4 digits 4 digits

Parameter	Units	Accuracy	Precision (allowable RPD)	Approximate Expected Range	Sensitivity
		400 to 3000 NTU ± 3% of reading			
Water Clarity (Secchi disk)	m	0.1	10%	0 - 4 m	0.1 m
Ammonia (LaMotte 3304, salicylate method)	ppm	0.0, 0.05, 0.1, 0.25, 0.5, 1.0, 1.5, 2.0 ppm	(color metric)	0 - 1.0 ppm	0 ppm
pH (LaMotte 2218 wide-range indicator)		5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5	(color metric)	6.5 - 8.5 ppm	5.0 ppm
pH (Eureka Manta+ 35)		± 0.2	5%	6.5 - 8.5 ppm	.01

Table 2: Acceptance Criteria for Laboratory Monitoring Parameters

Parameter	Method	Reporting limit	Accuracy	Precision
Fecal Coliform	Membrane Filter, SM9222D-2006	< 1 CFU/100mL	+/- 20%	+/- 5%
Enterococci	Membrane Filter, EPA 1600	< 1 CFU/100mL	+/- 20%	+/- 5%
Ammonia	SM22 4500	< 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

- Replicate field measurements were taken for one station per sampling day at the first in-harbor station sampled for 22 of the 23 sampling days (no replicate on 5/23/2018)(representing an average of 11% of all samples on a given day).
- Relative percent difference (RPD), as outlined in **Table 1** and **Table 2**, was used as precision acceptance criteria. RPD was calculated as follows:

$$RPD = \frac{\left| (p) - (r) \right|}{(1/2)((p) + (r))} * 100$$

where:
(p) = Primary Sample, the first sample collected at that location
(r) = Replicate Sample, the second sample collected at that location

- **Table 3** summarizes the results of the precision acceptance criteria for primary and replicate profiles for parameters analyzed in the field. No replicate measurements were recorded for water clarity (Secchi disk) for any of the 22 sampling dates when replicate measurements were taken. Air temperature was recorded for one replicate sample (9/14/18) and was within the 10% RPD precision criteria range. 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

Parameter	Precision (RPD)	Number of sampling events outside precision criteria	Dates
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)	10%	6	8/2/18, 8/8/18, 8/23/18, 8/29/18, 10/10/18, 10/17/18
Dissolved Oxygen (bottom)	10%	1	8/2/18
pH (surface)	5%	0	N/A
pH (bottom)	5%	0	N/A
Turbidity (top)	10%	5	5/30/18, 6/6/18, 7/11/18, 8/15/18, 9/5/18
Turbidity (bottom)	10%	6	8/8/18, 8/15/18, 8/23/18, 8/29/18, 9/5/18, 10/10/18
Depth	10%	0	N/A

Accuracy

- Field measurement accuracy was assessed by performing pre-checks, calibration checks, and post-checks of the field monitoring equipment the day prior and the day following monitoring events. The Eureka Manta+ 35 was calibrated for each measurement parameter the day prior to each monitoring event. Instruments were calibrated according to procedures outlined in the user manuals. Calibration records are logged and maintained by CSHH and are available upon request. The calibrations were checked for each sampling event by completing the following checks at CSHH #1 (the first monitoring station visited):
    - Comparing DO results from the Eureka Manta+ 35 to a result obtained via Winkler titration.

  - Comparing pH results from the Eureka Manta+ 35 for one location to a result obtained via LaMotte field test.
- Laboratory accuracy was evaluated from laboratory control samples (trip blanks) and surrogate samples, published historical data, method validation studies, and experience with similar samples.
- Parameter-specific acceptance criteria for accuracy are summarized in **Table 1** and **Table 2**.

Representativeness of the Data

- Sampling sites were selected to be representative of the conditions for a specific area of the water body (or a specific pollution source).
- Outfall pathogen monitoring stations were not representative of estuarine water quality but are considered representative of conditions in areas within close proximity to fresh water 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 of the Data

Established field protocols were used for sample collection and standard laboratory analytical methods were used for sample analysis, consistent with previous CSHH water-quality monitoring events. Samples were collected generally on the same day of the week and at the same time of day.

Completeness of the Data

Data was collected on 23 sampling events with the goal of collecting at least 70% of the anticipated number of samples on that day to analyze for both in-harbor and outfall pathogen monitoring, nitrogen monitoring, and for the vertical profiles. The overall goal for all sampling events for the season was 75%, which was met.

- 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 six times) over the 23 week sampling period. This goal was met, as each station was sampled at least seven times during the sampling period.
- Data collection for stations #1-3, #8, #13, #16-17 was evaluated for completeness for the following parameters: water temperature, salinity, dissolved oxygen, pH, air temperature, water clarity, and turbidity. All sampling days met or exceeded the 70% acceptance criterion for sample collection except for 10/24/2018 (43% of samples collected). Sampling was affected on 10/24/2018 due to high wind and waves at outer-harbor stations; however 5 lower-harbor stations (#4-7, #14) were surveyed and sampled.
- Data collection for stations #1-3, #8-13, #14A, #15A, #15B, #16-17, and #17A was evaluated for completeness for the following parameters: fecal coliform and enterococci. All sampling days exceeded the 70% acceptance criterion except for 10/24/2018 (67% of samples collected). Sampling was affected on 10/24/2018 due to high wind and waves.

  - Data collection for stations #1-3, #8-13, #14A, #15A, #15B, #16-17, and #17A was evaluated for completeness for the following parameters: ammonia, nitrate, and nitrite. All sampling days met or exceeded the 70% acceptance criterion except for 10/24/2018 (67% of samples collected). Sampling was affected on 10/24/2018 due to high wind and waves at outer-harbor stations.

Sensitivity of the Data

- 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 nitrogen and fecal coliform and enterococci bacteria, as outlined in **Table 2**.

Conclusion: A majority of sampling events met the completeness goal outlined in the QAPP, and the overall completeness goal of 75% for the monitoring season. 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 replicate data and 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 criteria should be noted and considered when analyzing the data, the data collected by the Coalition to Save Hempstead Harbor during the 2018 water-quality monitoring season can be considered appropriate for use for its intended purposes.

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