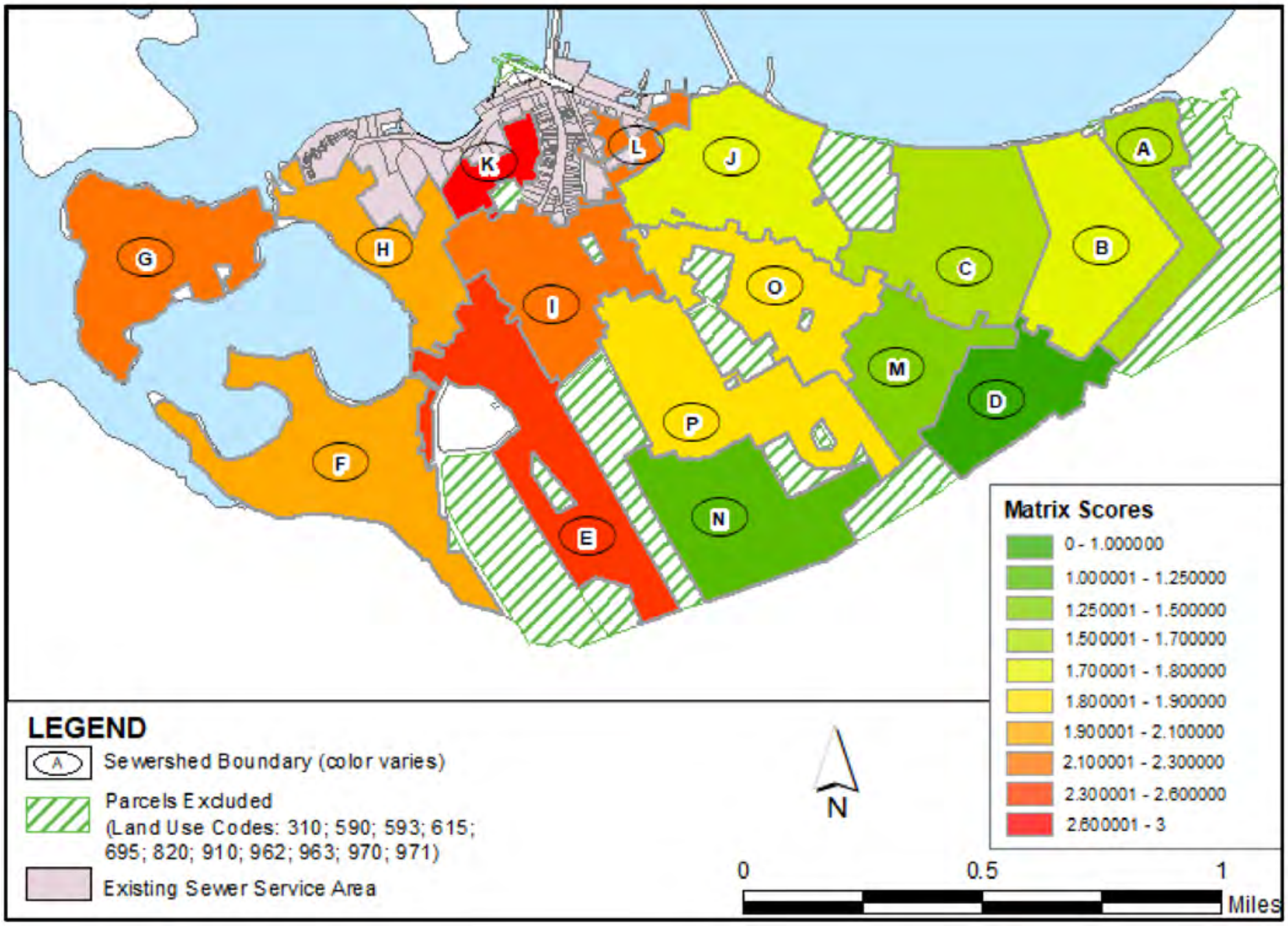
TOWN OF SOUTHAMPTON COMMUNITY PRESERVATION FUND
VILLAGE OF SAG HARBOR

CONSTRUCTION OF SEWER SERVICE EXPANSION AREAS IN SEWERSHEDS "K" AND "L"

ATTACHMENTS



Detail, Sag Harbor Sewershed Sewershed Map with Matrix Scores, Village of Sag Harbor Sewer Master Plan 2022. Cameron Engineering

INDEX

APPENDICES

- Draft Sewer Master Plan
- Sewershed "K" – Engineering Report (Includes Short Environmental Assessment Form)
- Sewershed "K" – 50% Plans
- Sewershed "K" – Specifications
- Sewershed "L" – Engineering Report (Includes Short Environmental Assessment Form)
- Sewershed "L" – 50% Plans
- Sewershed "L" – Specifications

Village of Sag Harbor
Construction of Sewer Service Expansion Areas in Sewersheds “K” and “L”

PROPOSAL SUMMARY

The Village plans to construct a sewer system expansion to collect and convey approximately 14,446 gallons per day (GPD) of sanitary wastewater generated within areas identified in the Sag Harbor Sewer Master Plan as Sewershed “K” and Sewershed “L” to the existing Village of Sag Harbor Wastewater Treatment Facility (WWTF). The project will connect approximately 51 parcels to the WWTF. Forty-four (44) parcels are located in Sewershed “K” and seven (7) are located in the Town of Southampton portion of Sewershed L. The parcels have been identified in the Village Sewer Master Plan as high priority areas for sewering.

Treated effluent discharged from the WWTF has nitrogen concentrations consistently shown via lab testing to be better than any approved onsite septic system. The WWTF regularly discharges less than 7 mg/l total nitrogen. The typical discharge of nitrogen from Onsite Wastewater Treatment System (OWTS) of 65 mg/l total nitrogen is reduced to 7 mg/l at the WWTF; this is an approximate Nitrogen reduction of 90%. Therefore, by connecting these 51 parcels to the Village’s WWTF, it will prevent nitrogen-rich OWTS point sources from these parcels from continuing to discharge to the groundwater that then flows into the harbor. Treatment of this flow at the WWTF thereby contributes to the improvement of water quality in the Peconic Estuary. The table below indicates that the project is projected to reduce nitrogen loading to surface waters by 2,551 lbs/year.

CPF funds are requested to support the construction of a Low Pressure Sewer (LPS) System that will collect and convey sanitary wastewater to the Village’s existing gravity sewer lines. The request budget, as summarized below, encompasses construction that is to occur in the Village Right of Way as well as installation of house connections to connect house waste lines to the street sewer.

Nitrogen Reduction – Sewersheds K and L				
Land Use Categories	**Parcels**	**Est. Sewage Flows (gpd)**	**Est. Nitrogen Loading (lbs/day)**	**Est Annual Nitrogen Loading (lbs/yr)**
K-Residential	29	10,500	5.08	1,854
K-Non-Residential	10	1,846	.89	326
K-Recreation and Open Space	5	-	-	-
L- Residential	7	2,100	1.02	371
Totals:	**51**	**14,446**	**6.99**	**2,551**

Budget Summary	**Totals**
K- ROW Construction (44 parcels)	$ 1,288,815
K- Parcel Connections (37 parcels)	$ 1,562,818
L- ROW Construction (7 parcels)	$ 600,780
L- Parcel Connections (7 parcels)	$ 138,905
Total CPF Request	**$ 3,591,318**

ITEM 3. PROJECT DESCRIPTION

3a. EXISTING CONDITIONS

Water quality

Three recent studies published by Dr. Christopher Gobler of the Stony Brook University School of Marine and Atmospheric Sciences (SOMAS) highlight concerns around nitrogen loading by onsite septic systems and the related impacts on surface water quality. They are summarized below.

Assessment of Water Quality in Marine Waters Surrounding Sag Harbor Village, 2018-2019 (2020).[1] Key findings include the following:

- Multiple water quality impairments were observed; Nitrogen, low oxygen, reduced water clarity, algal blooms, rust tides, and pathogenic bacteria were all detected at levels exceeding state and federal guidance values.

- Nitrogen was the nutrient promoting algal growth and, in turn, rust tides, low water clarity, and low oxygen.

- Wastewater from on-site septic systems was the primary source of nitrogen in Sag Harbor and Sag Harbor Cove.
  - Nitrogen loading analyses indicated that septic tanks and cesspools were the strongest source of N for both the Cove, the Inner Harbor and the Harbor, representing between 70%-90% of the total nitrogen load.

- Upgrading septic systems and/or connecting homes to the sewage treatment plant will reduce the incidence of rust tide, algal blooms, and hypoxia while improving water clarity.
  - The report noted that nitrogen discharge from the Village's existing wastewater treatment facility (<5 Mg/L) is better than any approved onsite septic system, including the newer I&A treatment systems.

Refined Assessment of Water Quality in Marine Waters Surrounding Sag Harbor Village, 2020 (2021) provided the following conclusion: "Given the connection between excessive N and water quality impairments, reductions in N loading across Sag Harbor are warranted. Nitrogen loading analyses indicated that septic tanks and cesspools were the strongest source of N for the Harbor, representing 90% of the total load. Given this, upgrading these systems and/or connecting homes to the sewage treatment plant would be the effective mitigation approaches." (Page 15)

Refined Assessment of Water Quality in Marine Waters Surrounding Sag Harbor Village, 2021 (April 2022) validates findings of the 2021 report. The report also indicated that the Suffolk County Subwatersheds Study declared that Sag Harbor Cove should strive for a 62% to 81% N

[1]Available at: https://www.sagharborpartnership.org/uploads/1/0/4/2/104256339/sag_harbor_2019_draft_final_report.pdf

reduction in order to achieve water quality improvements, but also asserted that Sag Harbor was not a high priority for water quality improvement due to absence of HABs and hypoxia during historical Suffolk County monitoring efforts. However, Gobler's team has conducted more frequent monitoring than the County, and has in fact detected HABs and hypoxia.

The Village of Sag Harbor *Water Quality Improvement Project Plan* (WQIPP) completed for the Village by the firm Nelson, Pope & Voorhis (NPV) in August 2016[2] indicates that:

- Stormwater and other pollutants associated with onsite septic systems have increased as the Village and neighboring areas have developed and matured (see attached map titled Priority Waterbodies List).
- Due to historic settlement patterns, many Village lots do not conform with current lot size and overall density requirements recognized today as being necessary for groundwater and surface water protection. With many small developed lots in proximity to Total Maximum Daily Load (TMDL) waterbodies and in high groundwater areas, it is likely that on-site sanitary treatment systems are contributing to local water quality impairments.
- The Village of Sag Harbor's lowest topographic elevations occur along its extensive shorelines and northeastern boundary, where shallow depth to groundwater is also evident. Greater than 50% of the Village lies within the 0-2 year groundwater contributing area to local surface waterbodies.

The WQIPP presented a variety of conceptual water quality improvement projects designed to reduce, remediate and restore the health of shared Town and Village water resources in the Sag Harbor watershed. Two recommendations were presented for wastewater treatment with the intention that the concepts will be refined as ongoing evaluation of the means to achieve optimal water quality improvement progresses. These concepts are:

- Highest priority areas for sewering include developed, unsewered parcels within Groundwater Management Zone IV.
- Potential Expansion of Sag Harbor Wastewater Treatment Sewer Service Areas: conduct feasibility study to determine to advisability of extending the area served by the Village wastewater treatment facility, which is operating below capacity. This work has proceeded as evidenced by the draft Sewer Master Plan (2022).

Additional studies documenting surface water quality, planning, sewer capacity and sewer options provide data that inform and support water quality efforts in the Village. These are:

- Local Waterfront Revitalization Program. Adopted 1986 and amended 2006. Currently undergoing update.
- "Planning Strategies for the Village of Sag Harbor", Interscience Research Associates Environmental Planning & Development Consulting, 2008.
- "Sewer Capacity Study, Sag Harbor," Cameron Engineering, May 2014. This was part of a larger Suffolk County study for extension of existing sewer districts within the County.

[2] Available at: http://sagharborny.gov/DocumentCenter/View/136/2016-Water-Quality-Improvement-Plan-PDF?bidId=

- "Engineering Report, Village of Sag Harbor Wastewater Treatment Plant, Plant Capacity for Future Expansion of Sewer District," Dietrich Engineering, P.C., June 2018.
- "Triennial Review of Coliform Data, Shelter Island Sound-South, Shellfish Land Number 18S, Towns of Southampton, East Hampton and Shelter Island, 2013-2017", NYSDEC, Shellfish Growing Classification Unit, June 2018.
- "Suffolk County Subwatersheds Wastewater Management Plan", Camp, Dresser & McKee, February 2020.
- Reports of the DEC and Peconic Estuary Program (PEP) pertaining to water quality testing and classification of impaired water bodies.

    - Sag Harbor and Sag Harbor Cove is listed as an Impaired waterbody in the NYSDEC Priority Waterbody List.[3] The waterbody is impaired for shellfishing, and stressed for public bathing and recreation. Known pollutants are pathogens, algal/plant growth, and nutrients (nitrogen). The PWL listing was last revised 1/4/2016, and lists urban/storm runoff as a known source of pollutants, and onsite septic systems as a suspected source. Dr. Gobler's 2021 and 2022 reports referenced in this document have since confirmed the role of onsite systems as the major contributors of nitrogen to surface waters.
    - Sag Harbor and Sag Harbor Cove was among the waterbodies covered by the Peconic Estuary Pathogen TMDL to address shellfishing impairments was established in 2007.
    - Sag Harbor and Sag Harbor Cove is included within the PEP study area. The PEP 2020 Comprehensive Conservation and Management Plan[4] identifies high levels of nutrients, particularly nitrogen from non-point sources such as residential septic systems, as a contributing factor to observed water quality problems in the estuary.

Figure 1. Existing conditions. Sag Harbor (foreground) and Sag Harbor Cove (top). Source: SOMAS

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[3] Available at https://www.dec.ny.gov/docs/water_pdf/wiatllissisgb.pdf
[4] Available at https://www.peconicestuary.org/ccmp2020/

Sag Harbor Village Wastewater Treatment Facility

The Village has a somewhat unique designation of properties that is different from other municipalities for its sewerage system. All properties inside the Village of Sag Harbor municipal boundary are within its sewer district, which encompasses the entire Village. The district is defined in Village code as its "sewerage system."[5] Only those properties that are within the sewer "service area," have the ability and are required to connect to the Wastewater Treatment Facility (WWTF). See Figure 2. Presently, approximately 13% of the parcels within the Village are connected.

The Village of Sag Harbor's WWTF has a design capacity of 250,000 gallons per day (MGD). Accounting for existing flows and regulatory requirements, the WWTF's excess capacity is currently calculated at 88,500 gpd. This capacity is adequate to accommodate the planned sewer area expansion for both Sewershed "L" and Sewershed "K." A discussion of this calculation is included in the attached engineering report for Sewershed "K."

Lab tests performed by Long Island Analytical Laboratories, Inc. indicate that the WWTF performs at a high level of efficiency. Tests performed in February 2020 determined that the nitrogen measurement was 1.96 Mg/L. Further, the fecal coliform count was less than 1.0 MPN/100 ml (1.0 the smallest measurement).[6] The March 2021 Discharge Monitoring Report (DMR) to the New York State Department of Environmental Conservation (DEC) shows the last 12 month (March 2020-March 2021) rolling average for Total Nitrogen at 2 pounds per month total discharge loading at a 7mg/l average concentration. By contrast, the WWTF permitted effluent is 10 Mg/L, our local groundwater is 4-4.5 Mg/L, and I/A systems are permitted at 19.00 Mg/L.

Figure 2. Sag Harbor Sewer Service Area and Village Boundary

[5] Village Code §220-1.2 defines the wastewater collection and treatment system as a "sewerage system."
[6] Long Island Analytical Laboratories, Inc. February 25, 2020. Available upon request.

2022 Sewer Master Plan and Engineering Efforts to Date

The Village, with support of its engineering consultant Cameron Engineering, initiated development of the Sewer Master Plan in July 2020 and it is currently at 95% completion. The goal of the plan is to provide guidance to the Village on the management of wastewater generated by residents and its downtown commercial district. To support this work, the Village received a grant of $72,400 from the Town of East Hampton CPF, representing 50% of the plan's total cost. A grant award from the Town of Southampton CPF, also for $72,400, supported the remaining 50%.

The draft Sewer Master Plan was delivered to the Village in January 2022 and is currently under final review. The plan delineates several sewersheds within the Village and ranked them using a weighted scoring methodology that took into account nitrogen loading, groundwater flows, topography, and similar factors, as shown in Figure 3. Sewersheds with higher matrix scores indicate higher priority for sewering. Complete information is included in the attached draft Sewer Master Plan.

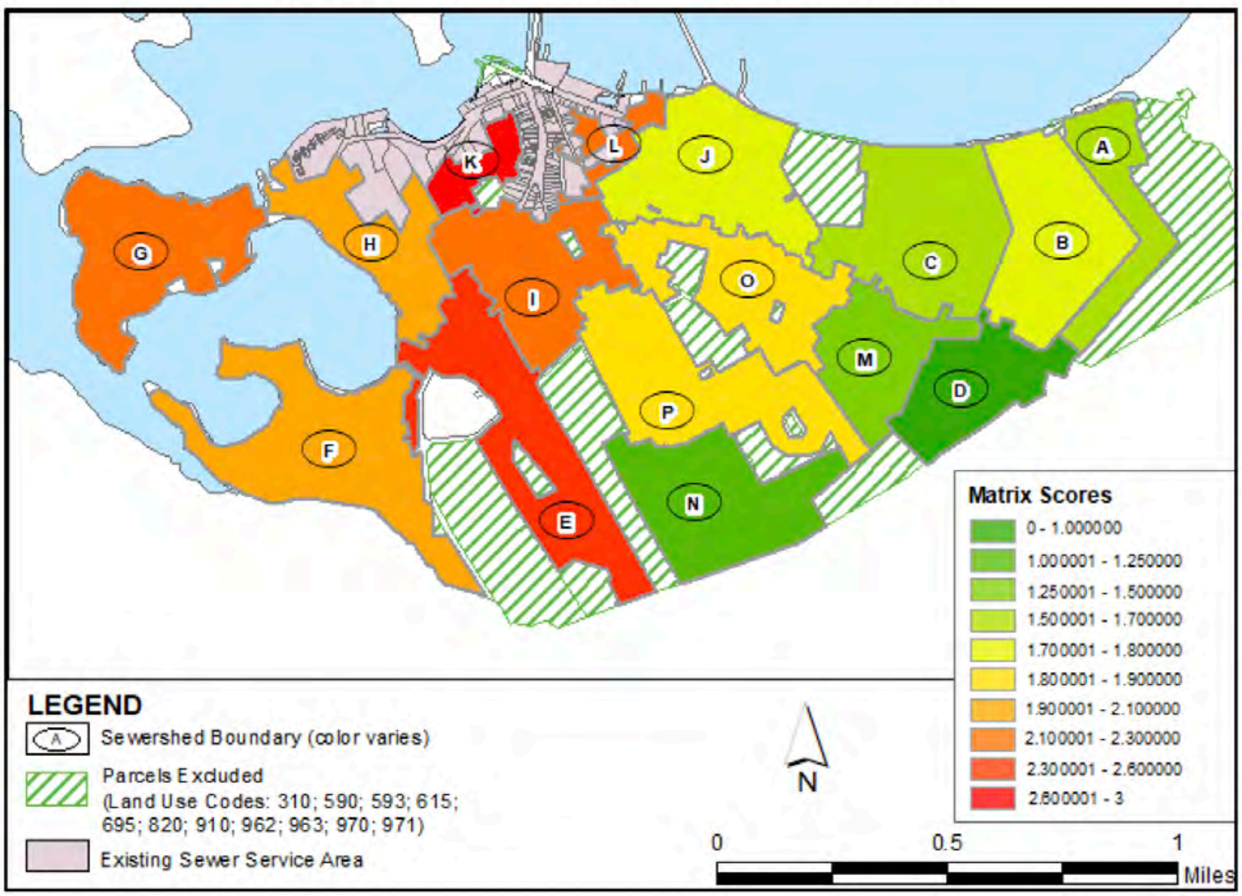

Figure 3. Sag Harbor Sewershed Map with Matrix Scores (Draft Sag Harbor Sewer Master Plan*, 2022).*

Several sewersheds were ranked as highly critical with respect to their impact on the Village's waterways. Sewershed "K" has been identified as the number one most critical sewershed in the Village due to its proximity to the harbor, density of parcels, and short travel time of OWTS effluent to the Sag Harbor Cove. It is comprised of 44 parcels located entirely within the portion of the Village that lies within the Town of Southampton. Sewershed "L" is a high priority parcel located primarily in the Town of East Hampton, with seven (7) parcels located in the Town of Southampton.

With funding support provided by the Town of Southampton and Town of East Hampton Community Preservation Fund programs, engineering reports and 50% design plans have been prepared for both Sewersheds "K" and "L." These form the basis of this grant request and are provided with the application attachments.

3b. How the project addresses the issue in the context of reduction as per the CPF WQIPP

The Village proposes to construct a sewer system expansion to collect and convey approximately 14,446 gallons per day (GPD) of sanitary wastewater generated within areas identified in the Sag Harbor Sewer Master Plan as "Sewershed K" and portions of "Sewershed L" situated within the Town of Southampton to the existing Village of Sag Harbor Wastewater Treatment Facility (WWTF). The project will connect an estimated 51 parcels to the WWTF. The parcels are identified by the Village Sewer Master Plan as high priority for sewering.

Treated effluent discharged from the WWTF has nitrogen concentrations consistently shown via lab testing to be better than any approved onsite septic system. Therefore, the Village's WWTF will prevent nitrogen-rich onsite wastewater point sources from continuing to discharge to the ground, thereby contributing to the improvement of water quality in the Peconic Estuary. The table provided with question 4a indicates that the project is projected to reduce nitrogen loading to surface waters by 2,551 lbs/year. The design flow will support existing development and is not intended to support new growth.

3c. Narrative describes proposed technology in sufficient detail and includes information on its demonstrated efficacy in similar setting (may include published data).

CPF funds are requested to support the construction of Low Pressure Sewer (LPS) System infrastructure that will collect and convey sanitary wastewater to the Village's existing gravity sewer lines. The request budget, as summarized below, encompasses construction that is to occur in the Village Right of Way as well as installation of house connections to connect house waste lines to the street sewer.

Engineering Reports, design plans and specifications for Sewershed "K" and Sewershed "L" are attached. They are stamped by a licensed professional engineer and present design considerations, recommended alternatives, pollutant load reductions, and engineer's cost estimates.

Separate engineering documents are provided for each sewershed because they are not contiguous. In keeping with recommendations of the draft Sewer Master Plan, the Village has proceeded with engineering for these Sewershed "K" and Sewershed "L" as the top priorities for achieving nitrogen reduction goals. Key details for each sewershed are summarized below.

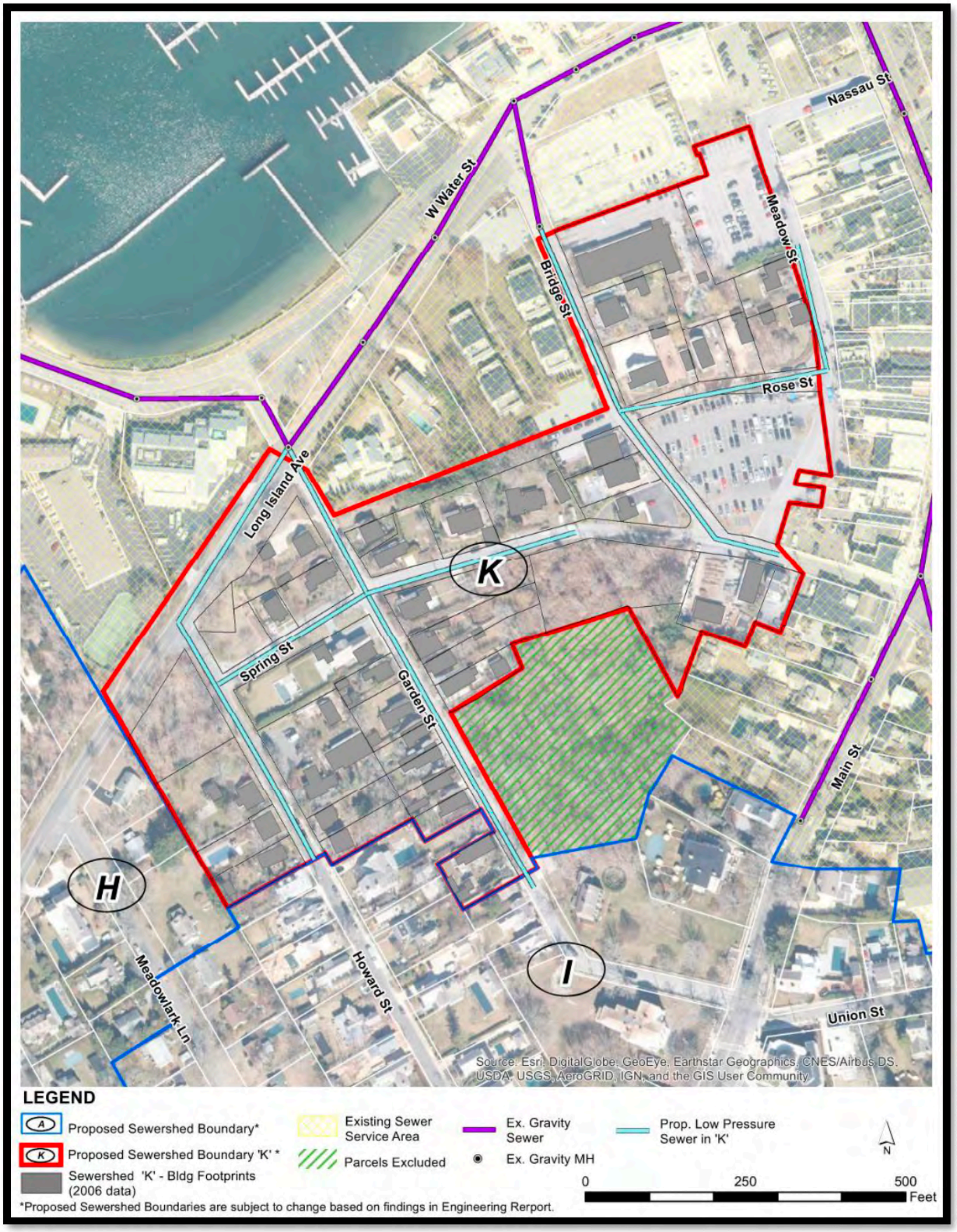

Figure 4. Sag Harbor Sewershed Boundary K and Existing Sewer Service Area Map, Sewershed K Engineering Report. Cameron Engineering, 2022

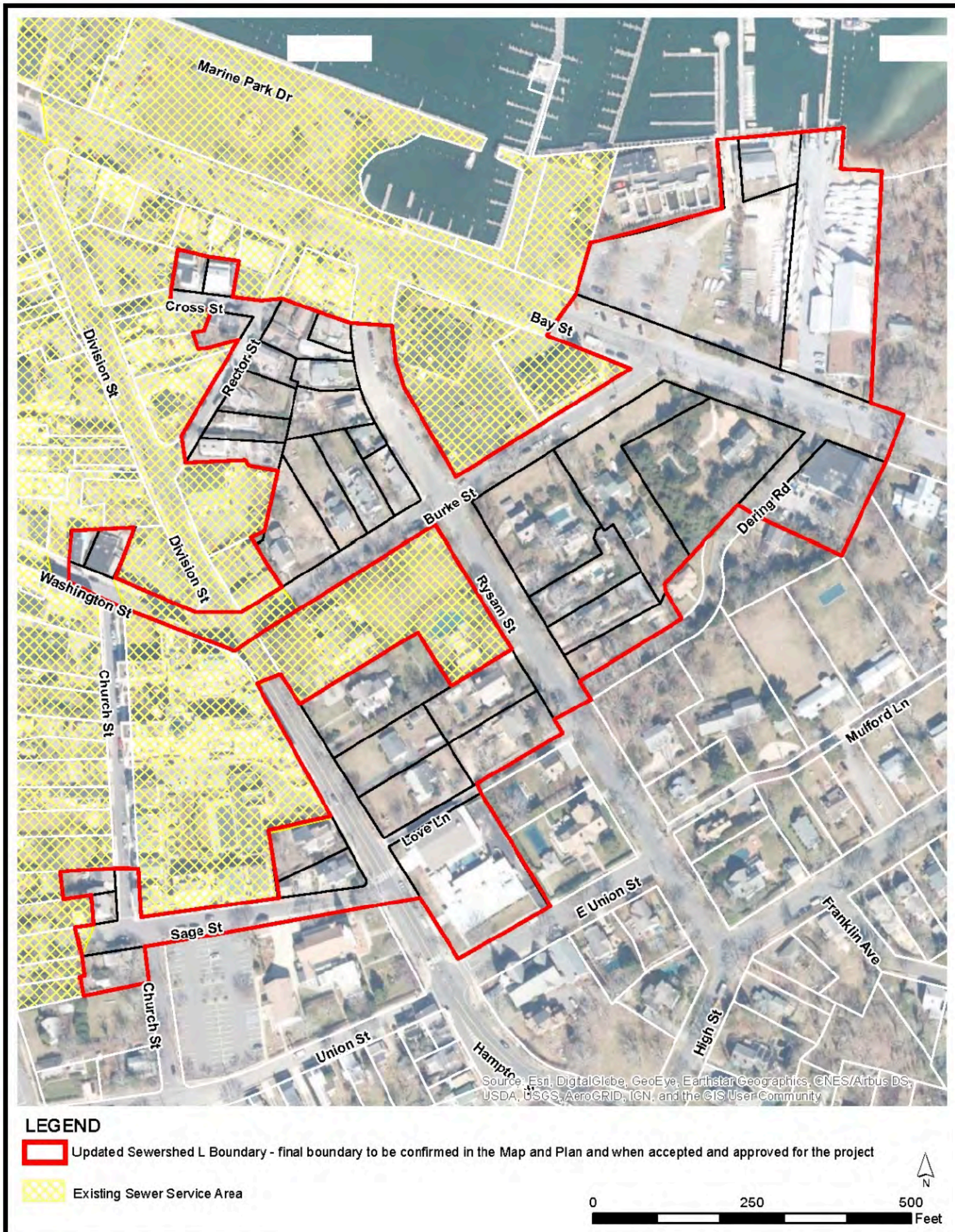

Figure 5. Sag Harbor Sewershed "L" and Existing Sewer Service Area Map, Sewershed "L" Engineering Report Cameron Engineering, 2022. ***Note areas in the Town of Southampton are situated west of Division Street***

- **Sewershed K** is the highest priority sewershed located within the Town of Southampton. It is located entirely within the Town boundary. The sewershed is comprised of 44 parcels, five of which consist of recreation and open space. See Figure 4.
  - The Right of Way construction budget includes sewer hookup capacity for all 44 parcels.
  - The Parcel Connection budget includes connections for the 37 developed parcels.

- **Sewershed L** is the highest priority sewershed located within the Town of East Hampton. It consists of 40 parcels, 33 of which are located in East Hampton and seven (7) in the Town of Southampton. This grant request includes costs associated with work to be performed in the Town of Southampton boundary only. See Figure 5.

3d. Narrative indicates how the project supports Town of Southampton, Suffolk County, NYSDEC Long Island Nitrogen Action Plan (LINAP) or other adopted goals/policies (provide references with pages numbers, etc.)

Town of Southampton Water Quality Improvement Project Plan (2016): The plan indicates that:

- The highest concentration of nitrogen from septic systems to the Peconic Estuary originates primarily from Sag Harbor, Riverhead and Montauk (p. 29).
- The primary source of pollution to the Town's waters originates from onsite cesspool and septic systems, and that the bulk of the Town's attention at the onset of the CPF funding program will be focused on reducing those loads (p.20).
- All Village coastline that lies within the Town of Southampton is situated in a high priority area, as shown on the attached map. The high priority area includes substantial portions of the areas that are targeted for sewer service expansion.

Suffolk County Comprehensive Water Resources Management Plan[7]: The plan identifies Sag Harbor Cove and Connected Creeks as Wastewater Management Area 10 (page 6-10) and determines that the area is a wastewater management Priority Rank 2 area with an overall ideal water quality goal of 81 percent. Page 6-19 states that residential neighborhoods surrounding Sag Harbor Cove "scored in favor of sewering due to their proximity to the existing WWTF and the ecological rank of Priority Rank 1. In addition, Sag Harbor Cove is identified as potentially requiring nitrogen load reductions above the reduction that could be achieved through the use of I/A OWTS alone to meet water quality goals. The proposed project is directly supportive of these findings by advancing efforts to connect the targeted neighborhoods to the WWTF.

Long Island Nitrogen Action Plan (LINAP)[8]: Goal 4.a.a is to develop "action plans which contain near term actions that will reduce nitrogen pollution to groundwater and surface waters." The proposed project is directly supportive of this goal as it will lead to implementation of wastewater system improvements that will reduce nitrogen pollution to groundwater and surface waters (page 7).

Peconic Estuary Program (PEP) Comprehensive Conservation and Management Plan[9]: Within the Clean Water Goal, Objective E calls for decreasing negative impacts from legacy, current and future

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[7] Available at: https://suffolkcountyny.gov/Portals/0/formsdocs/planning/CEQ/2020/RevisedComplete%20SWP2-21-20.pdf
[8] Available at: https://www.dec.ny.gov/docs/water_pdf/linapscope.pdf
[9] Available at: https://www.peconicestuary.org/ccmp2020/

nutrient inputs. The proposed project is directly supportive of this goal as it will enable the Village to connect properties in a high priority area to the WWTF, thereby reducing nitrogen and other pollutants entering the estuary. The sewershed is identified as a high priority based on proximity to WWTF, proximity to surface water, groundwater depths/travel times, and nitrogen removal potential.

Sag Harbor Village Water Quality Improvement Plan (WQIPP)[2]: As previously noted, the proposed project is supported by the WQIPP recommendation to "conduct feasibility study to determine to advisability of extending the area served by the Village wastewater treatment facility, which is operating below capacity." (Page 6)

2022 Draft Sag Harbor Village Sewer Master Plan: The project implements a recommendation of the Sag Harbor Sewer Master Plan to utilize available capacity of the WWTF to extend the sewerage system to parcels located in Sewersheds "K" and "L" (p. 5-6 et. al).

4. WATER QUALITY BENEFIT

4a. Identify Nitrogen, Pathogen or Pollutant of Concern (POC) including Existing Condition and Target Reduction.

The project is expected to reduce the flow of nutrients and pollutants to area surface waters. The below summary table indicates that nitrogen reduction is 2,551 lbs. per year.

It is acknowledged for the purpose of this funding request that the WWTF is located in the Town of East Hampton, but all costs included in this grant request are linked with parcels and Right of Way areas located in the Town of Southampton. The project addresses water quality goals held in common by both towns.

Nitrogen Reduction – Sewersheds K and L				
Land Use Categories	**Parcels**	**Est. Sewage Flows (gpd)**	**Est. Nitrogen Loading (lbs/day)**	**Est Annual Nitrogen Loading (lbs/yr)**
K-Residential	29	10,500	5.08	1,854
K-Non-Residential	10	1,846	.89	326
K-Recreation and Open Space	5	-	-	-
L- Residential	7	2,100	1.02	371
Totals:	**51**	**14,446**	**6.99**	**2,551**

4b. Describe plans for collecting and reporting on water quality over time.

The water quality monitoring activities initiated by the Stony Brook School of Marine and Atmospheric Sciences (SOMAS) in 2018 will continue to be supported by the Village in 2022 and moving forward.

4c. Indicate useful life of proposed technology (must meet or exceed five years).

The sewer system will exceed the five-year threshold required by CPF. The proposed low pressure pumping system force main is expected to have a minimum of a 30-year service life. Fittings, valves and other ancillary equipment associated with the force main are expected to have a 10-15 year service life. With regard to the residential LPS pumping units, it would be expected that some components of the units such as the fiberglass housing and piping would have a greater than 20-year service life. Pumping units would be expected to have a 10-15 year service life with routine maintenance being performed in accordance with manufacturer's recommendations by qualified service technicians.

SECTION 5. COST FACTORS

5a. Explain how you have confirmed that the proposed budget is reasonable, appropriate, and necessary. Provide any and all estimates or documentation of how costs were determined.

The project budget was developed by Cameron Engineering. As demonstrated in the attached statement of qualifications, Cameron has extensive experience in the planning, design and engineering of sewer systems in Suffolk County. The attached Engineering Reports for Sewersheds "K" and "L" provide detailed cost estimates for each sewershed based on engineering analyses and knowledge of current market conditions. While best efforts have been made to prepare accurate estimates, actual costs will not be known until the bidding process is complete.

Sewershed "L" straddles the boundary between the Towns of Southampton and East Hampton. As a result, the report presents construction costs for the entire sewershed. Recognizing that Southampton CPF funds cannot be used to support improvements within the Town of East Hampton boundary, Cameron Engineering has analyzed the budget provided in the Sewershed "L" engineering report and provided a cost allocation for Sewershed "L" as follows:

Sewershed "L"	**Sewershed "L" Total Construction Cost** *(Locations in East Hampton & Southampton)*	**Sewershed "L" Southampton Only ROW and 7 Parcel Connections**
ROW Construction		
Construction of Sewers - ROW Sewers	$6,177,676	$492,671
Construction Administration-Design Services During Construction	$175,000	$30,625
Construction Inspection Services - Resident Engineer	$442,768	$77,484
Subtotal ROW	**$6,795,444**	**$600,780**
House Connections		
Installation of House Connections - 60ft (20 parcels)	$305,360	$53,438
Installation of House Connections - 100ft (20 parcels)	$428,380	$74,967
Construction Oversight ($1500 each)	$60,000	$10,500
Subtotal Parcels	**$793,740**	**$138,905**
Total	**$7,589,184**	**$739,685**

The total grant request budget is summarized as follows:

CPF Request Budget Summary	Totals
K- ROW Construction (44 parcels)	$ 1,288,815
K- Parcel Connections (37 parcels)	$ 1,562,818
L- ROW Construction (7 parcels)	$ 600,780
L- Parcel Connections (7 parcels)	$ 138,905
Total CPF Request	**$ 3,591,318**

5b. Describe any matching funds to be provided

Village contributions to the project which are not reflected in the grant budget include:

- In-kind staff and consultant resources for project management, administration and grant writing
- Estimated $7,500 to continue water quality monitoring to be performed by SOMAS in 2022

Additional leveraged support includes studies that informed development of the Sewer Master Plan:

- 2018 study of several sewer service expansion options, prepared by Dietrich Engineering ($10,455) and funded by the Village.
- Water quality and testing studies performed by Dr. Christopher Gobler of SOMAS. The full cost of studies conducted 2018-2022 was approximately $140,130, with the majority of funds provided by community fundraising efforts led by the Sag Harbor Partnership, and $27,500 provided by the Village.
- Town of East Hampton CPF 2020 award for $72,400 to fund 50% of the cost for preparing the Sewer Master Plan. East Hampton CPF has also support the cost of design for Sewershed L.
- Ongoing Operations and Maintenance of the existing Village of Sag Harbor WWTF and collection/conveyance system; annual budget for upcoming fiscal year is estimated at approximately $813,000. The ongoing O&M cost is expected to increase as the sewer service area expands.

5c. Explain why the project cannot proceed and intended benefits cannot be achieved without external funding. Please describe how the project will proceed if funds awarded are lower than requested or if there are cost overruns.

External funds are necessary in order for the project to move forward.

- Due to the total cost of other Village obligations, and the projected cost of the entire multi-year sewer project encompassing multiple sewersheds, obtaining capital by bonds or long-term loans has not been seen as a viable financing alternative.
- CPF funding, with possible supplemental funding from state grants, and using the CPF funds as a local match, has from the outset of the Village's sewer planning initiative, been considered as the primary funding source.
- In addition to this request, the Village is actively seeking approximately $6.8M for construction of the East Hampton portion of Sewershed "L." The Village also anticipates that two additional sewersheds (tentatively identified as Sewershed "I" and Sewershed "E") can be sewered using

remaining excess capacity in the WWTF. The cost of that additional future expansion is not yet known, but is expected to exceed the cost of the current projects for “L” and “K.”
- External funding for parcel connections have not been identified.

Given the significant demand for capital, the Village is challenged to compete for limited funds available through CPF, New York State and Suffolk County. **Full funding from the Town of Southampton CPF for this project will enable the Village to proceed to construction without delay.** This sewershed is likely to be the least costly of all sewer service expansion areas in the Village. The Village would then be able to focus its grant development efforts on the other priority sewersheds, the majority of which are situated in Southampton.

If funds are awarded at a lower level than requested, the Village will continue to seek other sources of funding to make up the shortfall, though this will affect the project timeline and delay the intended water quality improvement outcomes. Grant programs identified as potential sources of funding for Right of Way construction costs include:

- NYS Department of Environmental Conservation Water Quality Improvement Program (WQIP): Tentative deadline July 2022. Maximum request amount to be determined; requires 25% match. Awards typically announced December.
- NYS Wastewater Infrastructure Improvement Act: Deadline TBD. Typically requires 80% match.
- Suffolk County Water Quality Protection and Restoration Program: Deadline likely late Spring 2022. Likely maximum funding amount $250,000. Awards typically announced in the late Fall.

The Town expects to apply to NYSDEC WQIP in July 2022. The Sewershed “K” and “L” costs that are eligible for DEC grant funding is estimated at $1.6M. This includes ROW construction costs only. The required 25% local match from CPF funding would be $322,676. NYSDEC is not expected to fund construction administration nor parcel connections, estimated at $2M. If the DEC grant is awarded it would reduce the amount required from Town CPF funding by $1.3M to approximately $2.4M.

The Village is also in the process of submitting both Sewershed “L” and “K” projects to the New York State Environmental Facilities Corporation to enable it to qualify for short term financing.

6. MANAGEMENT, EXPERIENCE, ABILITY

6a. Describe applicant’s experience in completing similar projects

The Village of Sag Harbor wastewater treatment plant was constructed in the early 1970’s and has been continually operated under the supervision of the Village Department of Public Works in accordance with applicable regulations. Existing staff resources are sufficient to support maintenance and operation of the sewer service area expansion inclusive of the additional flows as well as maintenance and repair of collection and conveyance infrastructure.

The Village will oversee delivery of the funded scope of work under the direction of Trustee Aidan Corish. Since his tenure as Trustee began in 2017, his accomplishments have included helping to implement the first ever continuous water quality testing initiative in association with SOMAS;

initiating the project to expand the WWTF service areas to reduce the amount of nitrogen entering the waterways; and working continuously to secure grants for infrastructure projects. His oversight will occur in coordination with Village Clerk Kate Locascio, who will be responsible for financial administration; and Superintendent of Public Works Dee Yardley who is responsible for managing the WWTF. Trustee Corish will ensure public engagement via meetings of the Village Trustees.

Qualifications of the Cameron Engineering team are attached. Cameron has been retained to prepare the Sewer Master Plan, as well as all engineering tasks associated with expansion of the sewer service area into Sewersheds “L” and “K”. Cameron Engineering will continue to provide support to the Village for construction phases as well as O&M of the WWTF.

6b. Describe community support or opposition to project. If there is opposition, explain how this is to be addressed.

The Sag Harbor Partnership, a nonprofit organization dedicated to the preservation and enhancement of the quality of life in Sag Harbor, NY, was created to support environmental, education, historic preservation, economic and social programs that benefit the greater Sag Harbor community. The Partnership, working with the Village’s Harbor Committee and community stakeholders, raised funds from the community and awarded a grant to the SUNY School of Marine and Atmospheric Sciences at Stony Brook to complete the 2020 study authored by Dr. Gobler.

News coverage has been ongoing for several years, and includes the following articles:

- “Sag Harbor Launches Water Quality Initiative.” *East End Beacon,* June 1, 2018
- “Sag Harbor Begins to Weigh Expanding Sewer Plant Service Area.” *Sag Harbor Express*, February 6, 2019
- “Study Suggests Boaters May Be Releasing Septic Waste in Sag Harbor.” *Sag Harbor Express*, February 12, 2020
- “Sag Harbor Will Seek Funding for Sewer Engineering Study.” *Sag Harbor Express*, March 10, 2021

Public Meetings of the Sag Harbor Village Trustees have been held to inform the public about the project. The Trustees have adopted resolutions authorizing: retention of engineering services for development of the Sewer Master Plan and engineering designs; appointments of Sewer Committee members; and grant submissions to the Town of East Hampton and Town of Southampton CPF programs for the Sewer Master Plan, and engineering of sewer service area expansions for Sewershed “L” and Sewershed “K.”

Village officials have engaged community members in discussions about sewering with responses being generally positive. Community outreach and education efforts will be ongoing in order to ensure the public remains engaged and informed.

The outreach materials, news articles, and resolutions referenced above have been provided with prior grant applications to the Town and will be made available upon request.

6c. Describe any permits needed and timeframe/status of approvals.

The following are anticipated by May 2023:

- Village road opening permit
- Suffolk County septic/cesspool abandonment permit for parcels
- NYSDEC Dewatering Permit
- Notification to DEC on additional sewer connections

7. MAINTENANCE/MONITORING/EVALUATION

a. Please describe the proposed plan for on-going maintenance and evaluation including who will be responsible for the maintenance and monitoring. Please include how it will be funded.

The water quality monitoring activities initiated by SOMAS in 2018 will continue to be supported by the Village in 2022 and beyond.

The Map and Plan will detail operations and maintenance (O&M) requirements for the sewer system components to be located on the Village Right of Way (ROW); these will be the responsibility of the Village. Village personnel will monitor and respond to calls identifying suspected blockages of the low pressure sewer mains located in the Village ROW. Maintenance and repair of the existing sewer system is included in the Village's annual operating budget. Extension of the sewer service area's O&M would be included in future budgets.

Maintenance of parcel connections will be the responsibility of the individual property owner.

8. DURATION OF THE PROJECT

a. Provide a projected project timeline

In order to realize near-term environmental benefits, the Village has established an aggressive timeline for implementing the Sewer Master Plan recommendation to connect Sewershed "K" and "L" to the WWTF. This estimated timeline is subject to changed based on timeline of funding approvals.

Task	Date
Engineering Design Completed	May 2022
Draft Map & Plan	July 2022
SEQRA Finalized	August 2022
Public Meetings	June 2022 – September 2022
Final Map & Plan	October – December 2022
Project Financing	June 2022 – May 2023
Permits	May 2023
Bid & Award	September 2023 - November 2023
Construction NTP	December 2023
Construction Completion	January 2024 - January 2025

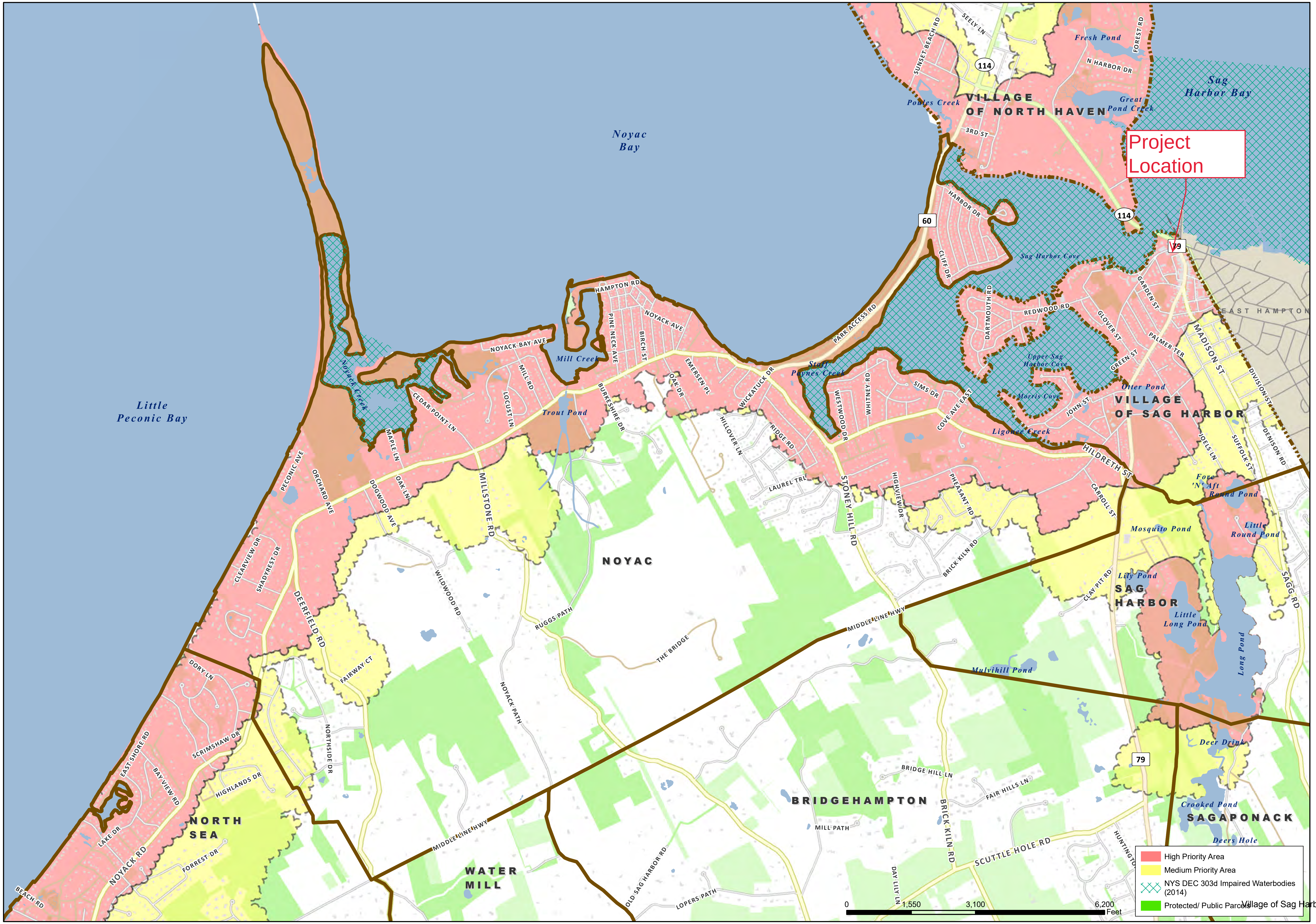
b. If project is multi-year or phased, provide a breakdown of budget and milestones.

Multiyear budgets will be provided with the Map and Plan for each sewershed area.

10. SUSTAINABILITY

The WWTF is located in the 500-year flood zone (Zone AE). The sewerage system includes flood hazard areas as shown on the attached FEMA flood zone and Sea, Lake and Overland Surge from Hurricanes (SLOSH) maps.

The Village is a stakeholder in the 2020 Suffolk County Multi-Jurisdictional Hazard Mitigation Plan. This plan addresses flood mitigation needs and will preserve Village eligibility for future FEMA funding opportunities for capital projects needed to mitigate the flood hazards at the WWTF. Planning and engineering services related to the proposed project have and will continue to incorporate flood mitigation as well as shallow groundwater issues. New sewer lines will use plastic piping with O-rings at the joints, so that any rise in groundwater level will not negatively impact the system. Likewise, manhole inserts will prevent surface flood waters from entering manholes at the street level.



Town of Southampton CPF Water Quality Improvement Project Plan

NOYAC

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Prepared By: The Town of Southampton Dept of Geographic Information Systems Date: 7/5/2016 - MAP ID: 2514

Suffolk County Real Property Tax Service
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REFINED ASSESSMENT OF WATER QUALITY IN MARINE AND FRESH WATERS SURROUNDING SAG HARBOR VILLAGE, 2021

Christopher J. Gobler

April 2022

Stony Brook University
School of Marine and Atmospheric Sciences

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EXECUTIVE SUMMARY

Sag Harbor is a village of historic significance and a popular regional destination. During the past decade, there has been increasing concern regarding water quality on eastern Long Island and a study from 2018 – 2020 revealed a series of water quality impairments within Sag Harbor including harmful algal blooms, hypoxia, and fecal bacterial contamination. Here, a follow-up study was designed to affirm water quality observations made from 2018 – 2020 and to gain a refined understanding of bacterial contamination within Sag Harbor surface water. During this study, four 'mini-studies' were performed: 1. The influence of the sump near Haven's Beach on the beach was evaluated, 2. General water quality at four marine sites, 3. General water quality at three freshwater locations, and 4. Fecal bacteria emanating from the sewage treatment plant. Water quality observations were largely consistent with prior monitoring with primarily good water quality conditions but also some concerns. The sump adjacent to Havens Beach was anoxic and rich in fecal coliform bacteria and *Entercoccus,* and these bacteria were transported to the neighboring beach, causing violations of state standards for swimming and shellfishing on multiple occasions during 2021 despite the beach being open for these activities. Regarding marine sites, while some water quality aspects were better during 2021 than in 2020, a dense rust tide occurred during July and August (with cell densities frequently exceeding the threshold of harm to marine life of 300 cells $mL^{-1)}$ and blooms *Alexandrium* and *Dinophysis* were present during spring. The occurrence of the rust tide and other water quality impairments affirmed the need to reduce watershed nitrogen (N) loads to improve water quality.

Bacteriological measurements affirmed prior observations and also provided evidence to support new conclusions. Based on studies in 2019 and 2020, enhanced spatial sampling identified marinas, surface run-off, and the sewage treatment plant as potential sources of pathogenic bacteria to surface waters. In 2021, the Beacon Pumping Stations was found to have consistently elevated levels of fecal bacteria, while levels at the Ship Ashore marina and the Sag Harbor Yacht Club were lower. Levels of Enterococcus at Windmill Beach exceeded state swimming standards on 3 of 11 days sampled. Assessment of three ponds (Lily Pond, Long Pond, Little Long Pond) found excellent water quality with the exception of a late season blue-green algal bloom in Long Pond. Finally, effluent from the sewage treatment plant contained elevated levels of fecal indicator bacteria on some occasions.

This study has provided a refined indication of where future efforts should focus with regard to both remediation and monitoring. Efforts to reduce N loads to surface waters are warranted and given the performance and capacity of the sewage treatment plant, a combination of extending sewer lines and upgrading onsite septic systems to low N systems seems warranted. The Haven's Sump is a strong source of fecal bacterial contamination to surface waters that is contaminating neighboring beaches on occasion. Fecal bacteria continue to present a problem in surface waters near the harbor. Efforts to control inputs from boats and optimal function of the sewage treatment plant is warranted. Continued monitoring of Sag Harbor surface waters is critical to assess the extent to which ongoing mitigation efforts are realized as improved water quality.

1. INTRODUCTION

During 2018 – 2020, the Gobler Laboratory performed a comprehensive study of Sag Harbor surface waters that was designed to 1. Assess water quality across Sag Harbor and Sag Harbor Cove, 2. To identify causes of water quality impairment, and 3. To identify managerial actions that could be taken to improve water quality. A series of impairments (measurements below state or federal guidance values) during each summer were observed. Hypoxia (dissolved oxygen < 3 mg L^{-1}) and anoxia (<0.5 mg L^{-1}) were observed both years in Upper Sag Harbor Cove, and, to a lesser extent, within Sag Harbor Cove and the inner harbor. Water clarity at most stations was < 2 meters during summer and sometimes < 1 meter within Upper Sag Harbor Cove. Levels of algae (chlorophyll *a*) were always above the EPA ideal value of 5 µg L^{-1} and at times exceeded the maximal guidance value of 20 µg L^{-1} in Upper Sag Harbor Cove and Otter Pond. While levels of harmful algal blooms caused by *Alexandrium* and *Dinophysis* never rose to a level of concern either year, high levels of the ichthyotoxic rust tide algae, *Cochlodinium*, were detected both years in Upper Sag Harbor Cove and in the inner harbor in 2019 and 2020. The Peconic Estuary has a target total N level of 0.4 mg L^{-1} and this level was occasionally exceeded in Otter Pond, the inner harbor, and at Haven's Beach. Experiments performed during both summers demonstrated that nitrogen was clearly the element limiting the growth of algae in Sag Harbor Cove and Upper Sag Harbor Cove. Levels of fecal coliform bacteria exceeded guidance values for shellfishing on occasion in Otter Pond, the inner harbor, and at Haven's Beach, with the latter location being open to shellfishing. Microbial source tracking revealed the sources of fecal bacteria differed by time and location and primarily included dogs and small mammals, humans, and birds. The human signal was strongest within the inner harbor, while dogs and small mammals, and birds were strongest for Otter Pond and Haven's Beach. Sediment surveys revealed the presence of thick and organic rich muds in Upper Sag Harbor Cove as well as isolated regions in the Cove and inner harbor. Nitrogen loading analyses indicated that septic tanks and cesspools were the strongest source of N for both the Cove and the Harbor, representing 70 and 90% of the total load, respectively. Given the ability of N to increase phytoplankton biomass, the exceedance of guidance values for total N, algae, and water clarity, and the occurrences of harmful rust tides that are promoted by excessive N, reductions in N loading across the region are warranted. Given the that overwhelming majority of N entering this region emanates from onsite septic systems, upgrading these systems and/or connecting homes to the sewage treatment plant would be the most effective approaches. While a more fine-scale study of pathogenic bacteria may be needed to optimize remedial approaches, minimizing or rerouting surface discharge of water from the Haven's Beach sump or Otter Pond may be effective management approaches.

Given these findings and given that there are presently efforts to mitigate nitrogen loading due to septic systems, a 2021 study was undertaken to affirm some trends from the 2018 – 2020 reports and also to gain a refined understanding of water quality standards and fecal bacterial contamination at Haven's Beach in and near the sump as well as water quality of nearby freshwater sites, and potential influence from the sewage treatment plant. Water quality parameters were monitored through the summer and fall of 2021 in the waters surrounding Sag Harbor. Regions covered in this study include Haven's Beach, the Ship Ashore marina, Windmill Beach, the pumping station outfall pipe near Beacon Restaurant, the Sag Harbor Yacht Club,and the nearby effluent from the sewage treatment plant, and three freshwater sites (Lily Pond, Little Long Pond, and Long Pond). Measurements were taken for temperature, salinity, and dissolved oxygen; discrete samples were collected to measure phytoplankton biomass, harmful algae, and bacterial contamination.

2. METHODS

2.2.1. Field sampling

For 2021, Haven's Beach was sampled more extensively than in previous years. Beyond the sump, other sites sampled included the pipes that feed the sump from Bay Street, the sump's outlet, the sampling pool of sump water on the beach (when present), the sump pool, and the east and west beach adjacent to the sump (Fig. 1.1). Haven's Beach was sampled May through October for fecal coliform bacteria and Enterococcus, as well as general water quality parameters (temperature, salinity, dissolved oxygen (DO)) and, within the sump, blue-green algae. Marine sampling sites included the Sag Harbor Yacht Club (hereafter, SH Yacht Club), a site in the upper cove (Ship Ashore), Windmill Beach, and pumping station outfall pipe near Beacon Restaurant (hereafter, Beacon) (Fig. 1.1). Marine sites were sampled May through October for general water quality (temperature, dissolved oxygen, salinity, and water clarity), chlorophyll *a*, harmful algal bloom species, and fecal coliform bacteria and Enterococcus. Freshwater sampling sites included Lily Pond, Little Long Pond, and Long Pond (Fig. 1.1). Freshwater sites were sampled for general water quality parameters (temperature, dissolved oxygen, and salinity), blue-green algae, and levels of the blue-green algal toxin, microcystin, if blue-green algae concentrations were above the threshold for blooms. Lastly, the effluent of the sewage treatment plant, immediately following UVL prior to discharge to Sag Harbor Cove (Fig. 1.1) was sampled for fecal coliform bacteria and Enterococcus.

Physical parameters of temperature, salinity, and dissolved oxygen were measured using a YSI handheld meter at surface (and depth where applicable). Continuous measurements of temperature and dissolved oxygen were made at the SH Yacht Club by use of a HOBO temperature/dissolved oxygen logger, which was deployed during summer 2021. Water clarity was measured by use of a secchi disk. Water samples were collected by use of 1-L bottles, which were washed with 10% HCl, liberally rinsed with deionized water prior to use. Once the water was collected on-site, the sampling bottle was transferred and kept in a dark, cool container (~5°C) until laboratory analyses could be performed within <6 h of collection.

2.2.2. Quantification of chlorophyll *a*

Upon the return of water samples to the laboratory at Stony Brook Southampton, 200 mL of water from each site, in triplicate, were passed through a glass fiber filter (size GFF = pore size = 0.7 µm) within a filter tower. A vacuum pump was used to drain the water through the filter tower, which was thoroughly rinsed with 0.2 μm filtered seawater. Upon complete filtration, filters were removed, placed in scintillation vials, and frozen at -20°C until analyses could take place. For analysis, 4 mL of 90% acetone was added to each scintillation vial and placed back in the freezer for 24 h. After 24 h, 1.5 mL of sample was extracted and placed in a 1.8 mL glass scintillation vial, which were placed into a Trilogy fluorometer for final analysis. Procedures for quantifying chlorophyll *a* are based on Parsons and Strickland (1963), USEPA (1997), and Parsons (2013).

2.2.3. Quantification of harmful algal bloom species

Upon receiving water samples collected from field sites, a whole water and a concentrated (1 L) sample was preserved in acidic Lugol's iodine solution at a final concentration of 2% (v/v). To decrease the limit of detection of *Alexandrium* and *Dinophysis* in water samples, concentration water samples were made by sieving 1 L of water through a 200 μm mesh (to eliminate large zooplankton) and then onto a 20 μm sieve and backwashed into a 15 mL centrifuge tube (Hattenrath-Lehmann et al., 2013). *Cochlodinium* counts were derived from the whole water sample. All harmful algal bloom species cell densities were enumerated using a 1 mL Sedgewick-Rafter slide under a compound microscope.

2.2.4. Indicator bacteria species

On each date, surface water (0.25 m depth) samples were collected in sterile 2 L bottles and transported on ice to the laboratory for further processing within two hours of collection. Triplicate whole water samples were collected for DNA analysis in which samples were well-mixed to ensure even distribution of biomass prior to filtering 25-100 mL onto a 0.2 μm Millipore polycarbonate filter, depending on water turbidity. Samples were immediately frozen in liquid nitrogen and stored at -80°C until further processing. In parallel, sites were additionally sampled for fecal coliform bacteria and Enterococcus bacteria from May through October, quantified using the IDEXX Enterolert & Quanti-Tray/2000 sampling kits, giving MPN per 100mL. The methods for the quantification of indicator bacteria are based on standard protocols (USEPA, 1978; Eaton et al., 1998; Lipps et al., 2018).

2.2.5. Water quality standards

For water quality parameters, there are various standards for marine waterbodies in New York. According to the New York State Department of Environmental Conservation (NYSDEC), levels of fecal coliform bacteria should not exceed 49 colony forming units (CFU) per 100 mL and should be, on average, below 14 CFU per 100 mL for shellfishing. According to the NYSDOH, levels of Enterococcus should not exceed 104 CFU per 100 mL for recreational swimming. According to the NYSDEC, dissolved oxygen concentrations are considered not conducive for aquatic life below 4.8 mg L^{-1} and should never fall below 3.0 mg L^{-1}. The NYSDEC and the National Oceanic and Atmospheric Administration (NOAA) state that secchi disk depth, a proxy for water clarity, should be above 2.0 m. According to NOAA, the maximum concentration for chlorophyll *a* should be 20 μg L^{-1}. For harmful algal blooms, such as *Cochlodinium*, standards for what is considered a bloom varies by species. For *Cochlodinium*, the alga does not pose a threat to human health but has been shown to cause mortality in finfish and shellfish at densities at or exceeding 300 cells mL^{-1}, which is what would be considered a bloom for the alga (Tang & Gobler, 2009).

3. RESULTS

3.1. Haven's Beach

3.1.1. Discrete monitoring

During 2021, temperatures varied across Haven's Beach (Fig. 2A). From the middle of May until the beginning of June, temperatures declined from ~21°C to 19 – 20°C across most sites, with the exception of the feeding pipe (~15°C). Temperature increased to~25°C by the end of June, with the exception of the feeding pipe and the beach pool, which had temperatures of ~20 and ~27°C, respectively. By the middle of July, temperatures at the sump pool, sump east, and sump west sites were ~24°C while temperatures at the beach pool were ~27°C and were 17 - 20°C at the sump ditch, sump pipe, and feeding pipe. Throughout August, temperatures generally ranged 20 – 25°C across all sites except at the sump east and sump west sites, which had temperatures of ~29°C. By the middle of September, temperatures began to decline at all sites, ranging 15 – 23°C (Fig. 2A). During summer, average surface temperatures were 23.5 ± 2.0°C, with the lowest average temperatures (~20°C) occurring at the feeding pipe and sump pipe and the highest average temperatures (~25°C) occurring at the sump east and beach pool sites (Fig. 2B). Average bottom temperatures were 24.1 ± 2.0°C, with the lowest average temperatures (~21°C) occurring at the feeding pipe and sump pipe sites and the highest average temperature (~28°C) occurring at the beach pool site (Fig. 2B).

At Haven's Beach, salinity at the sump ditch, sump pipe, beach pool, feeding pipe, and sump pool sites remained <2 PSU for the entirety of 2021, while salinity at the sump west, sump east, and sump outlet sites ranged 25 – 30 PSU throughout 2021 (Fig. 3A). During summer, average surface and bottom salinities at the sump ditch, sump pipe, beach pool, feeding pipe, and sump pool sites were 0.3 ± 0.2 PSU (Fig. 3B). At the higher salinity sites (sump west, sump east, and sump outlet), average surface and bottom salinities during summer 2021 were 29.0 ± 1.6 and 29.7 ± 0.9 PSU, respectively (Fig. 3B).

DO concentrations varied across each site during 2021 (Fig. 4A). At the sump east and sump west sites, DO decreased from ~9 mg L^{-1} to ~1 mg L^{-1} from the middle of May to the beginning of June. During that time, DO concentrations at the sump outlet site decreased from ~10 mg L^{-1} to ~8 mg L^{-1}. At the sump east, west, and outlet sites, DO generally ranged ~6 – 8 mg L^{-1} from the middle of June until the beginning of October (Fig. 4A). The beginning of June marked the only date that DO concentrations at the sump east and west sites decreased below the NYSDEC minimum for DO (4.8 mg L^{-1}) (Fig. 4A). At the beach pool site, DO concentrations were ~6 mg L^{-1} during June and the first half of July but decreased to ~2 mg L^{-1} by the beginning of October, with all measured DO levels from the end of July on being below the NYSDEC DO minimum (Fig. 4A). At the sump ditch, sump pipe, sump pool, and feeding pipe sites, DO concentrations ranged 0 – 5 mg L^{-1} and were almost entirely below the NYSDEC DO minimum (Fig. 4A). During summer, average surface and bottom DO concentrations were 4.2 ± 1.1 and 4.4 ± 0.6 mg L^{-1}, respectively, which are below the NYSDEC DO minimum. However, average surface and bottom DO concentrations were above the DO minimum at the sump east, sump outlet, and sump west sites (Fig. 4B).

Blue-green algae concentrations at the sump ditch site were <5 µg L^{-1} for the entirety of 2021, which was well-below the NYSDEC bloom threshold for blue-green algae (25 µg L^{-1}) (Fig. 5A). Chlorophyll *a* concentrations increased from ~5 µg L^{-1} in the middle of June to ~25 µg L^{-1} at the end of the month, decreased to ~3 µg L^{-1} at the end of July, increased to ~11 µg L^{-1} by the middle of August, and ranged ~3 – 5 µg L^{-1} throughout September. Chlorophyll *a* concentrations at the site only increased above the USEPA chlorophyll *a* maximum for marine sites (20 µg L^{-1}) during the end of June (Fig. 5A). During the summer, blue-green algae, and total chlorophyll *a* concentrations were, on average, 0.7 ± 0.6 and 5.6 ± 3.2 µg L^{-1}, respectively, with maximum concentrations of 1.7 and 10.9 µg L^{-1}, respectively. Average and maximum blue-green algae and total chlorophyll *a* concentrations were below the NYSDEC blue-green algae bloom threshold and USEPA chlorophyll *a* maximum, respectively (Fig. 5B).

3.1.2. Indicator bacteria

Fecal coliform bacteria levels were >401 CFU per 100 mL at the feeding pipe site for almost every sampling date, with the exception of 28-July-2021 (~130 CFU per 100 mL), which were all above the NYSDEC fecal coliform standard for shellfish (14 CFU per 100 mL) (Fig. 6A). At the sump east site, fecal coliform levels were >401 CFU per 100 mL on 4-June-2021, 11-August-2021, 10-September-2021, and 7-October-2021, which were above the NYSDEC standard for shellfish. On all other dates, fecal coliform levels ranged from <2 to ~120 CFU per 100 mL (Fig. 6A). At the beach pool site, fecal coliform levels were >401 CFU per 100 mL on 19-May-2021, which was above the NYSDEC standard for shellfish. On all other sampling dates, levels ranged <2 – 86 CFU per 100 mL, with concentrations above the NYSDEC standard for shellfish at the end of September and beginning of October (Fig. 6A). At the sump outlet, fecal coliform levels were 330 CFU per 100 mL on 17-June-2021 and >401 CFU per 100 mL on 28-July-2021, 11-August-2021, 10-September-2021, and 7-October-2021, and levels at 17 CFU per 100 mL on 22-September-2021, all of which were above the NYSDEC standard for shellfish (Fig. 6A). At the sump pipe site, fecal coliform levels were >401 CFU per 100 mL on 27-August-2021, which is above the NYSDEC standard for shellfish. Levels ranged 4 – 70 CFU per 100 mL for all other sampling dates, with the higher values (30 – 69 CFU per 100 mL) at the end of July through September exceeding the NYSDEC standard for shellfish (Fig. 6A). At the sump pool site, fecal coliform levels ranged 49 to >401 CFU per 100 mL throughout 2021, all of which were above the NYSDEC standard for shellfish (Fig. 6A). At the sump ditch site, fecal coliform levels were 112 CFU per 100 mL, which is above the NYSDEC standard for shellfish, and was undetectable on all other sampling dates (Fig. 6A). At the sump west site, levels only exceeded the NYSDEC standard for shellfish on 4-June-2021 (>401 CFU per 100 mL), 28-July-2021 (36 CFU per 100 mL), and 27-August-2021 (106 CFU per 100 mL) and ranged <2 – 11 CFU per 100 mL on all other sampling dates (Fig. 6A).

Enterococci levels at the feeding pipe ranged from 260 to >401 CFU per 100 mL on all sampling dates, except on 10-September-2021 (<2 CFU per 100 mL), which were well-above the

NYSDEC enterococci standard for swimming (104 CFU per 100 mL) (Fig. 6B). At the sump east site, enterococci levels were >401 CFU per 100 mL on 16-June-2021 and ranged 0 – 33 CFU per 100 mL on all other sampling dates, which were below the NYSDEC standard for swimming (Fig. 6B). At the beach pool site, enterococci levels were 139, >401, and 166 CFU per 100 mL on 4-June-2021, 30-June-2021, and 28-July-2021, which were above the NYSDEC standard for swimming. On 27-August-2021, levels were 65 CFU per 100 mL. On all other dates, levels were <15 CFU per 100 mL (Fig. 6B). At the sump outlet site, enterococci levels were >401 CFU per 100 mL on 16-June-2021, 28-July-2021, 11-August-2021, and 10-September-2021, and were 148 CFU per 100 mL on 7-October-2021, which are above the NYSDEC standard for swimming. Levels on 22-September-2021 were 73 CFU per 100 mL (Fig. 6B). At the sump pipe site, levels were >401 and 156 CFU per 100 mL on 30-June-2021 and 28-July-2021, respectively, which are above the NYSDEC standard for swimming. Levels ranged 38 – 81 CFU per 100 mL on 4-June-2021, 15-July-2021, 27-August-2021, and 10-September-2021. On all other sampling dates, levels were <13 CFU per 100 mL (Fig. 6B). At the sump pool site, enterococci levels were 166 to >401 CFU on all dates in June and July and 10-September-2021, which were above the NYSDEC standard for swimming. During August, the second half of September, and the beginning of October, levels were 77 – 91 CFU per 100 mL (Fig. 6B). At the sump ditch site, enterococci levels were 177 CFU per 100 mL, which is above the NYSDEC standard for swimming and was undetectable on all other sampling dates (Fig. 6B). Lastly, at the sump west site, enterococci levels were 140 to >401 CFU per 100 mL on 4-June-2021, 30-June-2021, and 28-July-2021, which are above the NYSDEC standard for swimming. On 27-August-2021, levels were 61 CFU per 100 mL. On all other dates, enterococci levels ranged 4 – 27 CFU per 100 mL (Fig. 6B).

3.2. Marine sites

3.2.1. Discrete monitoring

At the marine sites during 2021, temperature was relatively consistent across the Beacon, Ship Ashore, SH Yacht Club, and Windmill Beach sites (Fig. 7). Temperature decreased from ~20°C in the middle of May to ~15 – 18°C in the beginning of June, increased to ~25°C at the end of June, and decreased to ~23°C by the middle of July. From that point until the end of August temperature increased to ~28 – 30°C and decreased to ~20°C by the beginning of October (Fig. 7A). Average surface and bottom temperatures across the marine sites were 25.2 ± 2.3 and 25.0 ± 2.3°C, respectively (Fig. 7B). Continuous measurements of temperature at the SH Yacht Club site showed that during the last week of June and first half of July, temperature generally ranged 22.5 – 24.9°C and increased to 26.9°C by 18-July-2021. By the beginning of August, temperature decreased to 24.6°C and remained at that temperature during the first week of the month. By the middle of the month, temperature increased to 27.1°C (Fig. 8).

Salinity was relatively consistent at the Ship Ashore, SH Yacht Club, and Windmill Beach sites. From the middle of May until the middle of June, salinity decreased from 29 – 30 PSU to ~28 – 29 PSU, increased to 29 – 31 PSU during August, and ranged 28 – 30 PSU throughout September (Fig. 9A). Salinity at the Beacon site was more variable compared to the other sites. Salinity ranged ~26 – 29 PSU throughout June and the beginning of July, increased to ~30 PSU by the end of August, and was ~29 PSU throughout September and the beginning of October (Fig.

9A). Average surface and bottom salinities across the marine sites were 29.3 ± 0.9 and 29.4 ± 1.0 PSU, respectively (Fig. 9B).

Dissolved oxygen at the Beacon site in Sag Harbor ranged 6.7 – 7.1 mg L^{-1} from the beginning of June until the middle of September and increased to 8.4 mg L^{-1} by the beginning of October (Fig. 10A). At the Ship Ashore site, DO generally ranged ~6 – 8 mg L^{-1} for the entirety of 2021 (Fig. 10A). DO concentrations at the SH Yacht Club was 7.4 – 8.0 mg L^{-1} during the second half of May and ranged 6.2 – 7.3 mg L^{-1} from the middle of June until the beginning of October (Fig. 10A). At the Windmill Beach site, DO concentrations increased from ~8 mg L^{-1} to ~10 mg L^{-1} by the end of June and ranged 6.2 – 6.9 mg L^{-1} from the end of July until the beginning of October (Fig. 10A). At no point during 2021 did DO concentrations at the marine sites decreased below the NYSDEC DO minimum (4.8 mg L^{-1}) (Fig. 10A). Average surface and bottom DO concentrations across the marine sites were 6.8 ± 0.6 and 6.8 ± 0.7 mg L^{-1}, respectively, which were above the NYSDEC DO minimum (Fig. 10B). Continuous measurements of temperature at the SH Yacht Club site showed that throughout the end of June and first half of July, DO concentrations ranged 6.5 – 8.0 mg L^{-1} and decreased to 6.2 mg L^{-1} by 19-July-2021 (Fig. 11). From that point until the beginning of August, DO concentrations ranged 6.2 – 7.0 mg L^{-1}. By 13-August-2021, DO increased to 7.3 mg L^{-1} and decreased to 5.6 mg L^{-1} by the middle of the month. At no point during summer 2021 did DO concentrations at the SH Yacht Club decrease below the NYSDEC DO minimum (Fig. 11).

Secchi disk depths at the Beacon site increased from 0.2 m in the middle of July to 0.6 m at the end of the month, decreased to 0.3 m by the end of September, and increased to 0.9 m at the beginning of October (Fig. 12). At the Ship Ashore site, secchi depths were 1.0 – 1.5 m from the middle of May until the middle of August and ranged 1.7 – 1.9 m throughout the rest of August, September, and beginning of October (Fig. 12). At the SH Yacht Club, secchi depths decreased from 2.6 m in the middle of May, decreased to 0.6 m at the end of June, and increased to 2.0 – 2.5 during September and the beginning of October (Fig. 12). At the Windmill Beach site, secchi depths were 0.2 – 0.5 m from the middle of June until the end of September (Fig. 12). With the exception of the middle of May and end of September at the SH Yacht Club, secchi depths at all sites were below the NOAA minimum for secchi disk depths (2.0 m) (Fig. 12).

Chlorophyll *a* concentrations at the Ship Ashore site increased from ~2 µg L^{-1} in the middle of May to ~11 µg L^{-1} at the end of June, ranged ~6 – 9 µg L^{-1} throughout August and beginning of September, and decreased to ~3 µg L^{-1} by the beginning of October (Fig. 13A). At the SH Yacht Club, concentrations increased from ~2 µg L^{-1} in the middle of May to ~13 µg L^{-1} in the middle of August, decreased to ~9 µg L^{-1} by the middle of September, peaked at ~19 µg L^{-1} towards the end of the month, and decreased to ~3 µg L^{-1} by the beginning of October (Fig. 13A). Chlorophyll *a* concentrations at the Windmill Beach site increased from ~4 µg L^{-1} in the middle of May to ~10 µg L^{-1} at the end of June, ranged ~5 – 8 µg L^{-1} throughout July and August, increased to ~13 µg L^{-1} by the middle of September, and decreased to ~2 µg L^{-1} by the beginning of October (Fig. 13A). At no point during 2021 did chlorophyll *a* at the marine sites exceed the USEPA chlorophyll *a* maximum (20 µg L^{-1}) (Fig. 13A). The overall summer average for chlorophyll *a* at Ship Ashore, SH Yacht Club, and Windmill Beach was 8.4 ± 2.1, 10.7 ± 4.2, and 7.7 ± 3.4 µg L^{-1}, respectively, while the summer maximum at the sites was 11.3, 18.9 and 13.4 µg L^{-1}, respectively (Fig. 13B).

The overall summer average and maximum at each site was below the USEPA chlorophyll *a* maximum (Fig. 13B).

3.2.2. Harmful algal bloom species

Alexandrium densities on 19-May-2021 were ~300 cells L^{-1} at the Ship Ashore and SH Yacht Club sites and 70 cells L^{-1} at Windmill Beach. At Windmill Beach, this was the only appearance of the alga at the site during 2021 (Fig. 14). On 4-June-2021, densities of the alga were 49 and 21 cells L^{-1} at Ship Ashore and SH Yacht Club, respectively, were 0 and 28 cells L^{-1}, respectively, on 16-June-2021, and were 56 and 0 cells L^{-1}, respectively, on 30-June-2021 (Fig. 14). The ~300 cells L^{-1} densities reported at Ship Ashore and SH Yacht Club on 19-May-2021 were above the density at which *Alexandrium* blooms and produce saxitoxin (100 cells L^{-1}) (Fig. 14).

Dinophysis was not detected at the marine sites in Sag Harbor until 4-June-2021, where densities were 883, 63, and 63 cells L^{-1} at Ship Ashore, SH Yacht Club, and Windmill Beach, respectively (Fig. 15). Following this appearance, on 16-June-2021, the alga increased in density at Ship Ashore, SH Yacht Club, and Windmill Beach to 14,084, 567, and 357 cells L^{-1}, respectively (Fig. 15). Densities decreased to 77, 28, and 0 cells L^{-1} at Ship Ashore, SH Yacht Club, and Windmill Beach, respectively, on 30-June-2021 (Fig. 15).

Cochlodinium densities at Ship Ashore were 18 – 37 cells mL^{-1} during August and 37 cells mL^{-1} on 22-September-2021 (Fig. 16). At the SH Yacht Club, the alga appeared at higher densities (115 cells mL^{-1}) on 11-August-2021, were ~20 cells mL^{-1} during the end of August and beginning of September, increased to 242 cells mL^{-1} on 22-September, and decreased to 19 cells mL^{-1} in the beginning of October (Fig. 16). At Windmill Beach, the alga was 9 cells mL^{-1} at the end of July, increased to 144 cells mL^{-1} on 11-August-2021, and decreased to 10 cells mL^{-1} on 27-August-2021. The alga was absent from the site on 10-September-2021 but reappeared at 1,652 cells mL^{-1} on 22-September-2021 but decreased to 11 cells mL^{-1} at the beginning of October (Fig. 16). With the exception of the peak densities at Windmill Beach at the end of September, densities were below the density at which *Cochlodinium* begins to be harmful to marine life (300 cells mL^{-1}) (Fig. 16).

3.2.3. Indicator bacteria

At the Beacon site, fecal coliform levels were 330 to >401 CFU per 100 mL from the middle of May until the middle of July, decreased to 177 CFU per 100 mL on 11-August-2021, increased to >401 CFU per 100 mL on 10-September-2021, and were <30 CFU per 100 mL at the end of September and beginning of October. All measured fecal coliform levels at the site were above the NYSDEC fecal coliform standard for shellfish (14 CFU per 100 mL) (Fig. 17A). At the Ship Ashore site, fecal coliform levels were at or below 15 CFU per 100 mL for the entirety of 2021, with the 15 CFU per 100 mL value (10-September-2021) exceeding the NYSDEC fecal coliform standard for shellfish (Fig. 17A). At the SH Yacht Club, fecal coliform levels ranged 11 – 13 CFU per 100 mL from the middle of May until the beginning of June, ranged 41 – 58 CFU per 100 mL from the middle of June to the beginning of September, was 125 CFU per 100 mL on 22-September-2021, and was <2 CFU per 100 mL in the beginning of October. All measured levels at or above 41 CFU per 100 mL at the site exceeded the NYSDEC standard for shellfish (Fig. 17A). At the Windmill Beach site, fecal coliform levels were >401 CFU per 100 mL on 4-June-2021, 36 CFU per 100 mL on 28-July-2021, and 106 CFU per 100 mL on 27-August-2021, which were above the NYSDEC standard for shellfish but ranged <2 – 11 CFU per 100 mL for the remainder of the 2021 sampling year (Fig. 17A).

Enterococci levels were 106 to >401 CFU per 100 mL at the Beacon site from the middle of May until the middle of July, which were above the NYSDEC enterococci standard for swimming (104 CFU per 100 mL). Levels were 96 CFU per 100 mL in the middle of August, increased to >401 CFU per 100 mL on 10-September-2021 and were <30 CFU per 100 mL throughout the end of September and beginning of October (Fig. 17B). At Ship Ashore, with the exception of 4-June-2021 and 30-June-2021, when levels were 112 and >401 CFU per 100 mL, respectively, enterococci levels were <10 CFU per 100 mL during 2021. The higher levels exceeded the NYSDEC standard for swimming (Fig. 17B). At the SH Yacht Club, with the exception of 4-June-2021 and 30-June-2021, when enterococci levels were 106 and 177 CFU per 100 mL, respectively, levels were <30 CFU per 100 mL during 2021. The higher levels exceeded the NYSDEC standard for swimming (Fig. 17B). At Windmill Beach, enterococci levels were 218, >401, and 140 CFU per 100 mL on 4-June-2021, 30-June-2021, and 28-July-2021, respectively, which exceeded the NYSDEC standard for swimming. On 27-August-2021, levels were 61 CFU per 100 mL. On all other sampling dates, levels were <30 CFU per 100 mL (Fig. 17B).

3.3. Freshwater sites

3.3.1. Discrete monitoring

At the freshwater sites during 2021, temperatures were relatively consistent (Fig. 18A). Temperatures increased from ~20°C in the beginning of June to ~29 – 32°C at the end of the month. Throughout July and August, temperatures ranged 24 – 33°C and decreased to ~22 – 24°C by the beginning of October (Fig. 18A). Average surface temperatures were 28.7 ± 2.0, 29.2 ± 2.7, and 26.8 ± 3.1°C at Lily Pond, Little Long Pond, and Long Pond, respectively, while average bottom temperatures were 28.5 ± 2.3, 30.1 ± 3.0, and 27.8 ± 3.2°C, respectively (Fig. 18B).

DO concentrations at Lily Pond ranged 4.3 – 5.0 mg L^{-1} from the beginning of June through the middle of July, increased to 9.3 mg L^{-1} at the end of the month, decreased to 3.0 mg L^{-1} at the end of August, and increased to 6.4 mg L^{-1} at the beginning of October (Fig. 19A). At the Little Long Pond site, DO concentrations decreased from ~7.0 mg L^{-1} at the beginning of June to 4.2 mg L^{-1} in the middle of August, increased to 5.4 mg L^{-1} at the end of the month, and decreased to 4.5 mg L^{-1} at the beginning of October (Fig. 19A). At Long Pond, DO concentrations ranged 5.7 – 7.5 mg L^{-1} throughout June until the middle of July, ranged 4.5 – 4.8 mg L^{-1} throughout August, increased to 6.5 mg L^{-1} in the beginning of September, and decreased to 5.3 mg L^{-1} by the beginning of October (Fig. 19A). All sites had DO concentrations that were below the NYSDEC DO minimum (4.8 mg L^{-1}) throughout August while Lily Pond had DO concentrations below the minimum all throughout June and the first half of July (Fig. 19A). Average surface DO concentrations were 5.2 ± 2.4, 5.4 ± 0.7, and 5.6 ± 1.2 mg L^{-1} at Lily Pond, Little Long Pond, and Long Pond, respectively, while average bottom temperatures were 4.2 ± 0.8, 5.5 ± 0.9, and 5.7 ± 1.3 mg L^{-1}, respectively (Fig. 19B). With the exception of average bottom concentrations at Lily

Pond, the average surface and bottom DO concentrations at the freshwater sites were above the NYSDEC DO minimum (Fig. 19B).

Chlorophyll *a* concentrations at Lily Pond decreased ranged 8 – 14 µg L^{-1} throughout June and July and ranged 2 – 4 µg L^{-1} throughout August and September (Fig. 20A). At Little Long Pond, concentrations were ~10 µg L^{-1} throughout June and the middle of July and ranged 1 – 5 µg L^{-1} throughout August and September (Fig. 20A). In Long Pond, concentrations increased from ~3 in the middle of June to ~19 µg L^{-1} in the middle of August, decreased to ~2 µg L^{-1} at the end of August, and peaked at ~49 µg L^{-1} in the middle of October (Fig. 20A). Chlorophyll *a* concentrations during June and July in Lily Pond and Little Long Pond and the first half of August and middle of October in Long Island were above the USEPA maximum for chlorophyll *a* in freshwater sites (8 µg L^{-1}) (Fig. 20A). The summer average chlorophyll *a* concentrations in Lily Pond, Little Long Pond, and Long Pond were 6.3 ± 4.6, 5.3 ± 3.7, and 7.8 ± 5.8 µg L^{-1}, respectively, while maximum summer concentrations were 14.4, 11.0, and 19.4 µg L^{-1}, respectively (Fig. 20B). While average summer concentrations did not exceed the USEPA chlorophyll *a* maximum, the summer maximum concentrations at each site exceeded this level (Fig. 20B).

3.3.2. Blue-green algae monitoring

Blue-green algae concentrations were very low (<1 µg L^{-1}) at all sites from the middle of June until the middle of September. However, at Long Pond, concentrations peaked at ~44 µg L^{-1} in the middle of October, which exceeded the NYSDEC blue-green algae bloom threshold (25 µg L^{-1}) (Fig. 21A). During summer, overall average blue-green algae concentrations were 0.4 ± 0.6, 0.2 ± 0.2, and 0.2 ± 0.2 µg L^{-1} at Lily Pond, Little Long Pond, and Long Pond, respectively, while summer maximum concentrations were 1.4, 0.7, and 0.7 µg L^{-1}, respectively (Fig. 21B). The summer average and maximum at each site was below the NYSDEC blue-green algae bloom threshold (Fig. 21B).

3.4. Sewage Treatment Plant

3.4.1. Indicator bacteria

At the sewage treatment plant, fecal coliform levels were <11 CFU per 100 mL throughout June, increased to 203 CFU per 100 mL on 15-July-2021 and again to >401 CFU per 100 mL at the end of July (Fig. 22A). Levels decreased to 13 CFU per 100 mL on 11-August-2021, increased to 330 CFU per 100 mL at the end of August, decreased to 156 CFU per 100 mL on 10-September-2021, and ranged 20 – 30 CFU per 100 mL at the end of September and beginning of October (Fig. 22A). Fecal coliform levels on 15-July-2021, 28-July-2021, 27-August-2021, 10-September-2021, 22-September-2021, and 7-October-2021 exceeded the NYSDEC fecal coliform standard for shellfish (14 CFU per 100 mL) (Fig. 22A).

Enterococci levels were 4 CFU per 100 mL in the middle of May, increased to 91 CFU per 100 mL in the beginning of June, and decreased to 13 CFU per 100 mL in the middle of the month (Fig. 22B). At the end of June, levels increased to >401 CFU per 100 mL, decreased to 91 CFU per 100 mL on 15-July-2021, and increased again to >401 CFU per 100 mL at the end of July. While levels were <2 CFU per 100 mL in the middle of August, levels ranged 118 – 148 CFU per 100 mL from the end of August to the middle of September and ranged <2 – 8 CFU per

100 mL from the end of September to the beginning of October (Fig. 22B). Enterococci levels on 30-June-2021, 28-July-2021, 27-August-2021, and 10-September-2021 exceeded the NYSDEC enterococci standard for swimming (104 CFU per 100 mL) (Fig. 22B).

4. MANAGEMENT OPTIONS

Management of pathogens in surface waters of Sag Harbor Village is warranted. Levels of fecal coliform bacteria exceeded guidance values for shellfishing in and around the sump at Haven's Beach in 2021. Haven's Beach is open to shellfishing and is a bathing beach locale. At the beach location east of the sump, only one *Enterococcus* sample exceeded the NYS Department of Health (NYSDOH) swimming standard (104 CFU per 100 mL) but more than half of the samples exceeded shellfishing standards. However, at the beach location west of the sump, there were three samples that exceeded the swimming standard and three that exceeded the shellfishing standard. Within the harbor, the Beacon site had elevated levels of fecal coliforms and enterococci throughout the sampling season. The Ship Ashore and SH Yacht Club sites had fecal coliform levels that were always below the shellfishing standard but experienced enterococci levels on multiple dates that exceeded the swimming standard. Windmill Beach only exceeded the fecal coliform shellfishing standard on one date but exceeded the swimming standard on three dates. The sewage treatment plant effluent site frequently exceeded fecal coliform and enterococci standard for swimming throughout 2021, although levels were moderate and perhaps only minorly impactful upon discharge and dilution. During 2019 and 2020, microbial source tracking revealed that the sources of fecal bacteria differed by time and location and primarily included dogs and small mammals, humans, and birds. The human signal was strongest within the inner harbor, while dogs, small mammals, and birds were the primary sources for Haven's Beach. Studies by the Gobler Lab a decade ago also identified high levels of fecal bacteria in the Haven's Beach region. Given the location of the sump adjacent to these waters, the creation of an expanded buffer system to intercept and divert run-off from these sites into surface water would reduce the delivery of pathogens.

Fecal contamination within the inner harbor presents a situation that is more straightforward in some respects, but more complex in others. As outlined above, the sewage treatment plant is likely a minor source of bacteria for this region and while boats are likely a source of bacteria, street run-off is also a source. Since this region is closed to shellfishing,a simple mitigation approach within the breakwater might be to ensure there is no swimming there. Given the findings at Windmill Beach, it may be prudent to close this site to swimming or perform enhanced monitoring. This region is closed to shellfishing.

During 2021, at marine locations within Sag Harbor, water quality has improved in some respects. Dissolved oxygen levels were consistently above the NYSDEC dissolved oxygen minimum (4.8 mg L^{-1}) at all sites, while chlorophyll *a* concentrations were below the USEPA chlorophyll *a* maximum for marine systems (20 µg L^{-1}). However, the red tide species *Alexandrium* and *Dinophysis*, and the ichthyotoxic rust tide algae, *Cochlodinium* were prevalent at all sites during 2021. All three species experienced densities that exceeded their respective threshold in which they are considered harmful to marine life. This shows that nitrogen (N) impairment is a continued issue for Sag Harbor. All of these harmful algae have been shown to be promoted by excessive N loading (Gobler et al., 2012). While the water quality at Lily Pond and Little Long Pond were excellent, a blue-green algae bloom at Long Pond indicates this site should be regularly monitored.

Given the connection between excessive N and water quality impairments, reductions in N loading across Sag Harbor are warranted. Nitrogen loading analyses indicated that septic tanks and cesspools were the strongest source of N for the Harbor, representing 90% of the total load. Given this, upgrading these systems and/or connecting homes to the sewage treatment plant would be the effective mitigation approaches.

In 2016, Suffolk County adopted Article 19 of the sanitary code which permitted the use of innovative and alternative septic systems. Such systems must reduce total nitrogen levels in septic effluent to less than 19 mg L^{-1} and, to date, five such commercially available systems have been approved for use. Additional systems are in the piloting stage of approval, making the array of choices even larger in the future. For example, the NYS Center for Clean Water Technology at Stony Brook University is piloting Nitrogen Removing Biofilters as onsite septic systems which have been achieving septic effluent of < 10 mg L^{-1} as well as >90% removal of drugs, pharmaceuticals, personal care products, and other organic contaminants. Presently, Suffolk County, the Town of East Hampton Town and the Town of Southampton all have grants available to homeowners to install any of the Article 19-approved low nitrogen septic systems. The cost of a ‘simple’ installation of the low nitrogen systems is presently ~$25,000 for simple installations but much more for complex site. The sum total of grants available is often in excess of the cost of the full installation of the systems meaning that, in many cases, they can be installed for free. In some cases, however, installation can become more expensive if, for example, major infrastructure or landscaping must be moved or replaced during the installation process.

Beyond the upgrading of septic systems, there are likely opportunities to connect parts of Sag Harbor Village to the existing sewage treatment plant. The plant is currently discharging very low levels of N to surface waters, on average < 5 mg L^{-1}, which is better than any approved onsite septic system. For regions near the sewage treatment plant, it may be cost effective to hook up homes and facilities to the existing plant. This must be fully investigated, however, as for some parts of Long Island such costs can exceed $50,000 per home and the installation of sewage lines can be disruptive to neighborhoods. Still, once connected, the installation would create a maintenance-free solution for homeowners although the connection to the sewage treatment plant will represent an additional utility fee. For onsite systems, Suffolk County requires homeowners to purchase operation and maintenance contracts with certified companies who will inspect systems one-to-two times per year to assure systems are functioning properly.

Recently, Suffolk County completed its Subwatersheds study and declared that Sag Harbor Cove should strive for a 62% to 81% N reduction to achieve water quality improvements, levels that could be achieved by upgrading septic systems. In contrast, the same study declared Sag Harbor was not a high priority for water quality improvement due to an absence of HABs and hypoxia during Suffolk County monitoring during the past decade. These findings are generally consistent with those of this study which also found water quality impairment was more significant in Sag Harbor Cove and Upper Sag Harbor Cove compared to Sag Harbor Bay. Our utilization of more high frequency monitoring compared to Suffolk County allowed for the detection of transient harmful algal blooms and hypoxia in Sag Harbor. Collectively, both studies prioritize N reductions in Sag Harbor Cove over Sag Harbor Bay.

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6. FIGURES AND TABLES

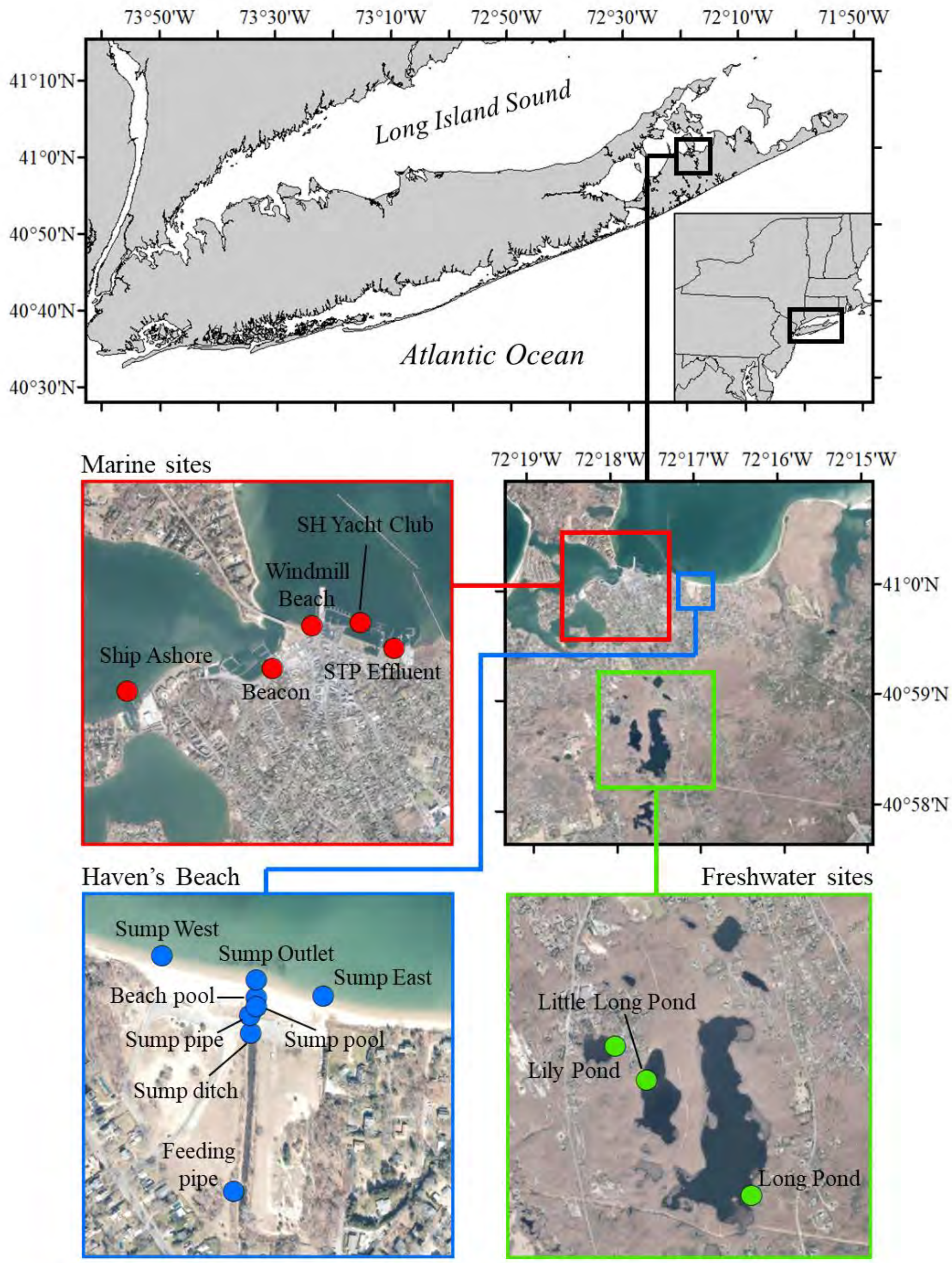


Figure 1. Map of Sag Harbor sample sites during 2021. Marine and sewage treatment plant effluent sampling sites are red, Haven's Beach sampling sites are blue, and freshwater sampling sites are green.

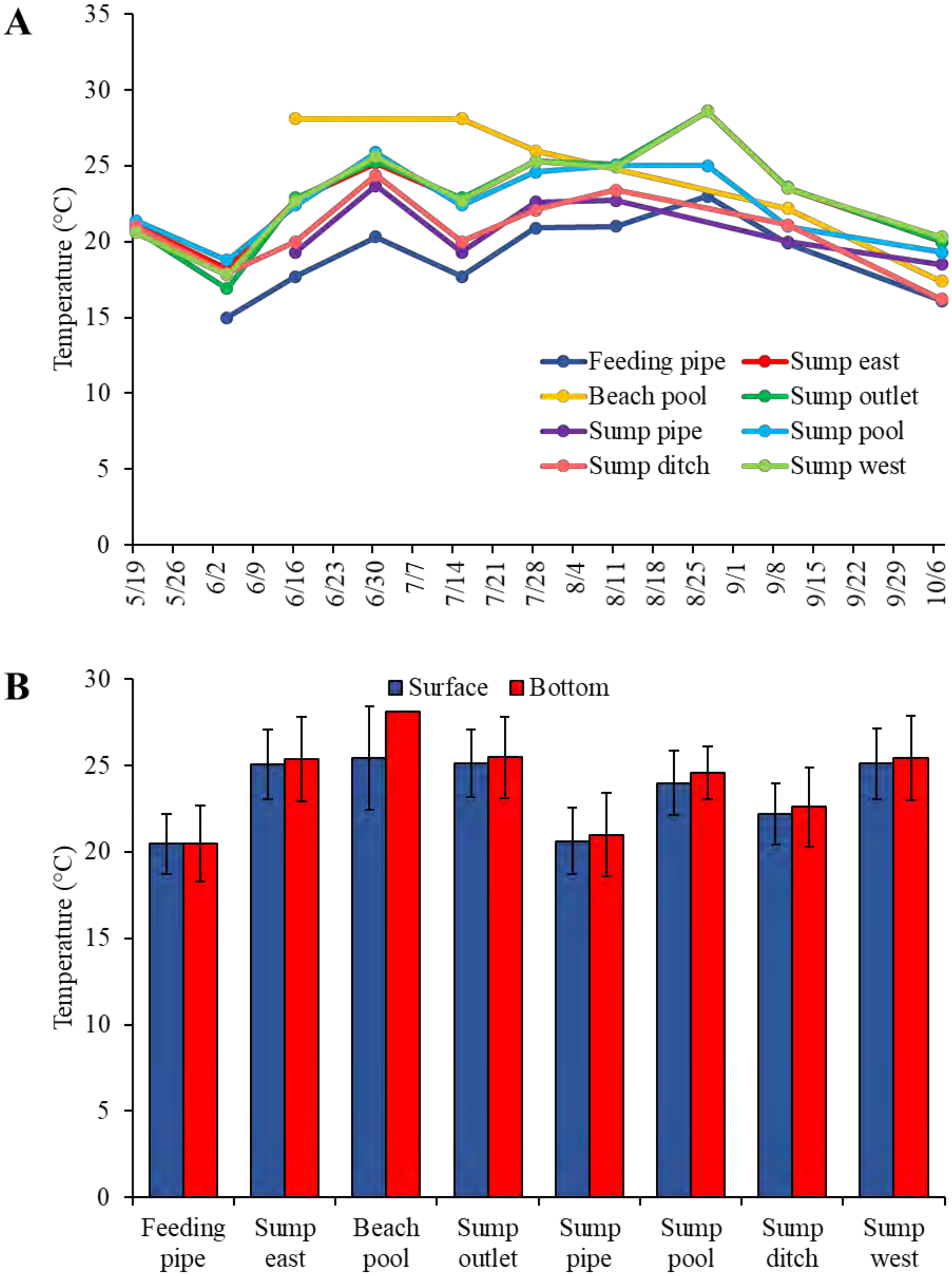


Figure 2. A) Time-series, and B) Average surface and bottom water temperatures (°C) across Haven's Beach during 2021. Columns represent means ± standard deviation.

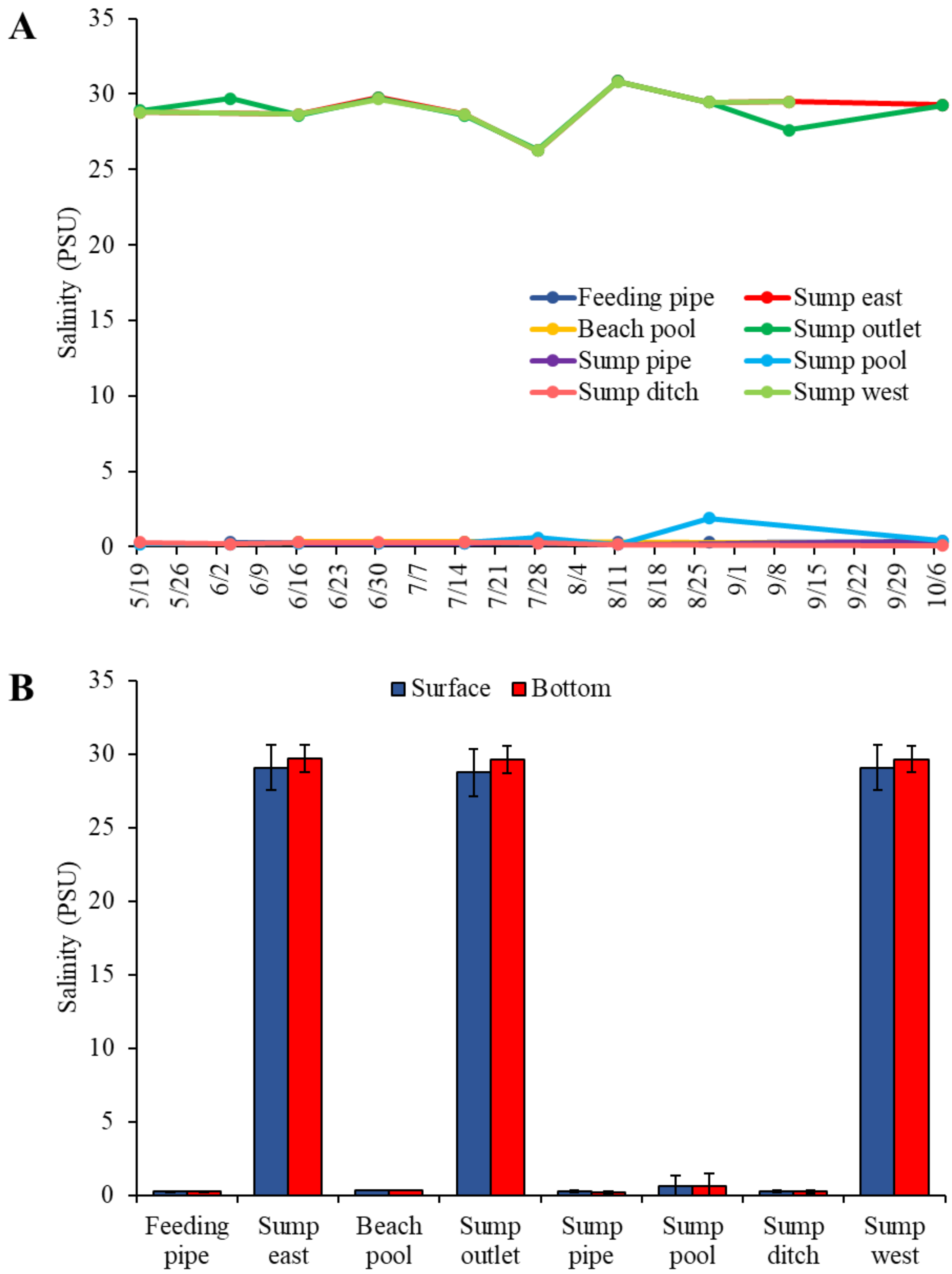
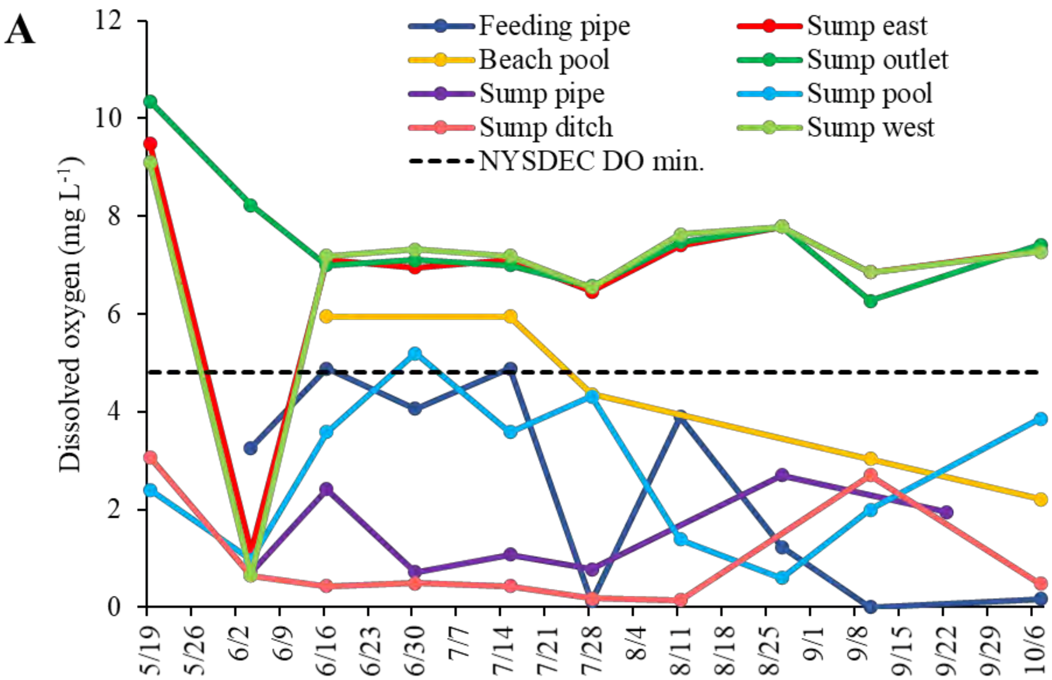


Figure 3. A) Time-series, and B) Average surface and bottom water salinities (PSU) across Haven's Beach during 2021. Columns represent means ± standard deviation.



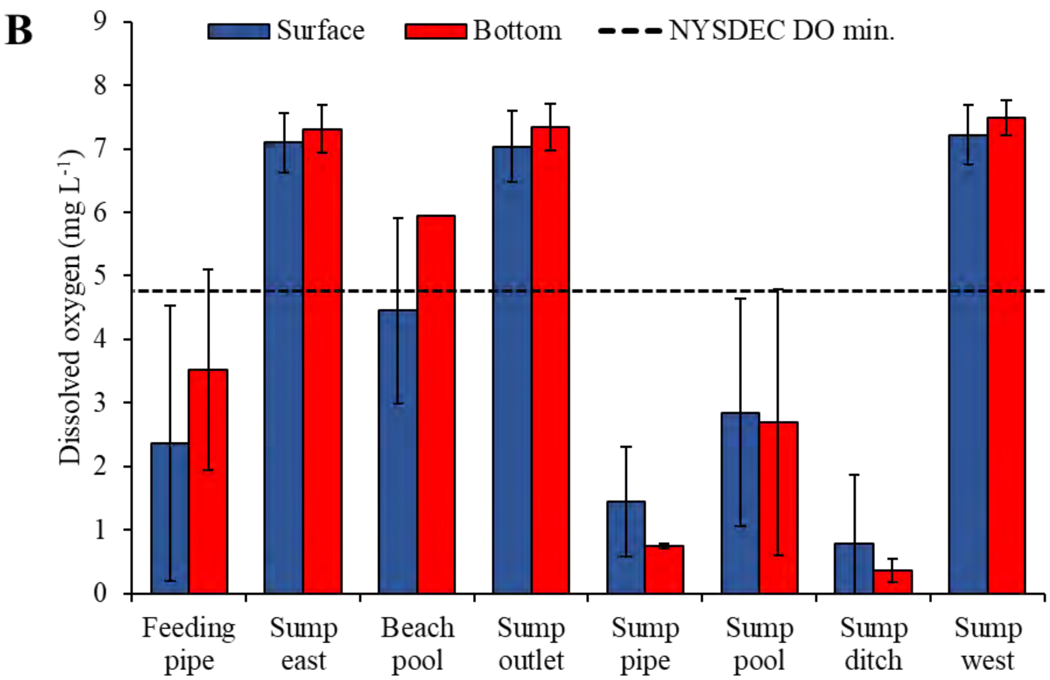


Figure 4. A) Time-series, and B) Average surface and bottom water dissolved oxygen concentrations (mg L-1) across Haven's Beach during 2021. Columns represent means ± standard deviation.

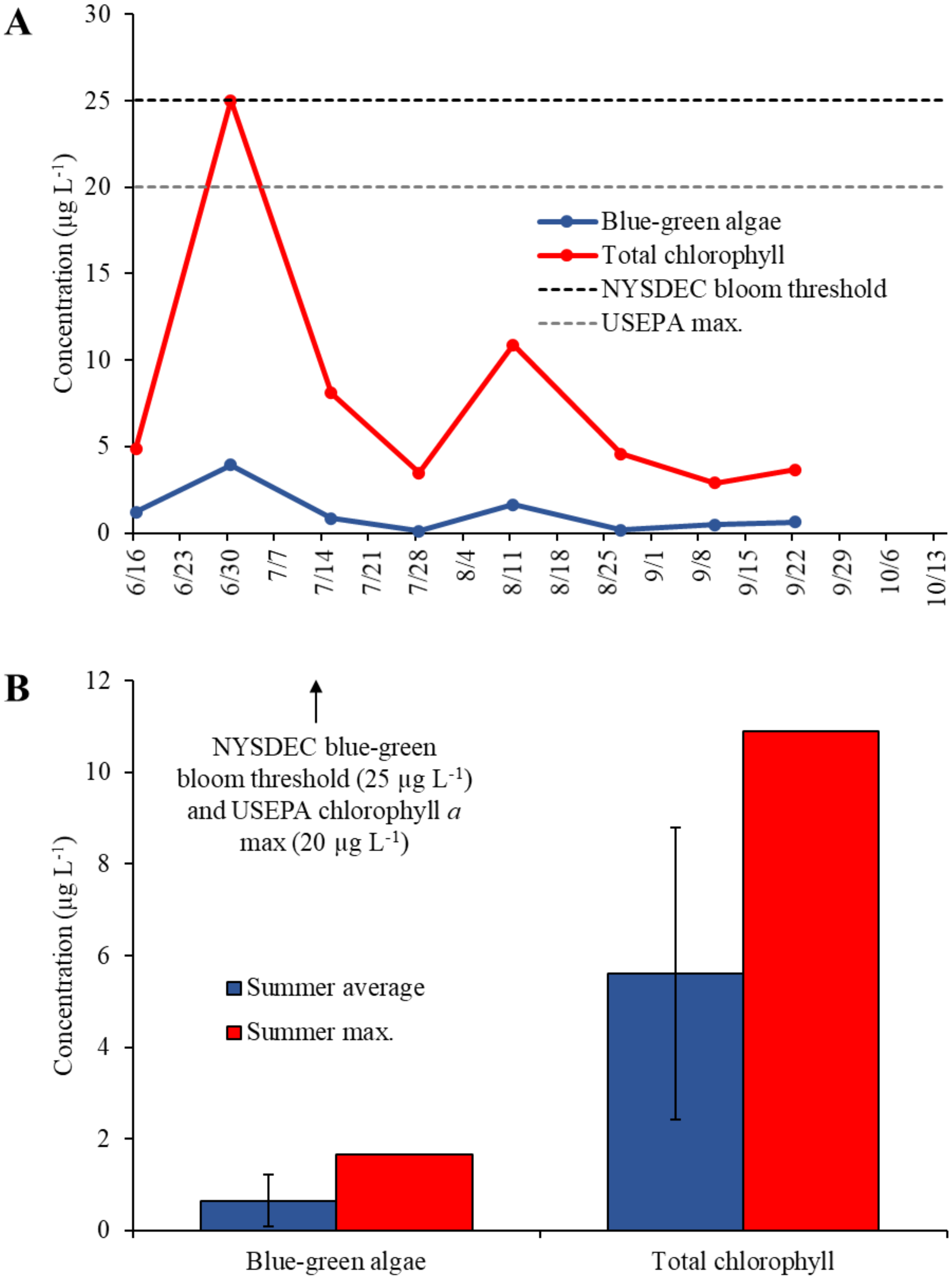


Figure 5. A) Time-series, and B) Summer average and maximum blue-green algae and chlorophyll *a* concentrations (µg L^{-1}) at the sump ditch site in Haven's Beach during 2021. Columns represent means ± standard deviation.

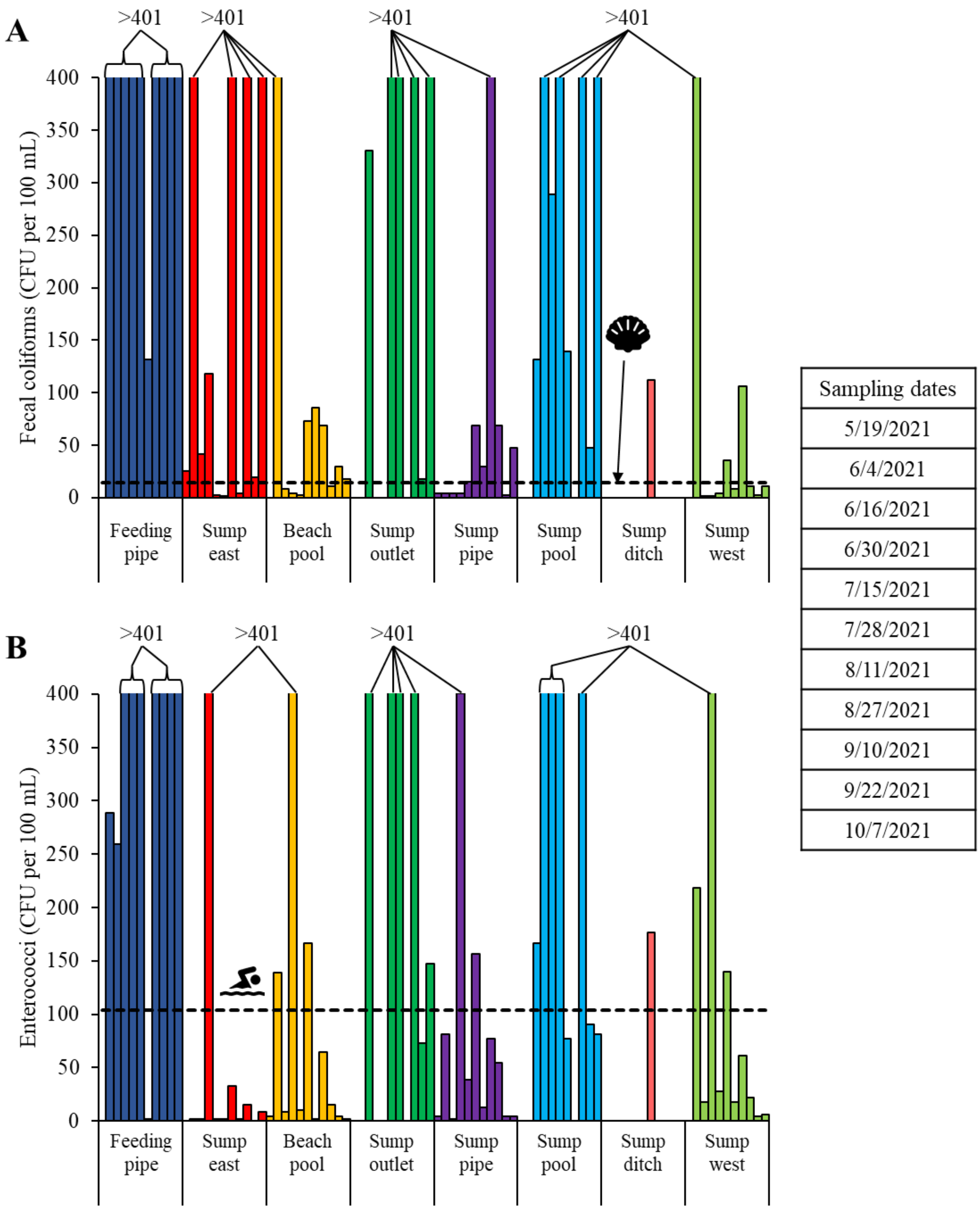


Figure 6. Time-series of A) fecal coliform and B) enterococci concentrations (CFU per 100 mL) across Haven's Beach during 2021.

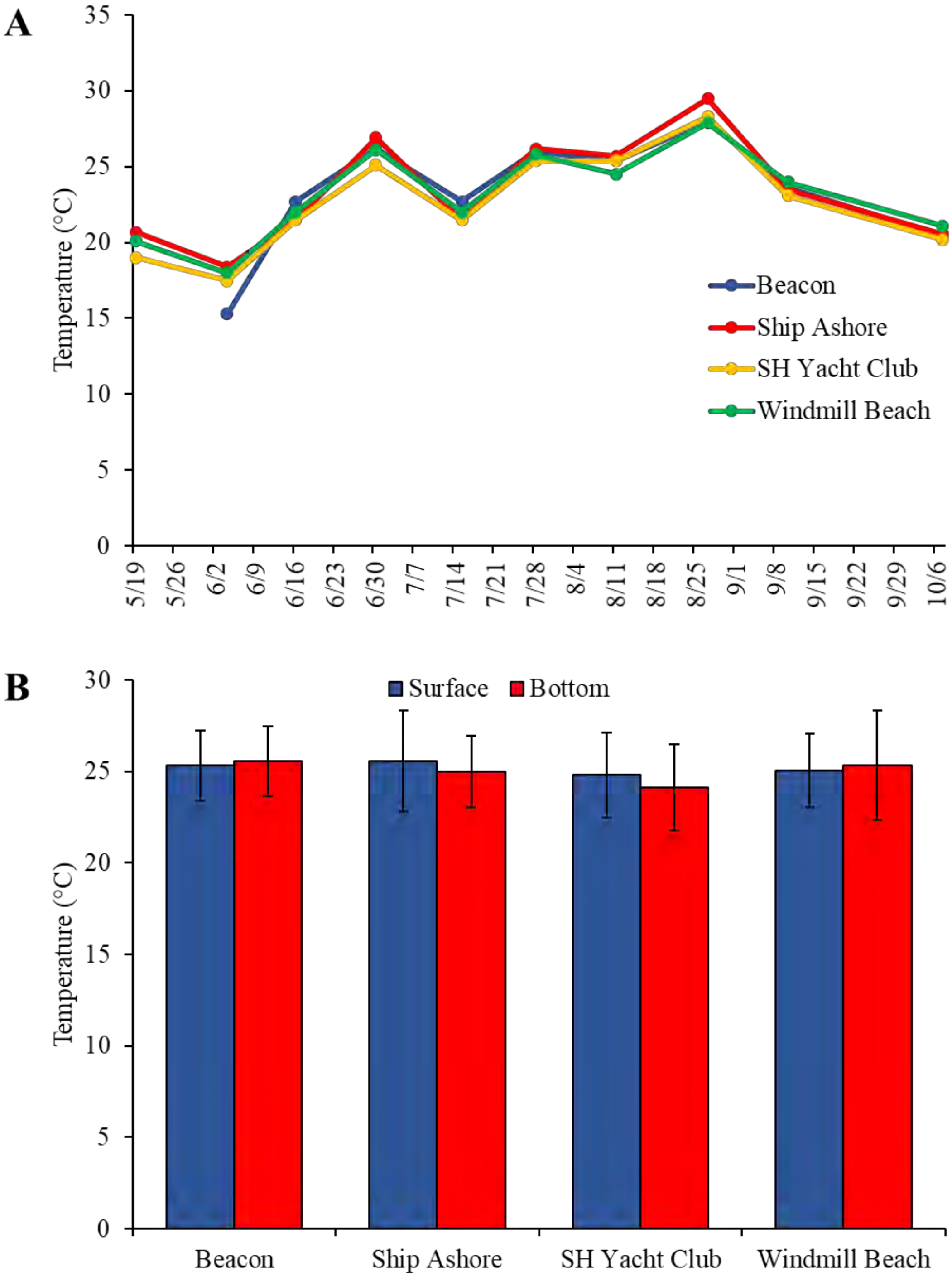


Figure 7. A) Time-series, and B) Average surface and bottom water temperatures (°C) across marine sites in Sag Harbor during 2021. Columns represent means ± standard deviation.

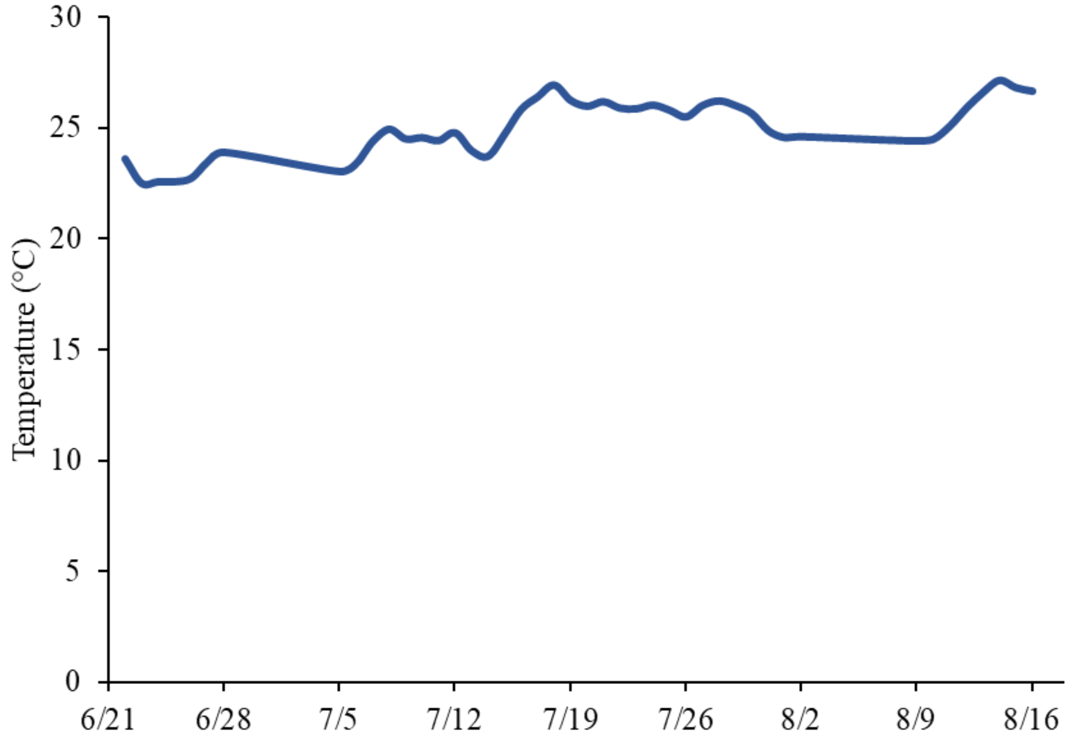


Figure 8. Continuous measurements of temperature (°C) taken from a HOBO temperature/dissolved oxygen logger deployed at the SH Yacht Club during summer 2021.

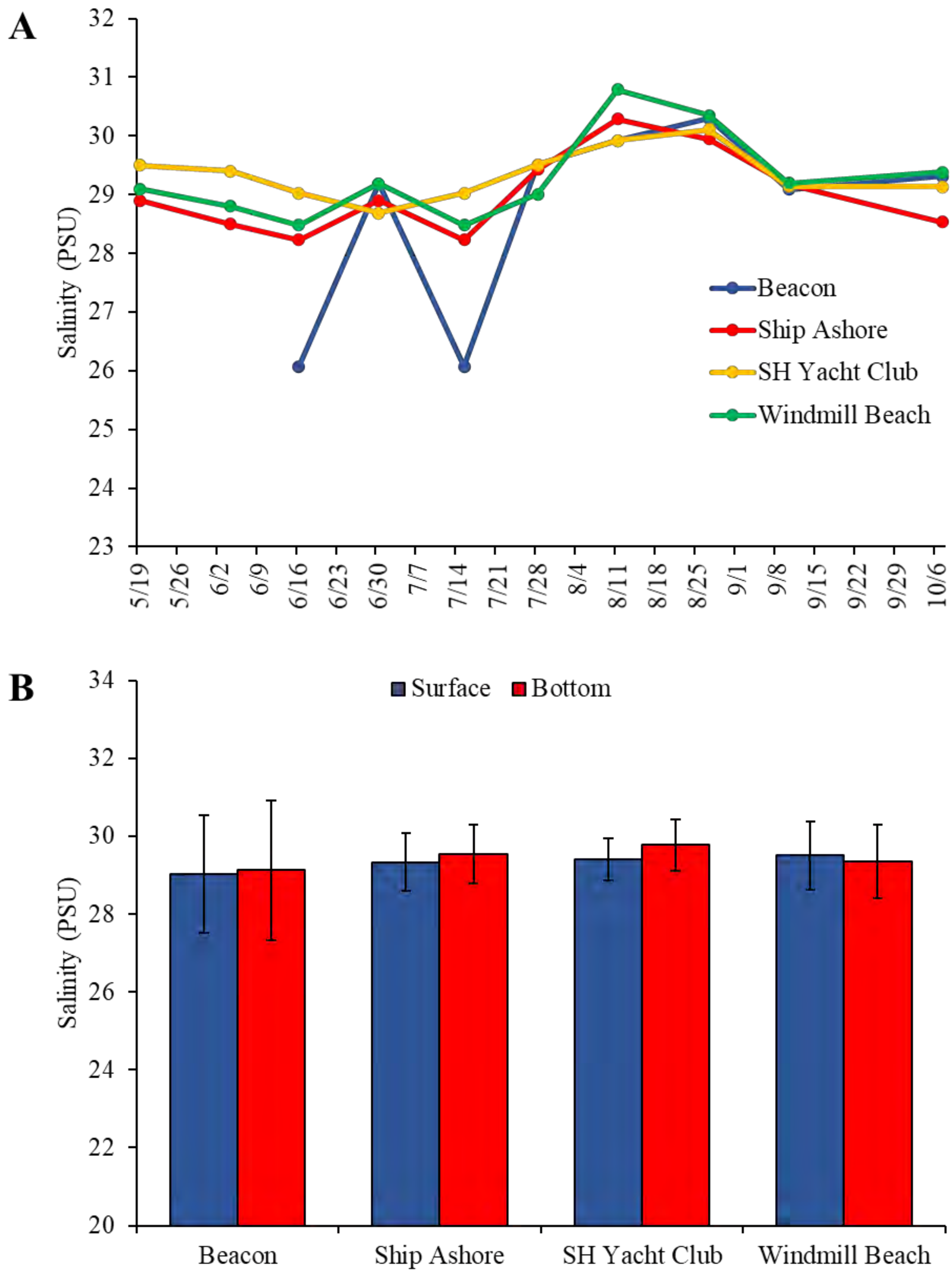


Figure 9. A) Time-series, and B) Average surface and bottom water salinities (PSU) across marine sites in Sag Harbor during 2021. Columns represent means ± standard deviation.

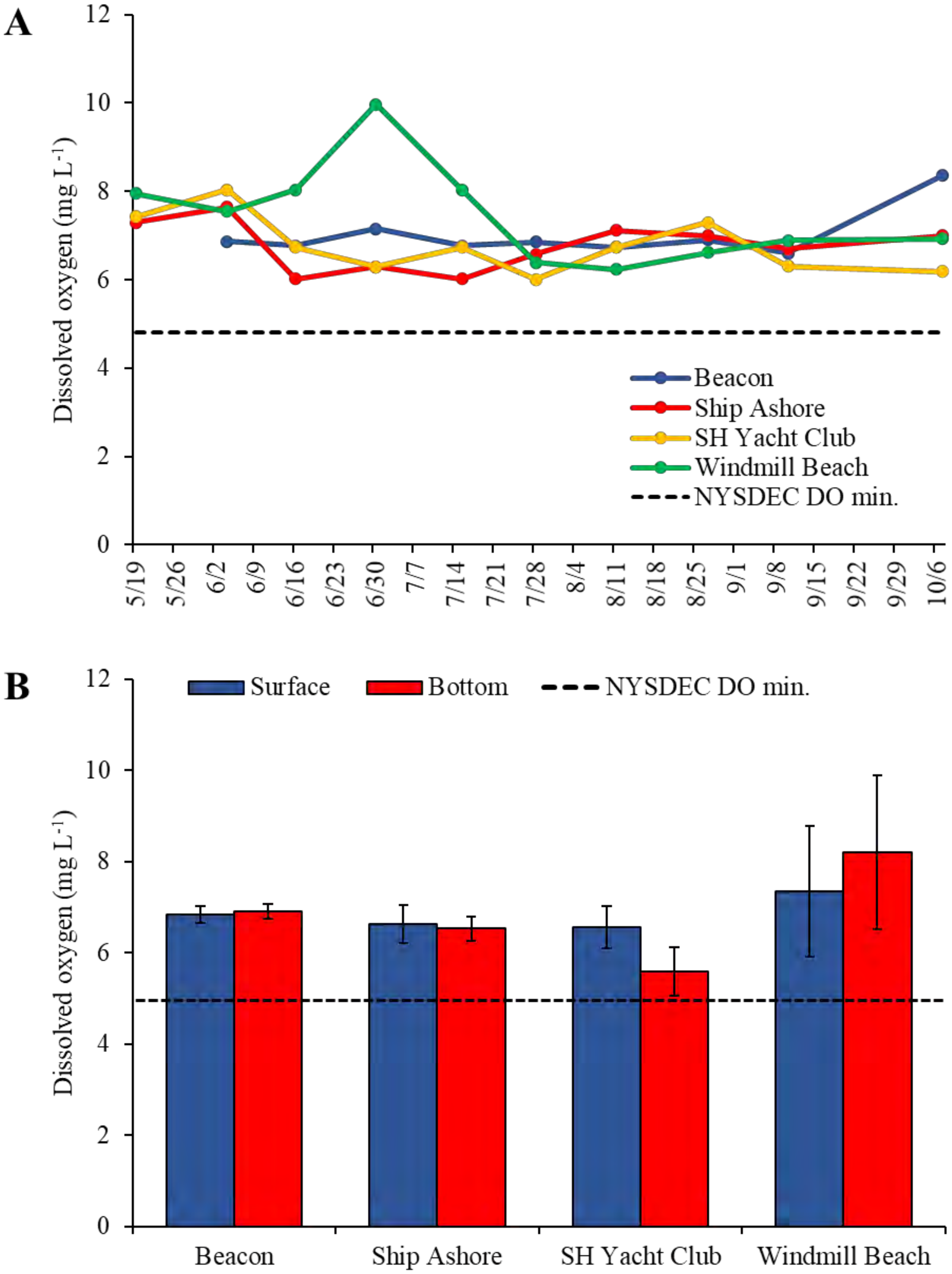


Figure 10. A) Time-series, and B) Average surface and bottom water dissolved oxygen concentrations (mg L-1) across marine sites in Sag Harbor during 2021. Columns represent means ± standard deviation.

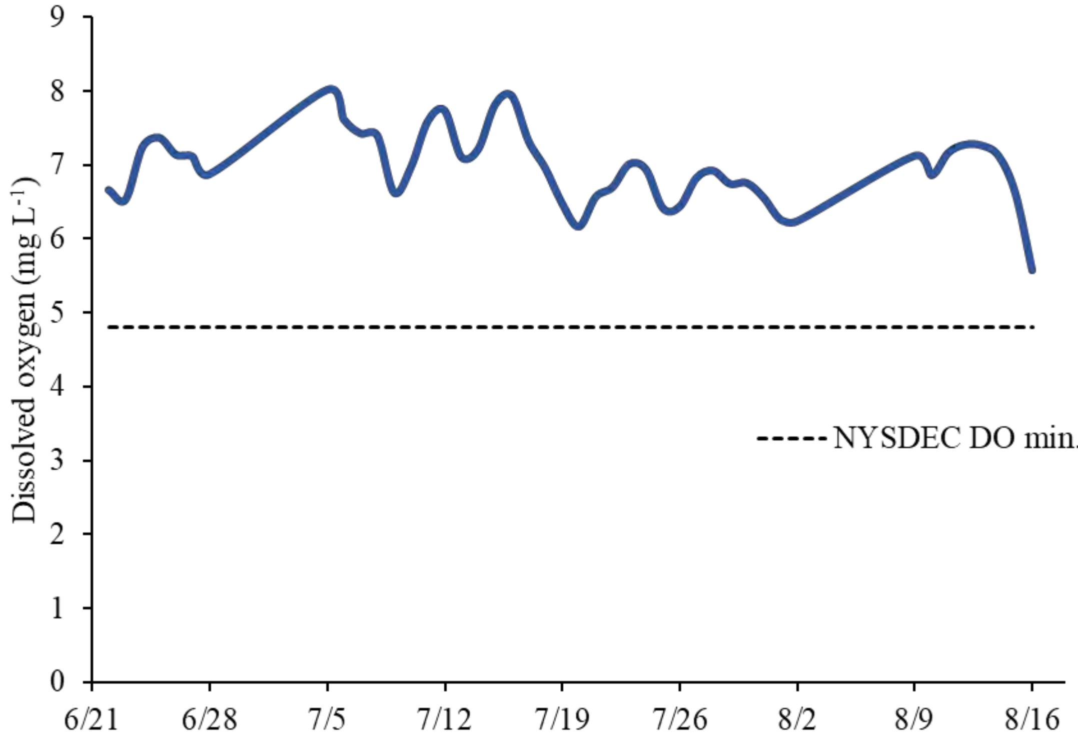


Figure 11. Continuous measurements of dissolved oxygen (mg L^{-1}) taken from a HOBO temperature/dissolved oxygen logger deployed at the SH Yacht Club during summer 2021.

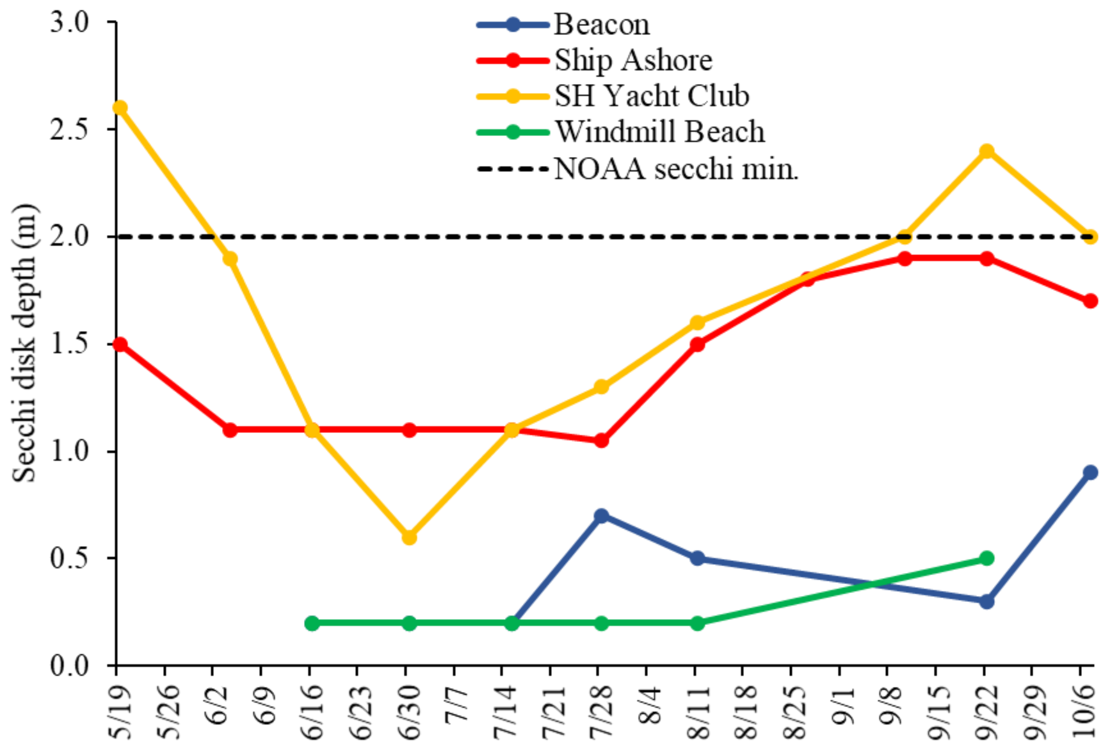


Figure 12. Secchi disk depths (m) across marine sites in Sag Harbor during 2021.

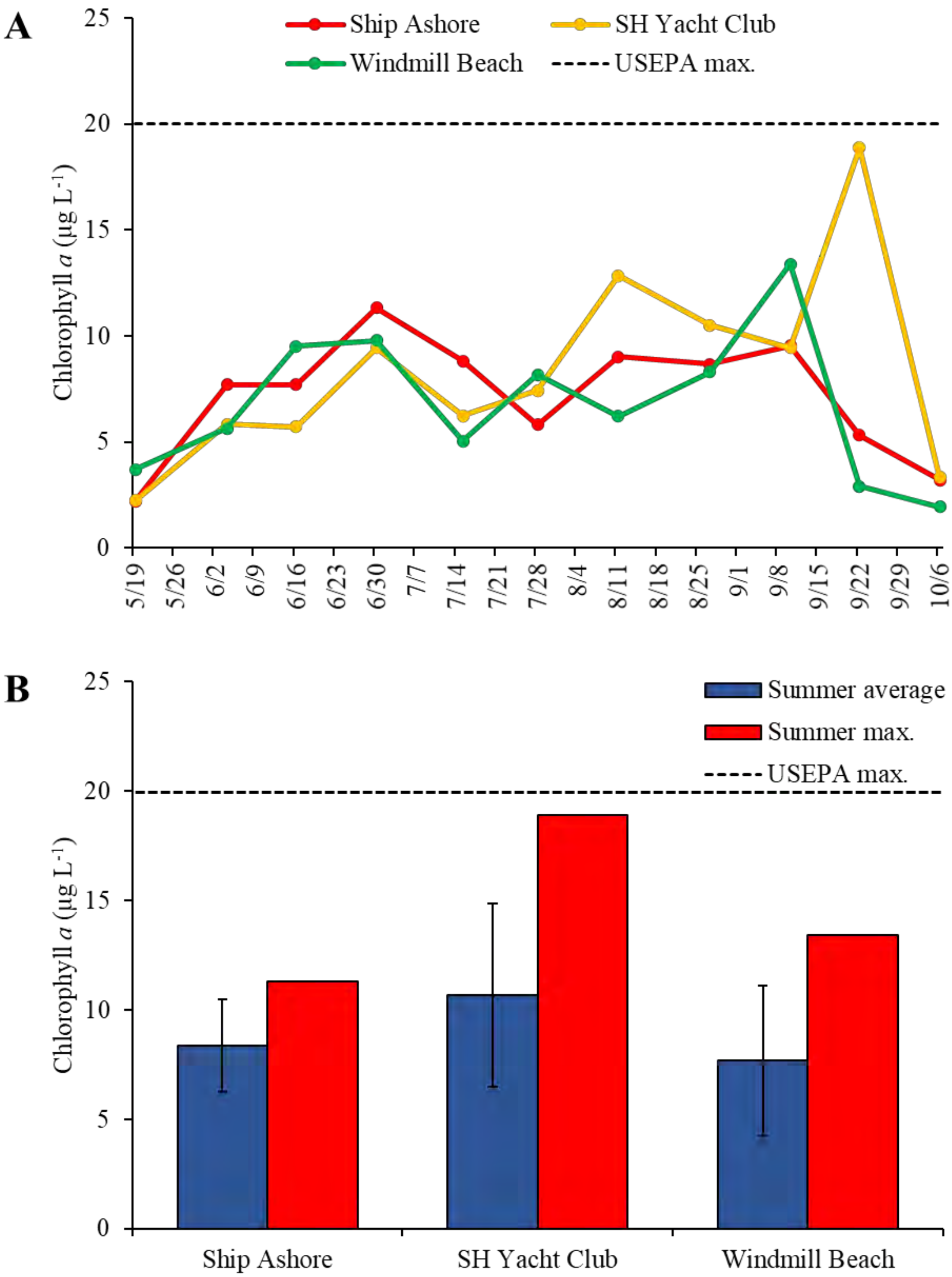


Figure 13. A) Time-series, and B) Summer average and maximum chlorophyll a concentrations (µg L-1) across marine sites in Sag Harbor during 2021. Columns represent means ± standard deviation.

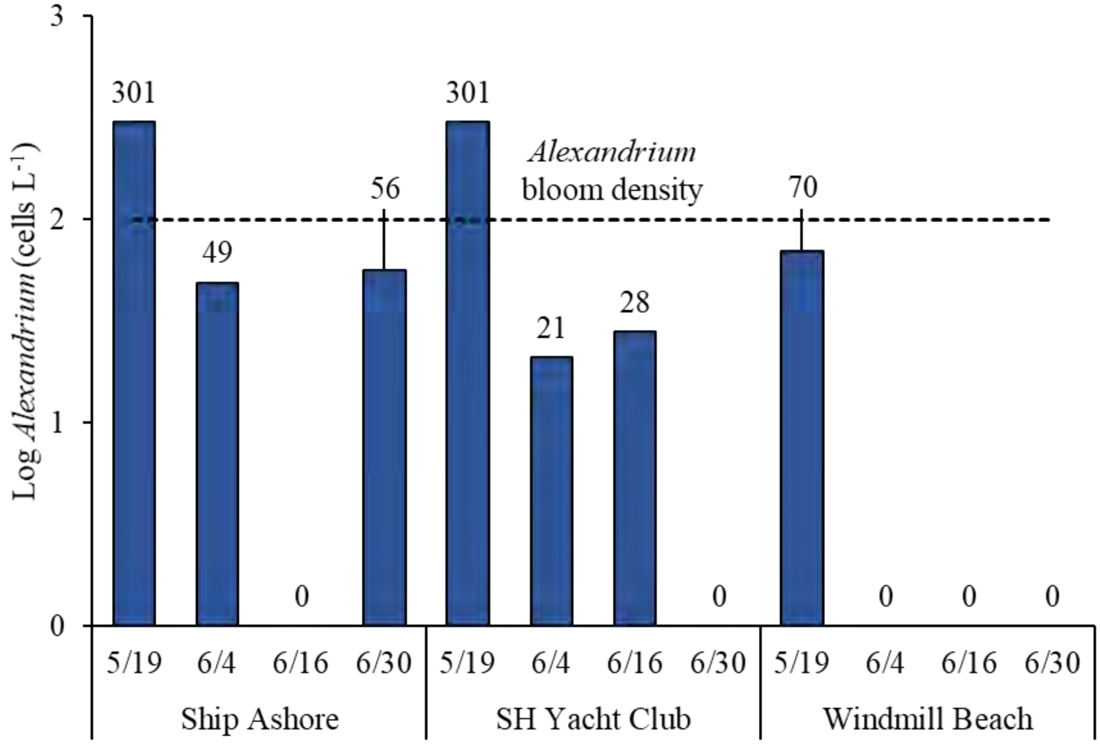


Figure 14. Log concentrations of *Alexandrium* (cells L-1) across marine sites in Sag Harbor during 2021. Actual concentrations appear above columns.

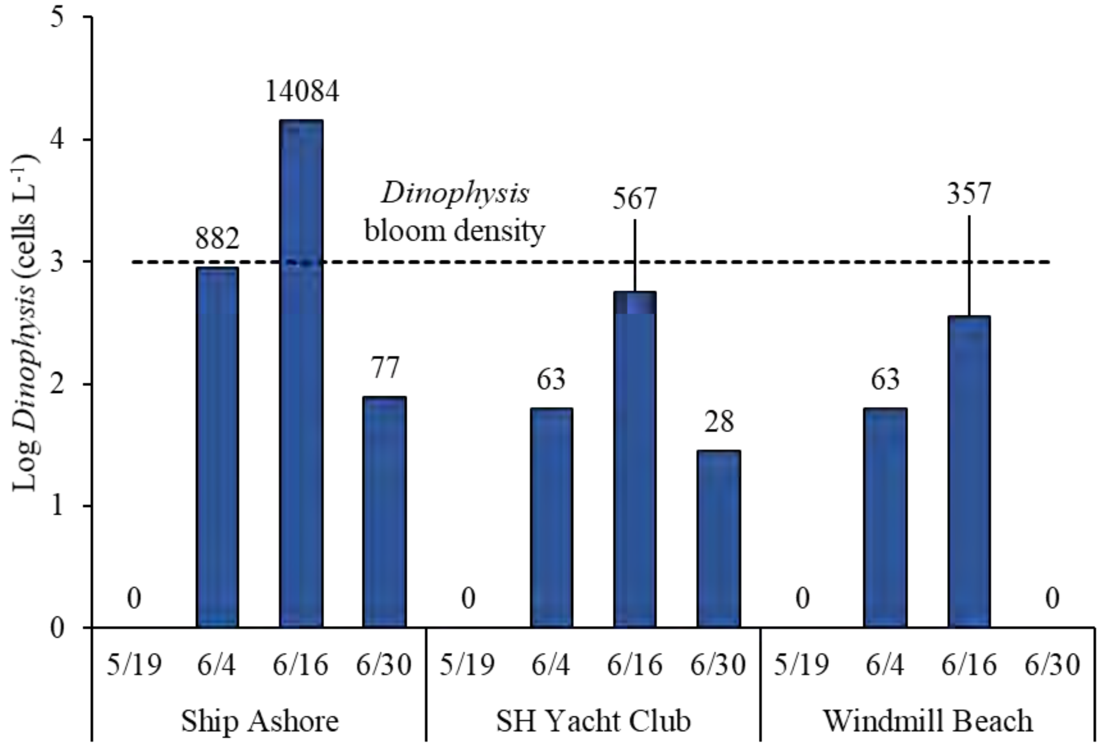


Figure 15. Log concentrations of *Dinophysis* (cells L-1) across marine sites in Sag Harbor during 2021. Actual concentrations appear above columns.

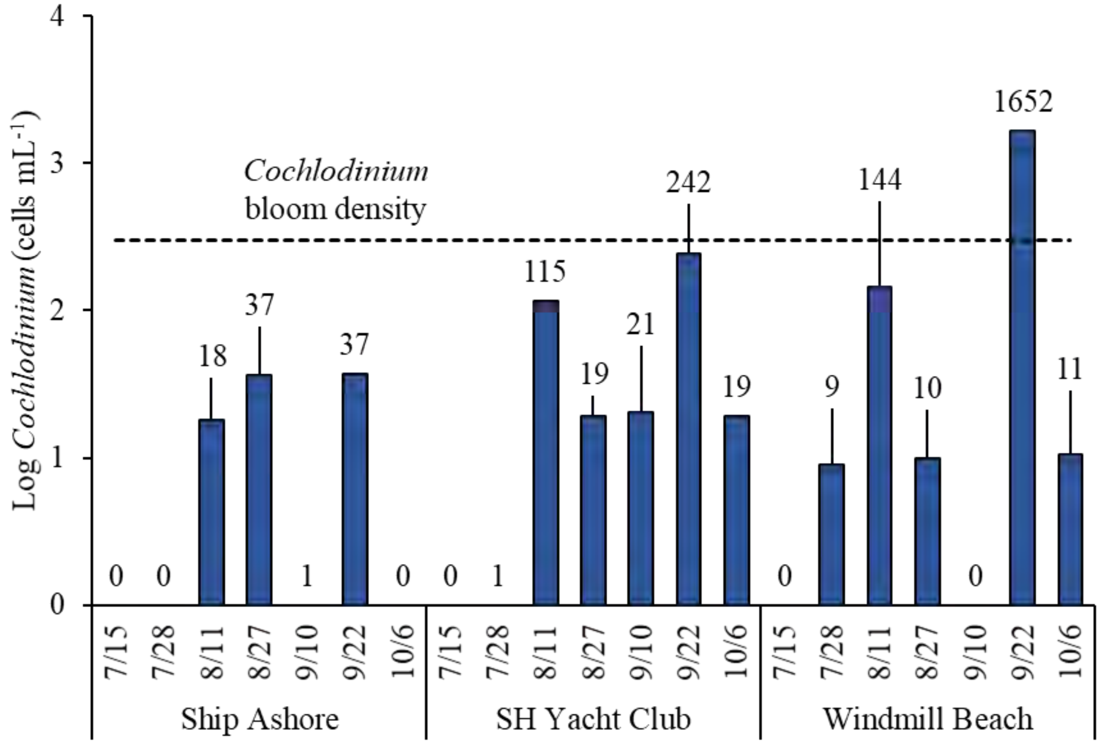


Figure 16. Log concentrations of *Cochlodinium* (cells mL-1) across marine sites in Sag Harbor during 2021. Actual concentrations appear above columns.

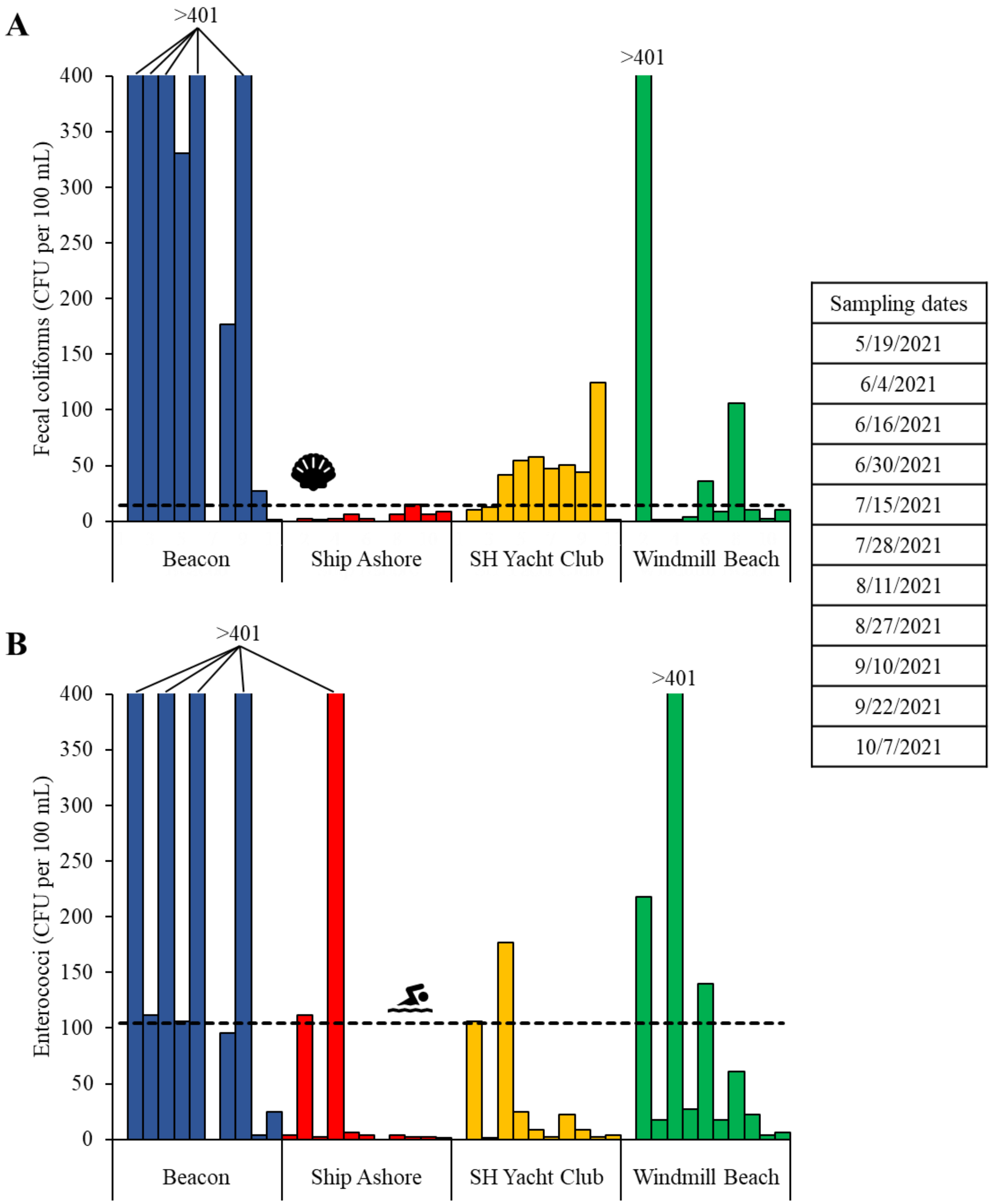


Figure 17. Time-series of A) fecal coliform and B) enterococci concentrations (CFU per 100 mL) across marine sites in Sag Harbor during 2021.

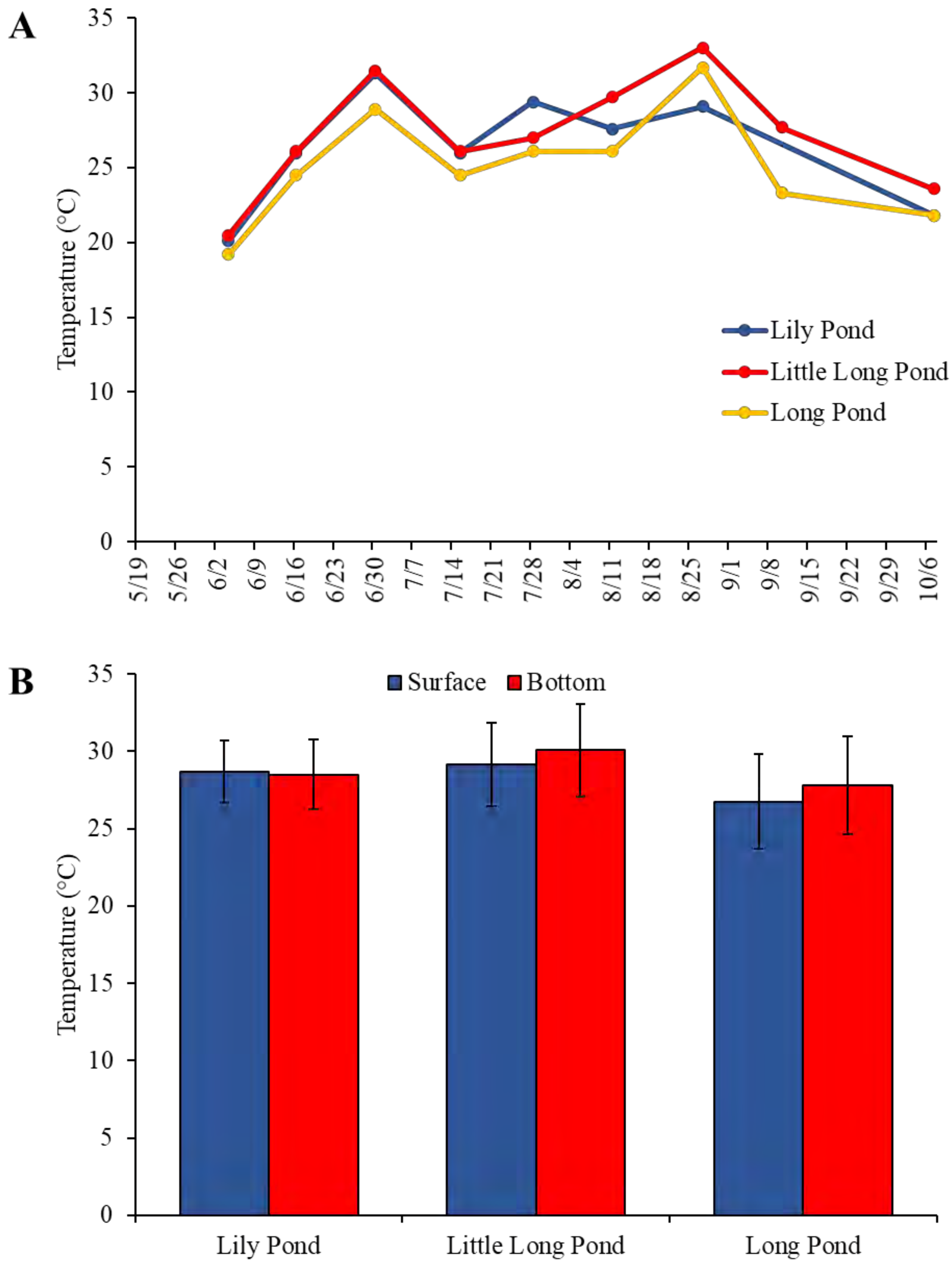


Figure 18. A) Time-series, and B) Average surface and bottom water temperatures (°C) across freshwater sites in Sag Harbor during 2021. Columns represent means ± standard deviation.

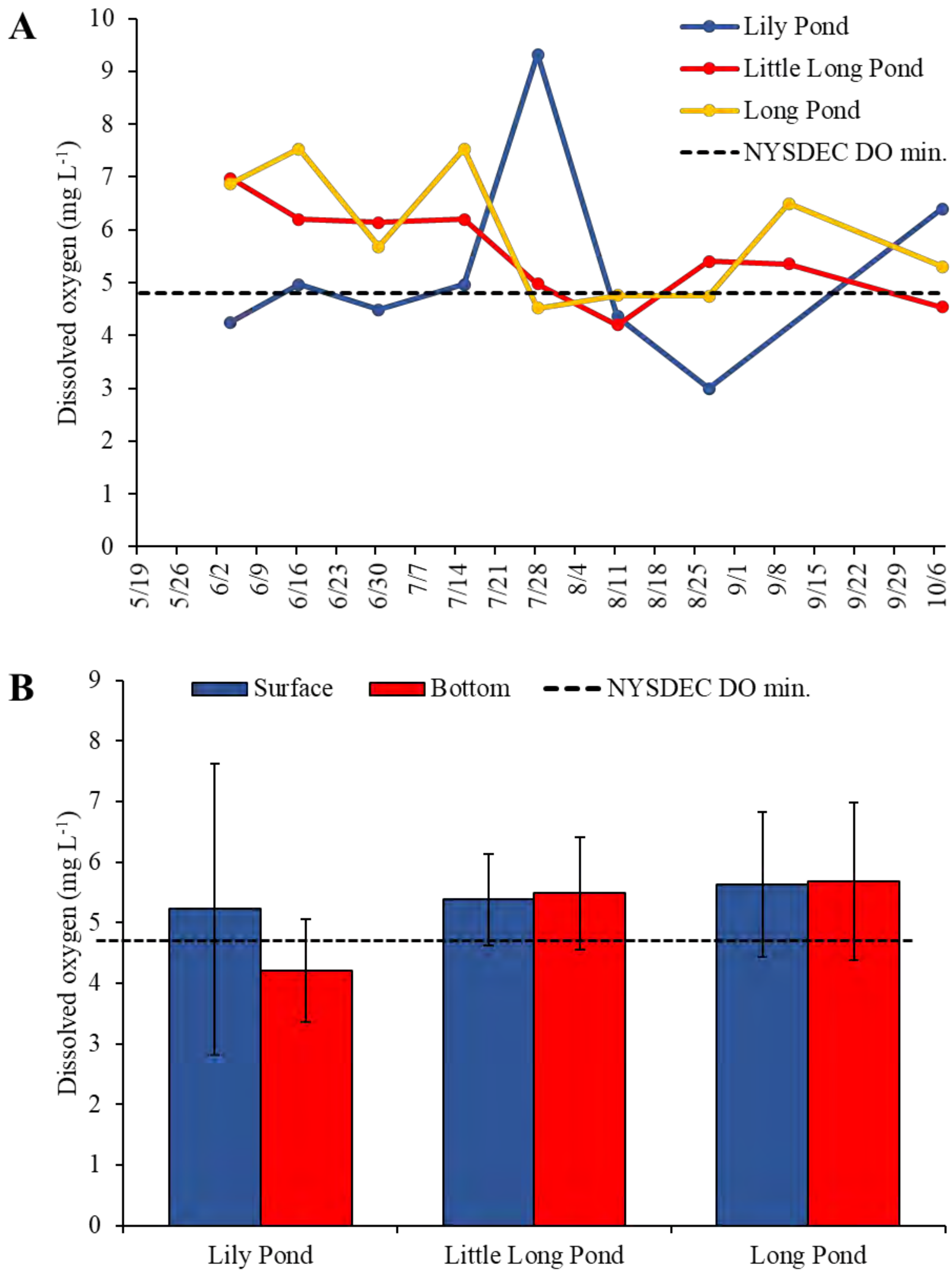


Figure 19. A) Time-series, and B) Average surface and bottom water dissolved oxygen concentrations (mg L-1) across freshwater sites in Sag Harbor during 2021. Columns represent means ± standard deviation.

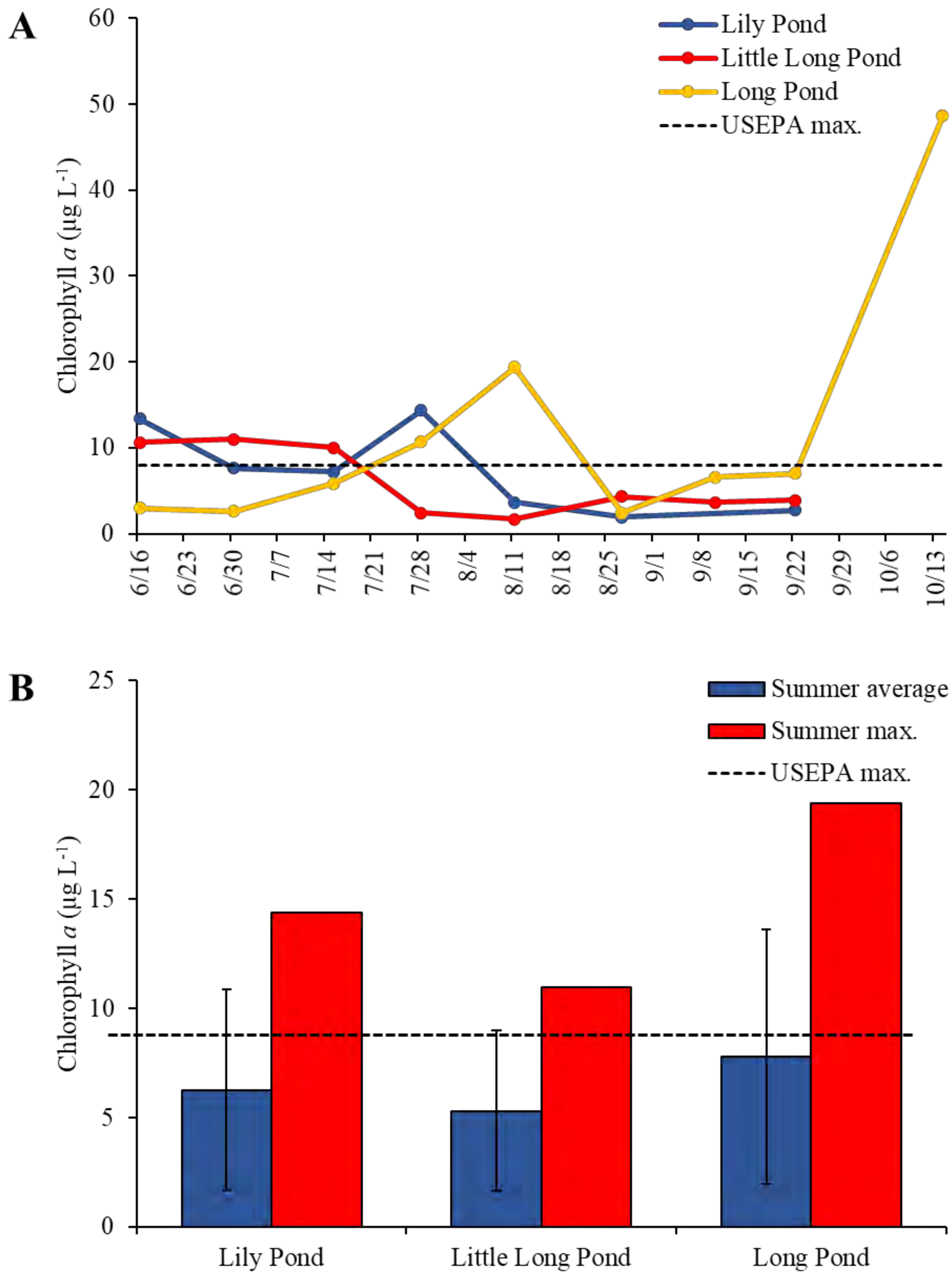


Figure 20. A) Time-series, and B) Summer average and maximum chlorophyll a concentrations (µg L-1) across freshwater sites in Sag Harbor during 2021. Columns represent means ± standard deviation.

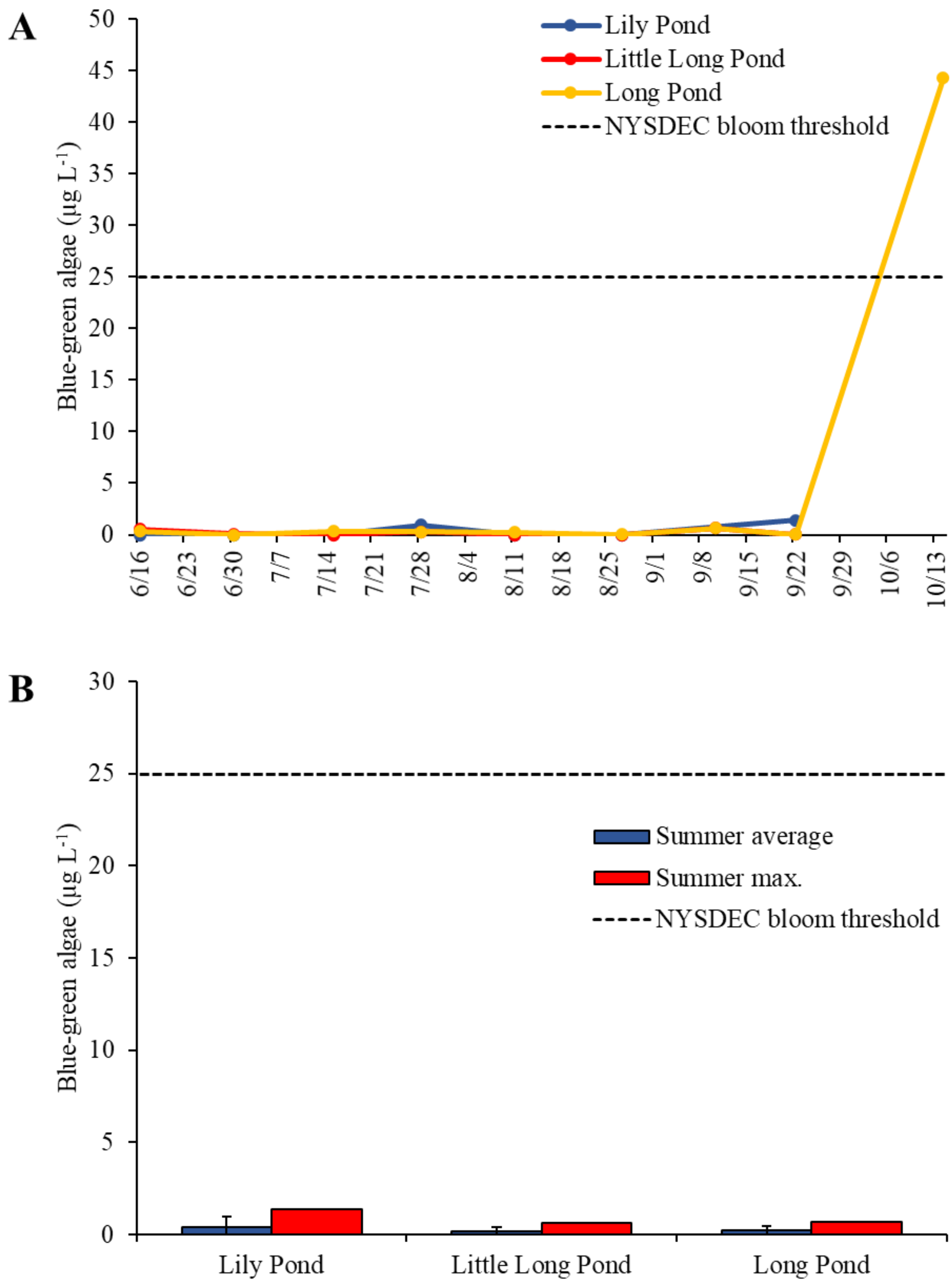


Figure 21. A) Time-series, and B) Summer average and maximum chlorophyll a concentrations (µg L-1) across freshwater sites in Sag Harbor during 2021. Columns represent means ± standard deviation.

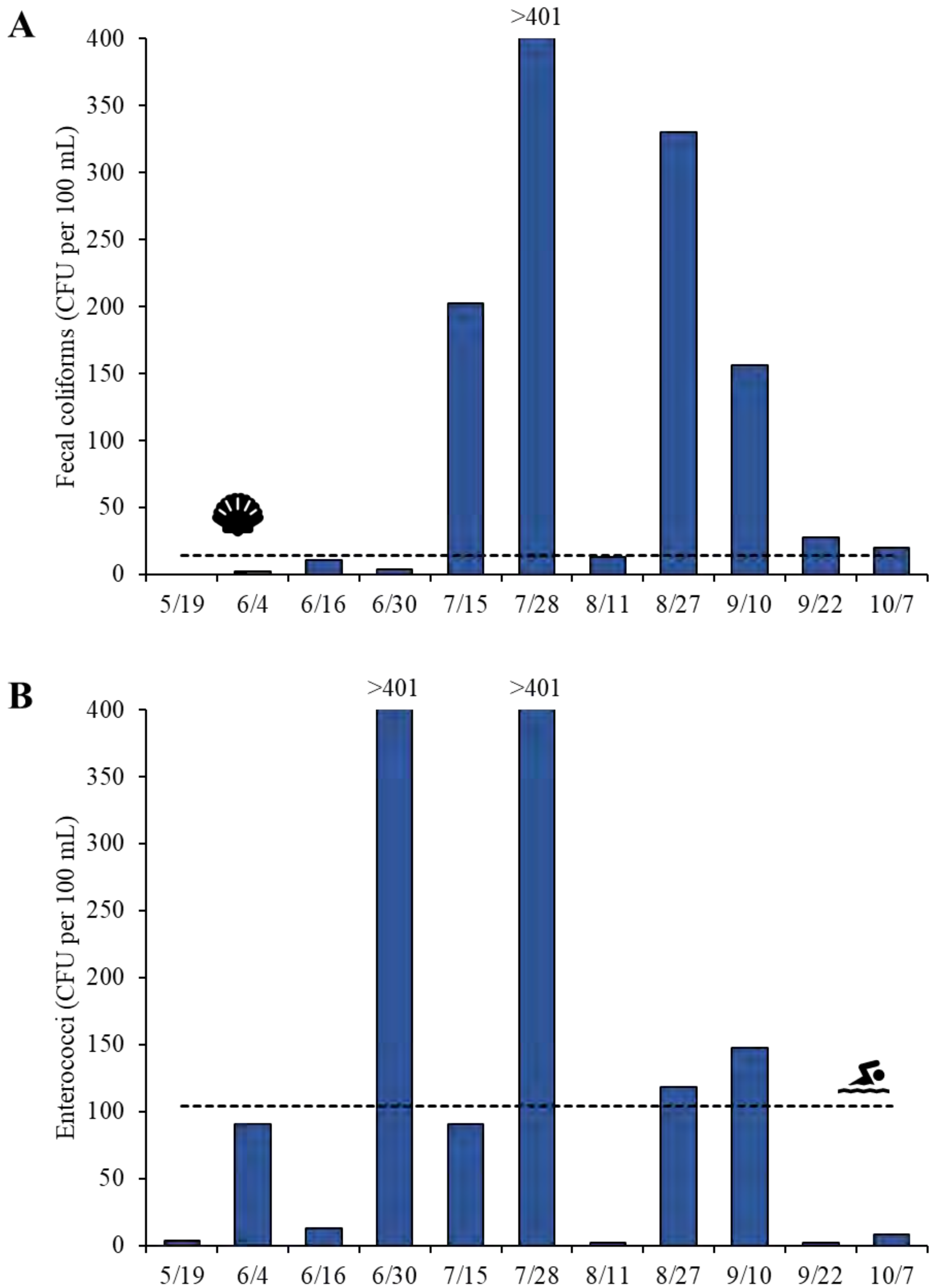
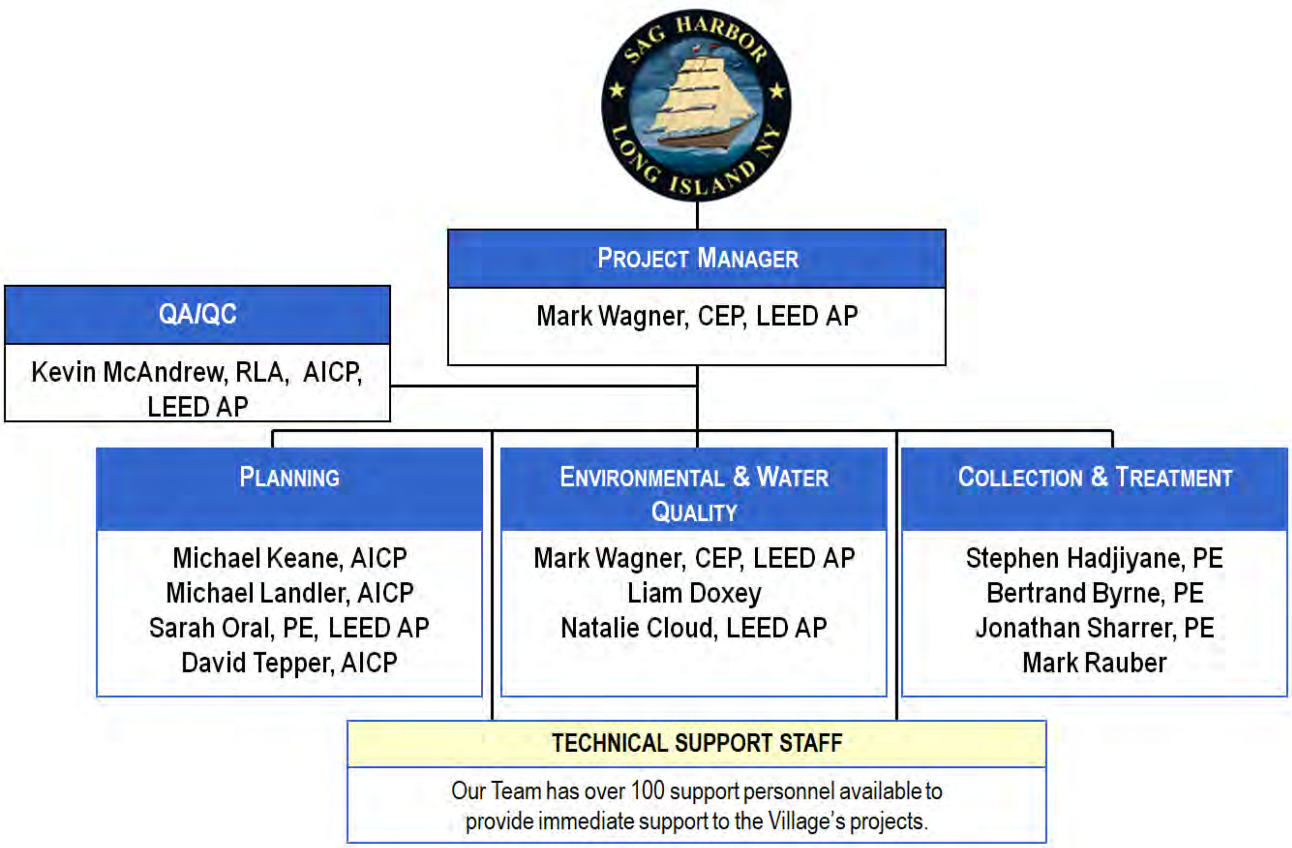


Figure 22. Time-series of A) fecal coliform and B) enterococci concentrations (CFU per 100 mL) taken from the effluent of the sewage treatment plant in Sag Harbor during 2021.

Staffing

Professional Management and Staff
Cameron Engineering is comprised of highly qualified planners, engineers, environmental scientists and landscape architects. This Village of Sag Harbor project will be properly staffed to take into account the strengths of the Firm and maximum utilization of its resources.

Organization Chart



Key Personnel

Mark Wagner, CEP, AICP, LEED AP - As Principal and Manager of Water and Wastewater Engineering, Mr. Wagner is extensively involved in the management and coordination of all projects involving wastewater collection, conveyance, treatment, operations and maintenance of municipal treatment facilities and solid waste treatment and management. Areas of responsibility include project planning, design, construction administration, providing operator training and technical assistance, processing systems troubleshooting, facility start-ups, regulatory interfacing, cost analysis and project permitting. Mr. Wagner has been with the firm since 1985. He has an excellent relationship with the local (SCDHS) and State (NYSDEC) regulatory agencies. Mr. Wagner is also a Grade 4A Certified Wastwater Treatment Plant Operator. Projects of note conducted under Mr. Wagner's direction include the Consolidation of the Villages of Lawrence and Cedarhurst Wastewater Infrastructure, Bergen Point Sewage Treatment Plant 120 MGD Ultraviolet Disinfection, Village of Greenport Water Pollution Control Plant BNR/UV Upgrade, City of Glen Cove BNR/UV Upgrade, City of Long Beach Total Residual Chlorine, Greater Atlantic Beach Water Reclamation TRC and Ammonia Reduction Project, and management and supervision of the Cedar Creek WPCP.

Mr. Wagner has been involved in the start up of processing systems, troubleshooting, and providing technical assistance to both municipal and private operators. He is a Certified Grade 4A Wastewater Treatment Plant Operator (Certificate No. 7146). He has been a Course Instructor for NYSDEC approved certification courses for over 35 years and has been involved first hand with the training of over 830 wastewater treatment operators. Mr. Wagner will serve as both the Program Manager and Project Manager.

Stephen Hadjiyane, P.E., BCEE – Mr. Hadjiyane has over 30 years of experience in the design and construction of wastewater treatment, pumping stations, and collection systems. His experience includes dry and wet pit submersible pumps, vertical shaft pumps, and ejector pumps. His broad experience in process design, mechanical pump systems, hydraulics, screening equipment's, and electrical/instrumentation is perfect for this assignment. His experience includes several Rockland County Sewer District No. 1 pump station improvements and chemical bulk storage facilities. His wastewater treatment plant and pump station experience includes upgrades to numerous projects for New York City Department of Environmental Protection, Nassau and Suffolk Counties, and Town of Greenwich, CT.

Michael Keane, AICP - As a Manager of our Land Use and Environmental Planning Group, Mr. Keane provides expertise in matters that concern both the natural and built environments. As an Urban Planner with 13 years of private and public sector experience, he has the proven expertise in managing complex land use and environmental planning projects across a broad spectrum of geographies. In land use projects, he addresses social, economic, and environmental issues in a manner that respects community needs, protects the environment, and satisfies fiscal realities.

Resumes follow this page.

Mark Wagner, C.E.P., LEED AP

Partner, Water & Wastewater Engineering

Education:
Bachelor of Science
Oceanography
Florida Institute of Technology

Licenses/Registrations:
Licensed Operator Grade 4A
New York State Wastewater Treatment

Certifications:
LEED Accredited Professional

Certified Environmental Professional (ABCEP)

Affiliations:
Energeia Partnership – 2017 Molloy College
New York Water Environment Association

- Partner, Energeia Partnership
- NYWEA Board of Directors
- Chairman, Long Island Chapter: 2003
- Board of Directors, Long Island Chapter: 1997 – 2004
- Former Chair, NYWEA Plant Operations and Maintenance Committee

Awards:

- NYWEA John Chester Brigham Award 2017
- NYWEA, Bob Carballeira Distinguished Service Award, 2014
- NYWEA, Milton T. Hill Award, 2005
- NYWEA, David Flaumenbaum Safety & Training Award, 2002
- NYWEA, Outstanding Operator, 1991
- NYWEA, Chapter Achievement Award, 1990

Years with this Firm: 34

Years with other Firms: 7

As Partner in charge of Water and Wastewater Engineering, Mr. Wagner is extensively involved in the management and coordination of all projects involving wastewater collection, conveyance, treatment, operations and maintenance of municipal treatment facilities and solid waste treatment and management. Areas of responsibility include project planning, design, providing operator training and technical assistance, systems troubleshooting, facility start-ups, regulatory interfacing, cost analysis and project permitting. Mr. Wagner has been the Project Manager for several sewer and storm water planning studies including the Village of Sag Harbor, Village of Southampton, Center Moriches, Smithtown/King's Park, Villages of Lawrence and Cedarhurst Consolidation and Rocky Point Downtown Study, the Five Towns Drainage Study and the SCDPW I/I Study.

Mr. Wagner is currently serving as the Partner-in-Charge on our Village of Sag Harbor's On-Call Engineering Services Agreement. He oversees the execution of current task orders including the wastewater management master plan, the Village's sewage treatment plan, the sewer rehabilitation system, and UV system engineering.

Mr. Wagner has a thorough understanding of regulatory issues relating to sewage collection and treatment including SPDES permits, Total Maximum Discharge Limitations (TMDLs), effluent limitations, Ten State Standards for design of systems as well as the SEQRA environmental review process.

Treatment plant upgrades performed under his direction include the Village of Greenport BNR, City of Glen Cove BNR, Greater Atlantic Beach Water Reclamation District Upgrade and Ammonia Reduction with Total Residual Chlorine reduction. Bergen Point Ultraviolet Light, City of Long Beach post Sandy improvements and Total Residual Chlorine reduction.

He has been involved in numerous facility start-ups throughout New York, New England and California. He is a Certified Grade 4A Wastewater Treatment Plant Operator (since 1978). He has been a Course Instructor for NYSDEC approved certification courses for over 36 years and has been involved first hand with the training of over 830 wastewater treatment operators. Mr. Wagner has participated in the Operators Challenge on both the State and National Levels.

As an Accredited Professional in Leadership in Energy and Environmental Design, Mr. Wagner has fostered green and sustainable design and operation features where appropriate. He has been highly successful in assisting clients in obtaining NYS Clean Air/Clean Water Bond Acts, American Reinvestment and Recovery Act (ARRA) as well as water quality improvement grants.

Mr. Wagner also leads the company's efforts in providing stormwater management services including development of planning documents, detailed design, permitting and construction management services.

Mr. Wagner has significant experience in solid waste management. He has been involved in permitting of off-island municipal solid waste transfer, disposal and yard waste composting projects. He coordinated the design and permitting of one of the largest outdoor biosolids and paper mill waste composting projects in NY State. Additionally, he has been involved in municipal solid waste characterization studies, permitting (6 NYCRR Part 360) of mixed waste processing facilities, transfer stations and yard waste composting operations.

CAMERON ENGINEERING

Richard Zapolski, P.E

Associate Partner, Civil Engineering, Site Development, Landscape Architecture & Planning

Mr. Zapolski is a professional Civil/Site Engineer and Planner with over 30 years of experience in Urban Planning and Land Development Projects with both the public and private sectors. He has planning and civil engineering design experience in several sectors including municipal roadway and capital improvement projects, institutional and educational facilities, transportation infrastructure, residential roadway and drainage design, commercial, residential, and industrial land development projects throughout the northeast, primarily in Suffolk and Nassau Counties, Long Island, NY as well as municipal training in International Building Codes, State Building Codes, FEMA, Town and County Emergency Operations, and Land Use Training for Municipal Planning and Zoning Officials.

Prior to joining Cameron Engineering, Mr. Zapolski served as Islip Town Commissioner with the Department of Planning and Development. He was responsible for five divisions of the Department, including Building, Engineering, Planning, Economic Development and Zoning Board of Appeals. He managed over 70 personnel and 7,000 applications. He oversaw Capital Improvement Projects within the Planning and Engineering Divisions. In this role, he also served as Floodplain Administrator following Hurricane Sandy in 2012, and was a Committee Member on four of the NY Rising Community Reconstruction plans for the Oakdale-Sayville, Bay Shore, West Islip, and Fire Island communities.

Currently, Mr. Zapolski is overseeing Midway Crossing, a $2B private public development project, developed in partnership with Suffolk County and the Town of Islip, which capitalizes on unique Long Island assets. The project, being developed by JLL, one of the world's leading commercial real estate companies, will include one million square feet of life science and commercial office space, a major indoor-outdoor sports and entertainment center, a hotel and convention center, a STEM education center, a new airport North Terminal, retail, a Microgrid served by various renewable energy sources, supportive infrastructure, etc. Cameron Engineering is the designated engineer for this major project. Mr. Zapolski's experience also includes:

- **SUSA Sports Complex, Carleton Ave., Central Islip, NY –** Cameron Engineering secured regulatory approvals for the complex. Improvements includes a venue amenity area developed with an entry plaza, the "Athletes Square", the mobile food truck and vendor court and shade structures to serve the competing teams.
- **GOSR - Shore Road Waterfront Park Natural Systems Resiliency Improvements, Lindenhurst, NY** – Providing utility and civil engineering services as part of the Community Reconstruction Program.
- **DASNY Oakdale/West Sayville Road Raising** - Cameron Engineering is providing professional services to identify and modify roads subject to chronic flooding in specific areas of Oakdale and West Sayville under the GOSR Community Reconstruction Program.
- **Beech Street/Park Street Complete Streets and Drainage Improvements, Nassau County, NY** – The Firm is providing design for the installation of drainage, curb, sidewalk, pavement, traffic signals, lane markings, traffic calming measures, streetscape features and incidental work. The intent is to improve safety for motorists and pedestrians and to improve drainage and flood resiliency.

Education:

Master of Science
Civil Engineering
Manhattan College

Bachelor of Science
Civil Engineering
University of Massachusetts

Licenses/Registrations:

Professional Engineer: New York

NYS Code Enforcement Official

Affiliations

- Member of ASCE
- Member ACEC
- Former committee member of
- ACEC Land Development
- Coalition
- Member of ICSC
- Member of DPCLI
- Member of SMPS
- Former committee member of
- ICSC's "Next Gen"
- Member of APA
- Guest speaker at SMPS
- Contacts with over 1000 owners, owner's reps., developers, attorneys, architects, consultants and municipal contacts

Years with this Firm: 5

Years with other Firms: 27

CAMERON ENGINEERING

Michael DeGiglio, RLA

Senior Associate, Landscape Architect

Mr. DeGiglio has over 20 years of experience practicing Landscape Architecture. During this time, he has been involved in all aspects of the profession including the layout and detailing of parks and athletic facilities. Mr. DeGiglio has been contributing and leading a variety of large-scale public and private master planning including, primary & secondary schools, college campuses, cemeteries, residential communities, golf courses, parks and athletic fields.

In addition to master planning, Mr. DeGiglio has developed site plans and contract documents for residential and commercial projects, as well as guiding them through the permitting and approval process of multiple municipal agencies. Residential projects have included large scale community planning, as well as high end detailing of private estates. Commercial or public projects have included college campuses, shopping centers, medical & office use buildings, hospitals, public gardens, congregate care facilities, and mixed-use athletic fields. Where required, Mr. DeGiglio has assisted and lead projects through the process of re-zoning, land divisions, variances, and public hearings.

Public projects have included downtown hamlet redevelopment planning, streetscapes, and mixed-use parks. As is the scope with many public projects, Mr. DeGiglio participates in facilitating public meetings, and interacting with elected officials. He has also been involved with environmental reviews involving New York State approval and/or funding.

Mr. DeGiglio is very familiar with stormwater related issues/regulations and reviews stormwater pollution prevention plans as part of Cameron Engineering's on call services agreement with the Town of Brookhaven.

Mr. DeGiglio is a proponent of sustainable design principles and has been involved with projects seeking LEED accreditation. His projects have featured rain gardens, vegetated detention basins, stream reconstruction, porous pavements, courtyards, vertical green screens, native plantings, and a green roof. Mr. DeGiglio's project experience includes:

- GOSR - Shore Road Waterfront Park Natural Systems Resiliency Improvements, Lindenhurst, NY – Providing utility and civil engineering services as part of the Community Reconstruction Program developed and managed by the Governor's Office of Storm Recovery.
- Bay Park Athletic Complex, Bay Park, NY - Cameron Engineering's scope of work was focused on the Master Planning and Redevelopment of the existing athletic complex / ball fields and sports courts.

Other Key Projects:

- Bay Walk Park – LWRP, Village of Port Washington North, NY
- Columbia University-Rocco Commisso Soccer Stadium, Bronx, NY
- Twin Rinks at Eisenhower Park, East Meadow, NY
- St. Joseph's College, Patchogue, New York
- Mill Pond Overlook, Oyster Bay, NY

Education:

Bachelor of Landscape Architecture
University of Georgia- School of Environment & Design

Associates Applied Science
Ornamental Horticulture/
Landscape Development
SUNY Farmingdale

Licenses/Registrations:

Registered Landscape Architect:
New York

Years with this Firm: 14

Years with other Firms: 10

Alhagie Camara

Civil Engineer

Mr. Camara has over 20 years of experience in civil design on various infrastructure and site development projects throughout the New York metropolitan area. He is well versed in topographical analysis including grading and elevation/slope analysis utilizing AutoCAD Civil 3D. Mr. Camara has vast knowledge of PANYNJ, NYCDEP, NYCDOT, NYSDOT, NYCDDC, ECS and Con Edison standards and specifications. His civil design experience includes surveying, site layout, roadway/street alignment layout, utilities, grading and drainage, storm water management, soil erosion and sediment control, landscaping, lighting, specifications and cost estimates, design of streetscape hardscapes, i.e., road rehabilitation and sustainable design. His Project experience includes:

- **MTA-LIRR Design-Build Services for the Long Island Rail Road Expansion Project from Floral Park to Hicksville -** The LIRR Expansion Project is a key element of Governor Andrew M. Cuomo's transportation infrastructure initiatives and is a strategic component of a comprehensive plan to transform and expand New York's vital regional transportation infrastructure. The Project extends approximately 9.8 miles between the Floral Park and Hicksville stations, where five branches converge carrying approximately 40 percent of LIRR's daily ridership. The scope of work consists of the construction of 9.8 miles of third track and the elimination of seven street-level train crossings ("grade crossings"). The Project also includes sound walls to reduce noise, station upgrades, and additional parking structures. The addition of a third track will increase track capacity through the corridor, making it easier to run trains, improve service reliability, provide two-way peak travel, reduce existing noise levels, and make transit more attractive.
- **Starlight Park Project/Bronx River Greenway, Bronx, NY –** Project Engineer - Mr. Camara served as the Project Engineer for this project which involved a continuous 17-foot-wide multi-use asphalt path that winds along the length of the park on both sides of the river and connects with adjoining segments of the Greenway to include 3 pedestrian bridge structures over Amtrak railways and Bronx River, 6 stone rip-rap stormwater water outfall aprons, new vegetated wetlands restoration areas and excavation of uplands and stone rip-rap river stabilization. This project included general layout of walkways, bike trails, dog run, pedestrian fitness loop, scenic overlooks, passive seating, wetland creation, ornamental security fence, storm water filtration basins. Mr. Camara checked surveys, reviewed design documents and construction cost estimates and updated the construction cost estimates, prepared Final Contract Documents, based on revisions/ design changes.
- **LaGuardia Airport Redevelopment Project, Assistant Project Manager, Virtual Design in Construction, Manager – Civil Engineering -** Mr. Camara's experience includes experience as a sitewide civil works project coordinator between the design team and the construction management team. The work included the use of 3D models in sitewide utilities coordination and to help the construction team identify design conflicts early. Mr. Camara created DTMs for grading, cut roadway sections and quantity take-offs using Civil3D and monitoring of as-builts.
- **Village of Island Park Flood Protection for Major Infrastructure -** Flood mitigation improvement measures evaluated include upgrades to storm drainage systems, new outfall tide gates, stormwater pumping station, upgrades and replacement of bulkheads and outfall headwalls, beach and shoreline stabilization.

Education:
Bachelor of Civil Engineering
New Jersey Institute of Technology

Certifications:
30 Hour OSHA Certification

Affiliations:
ASCE

American Society of Civil Engineers, Metropolitan Section

Years with This Firm: 4

Years with Other Firms: 16

Jax Gill, EIT

Environmental Engineering

Education:
B.S. Environmental Resources Engineering (ABET accredited)
Humboldt State University, Arcata, CA.
Major GPA 3.7

Certifications:
Ecological Restoration from Santa Barbara City College

Years with this Firm: 1

Years with other Firms: 5

Jax Gill is an environmental engineer. Jax would like to contribute meaningful and sustainable water engineering solutions in service to both human society and the natural environment. Jax has worked as an Assistant Environmental Engineer scoping new sewer and water main replacement projects throughout NYC based on drainage plan updates, civilian complaints, and investigation of existing conditions. Jax is expeienced in creating project maps and analyze data using ArcMap. Jax has experience overseeing approved CPI projects through design review, construction oversight, and project close-out. Jax has worked closely with Capital Program Director and Chiefs to balance our groups' 10-year budget and reassess project priority through major cuts due to the pandemic. Jax is experienced in designing and evaluating wastewater treatment alternatives for the currently unsewered Samoa Peninsula. Jax has reviewed development of the CEQA Environmental Impact Report. Jax has experience summarizing the existing water and wastewater systems for MCSD, identified projects of near-term importance, and estimated the cost of long-term total system replacement over 50, 75, and 100 years. Jax composed multiple hazard mitigation grant applications and developed scopes of work, project schedules, cost estimates, benefit cost analyses, and environmental checklists.

Jax Gill's experience includes:

- **Capital Project Initiation (CPI) Development for NYC DEP BWSO in Queens, NY -** Scope new sewer and water main replacement projects throughout NYC based on drainage plan updates, civilian complaints, and investigation of existing conditions. Create project maps and analyze data using ArcMap.
- **Capital Project Management for NYC DEP BWSO in Queens, NY -** Oversee approved CPI projects through design review, construction oversight, and project close-out.
- **Budget Management for NYC DEP BWSO in Queens, NY -** Work closely with Capital Program Director and Chiefs to balance our groups' 10-year budget and reassess project priority through major cuts due to the pandemic.
- **Samoa Peninsula Wastewater Project: Planning and Design Study for GHD in Eureka, CA -** Designed and evaluated wastewater treatment alternatives for the currently unsewered Samoa Peninsula. Reviewed development of the CEQA Environmental Impact Report.
- **McKinleyville CSD Sanitary Sewer and Main Line Replacement and Rehabilitation Master Plan for GHD in Eureka, CA -** Summarized the existing water and wastewater systems for MCSD, identified projects of near-term importance, and estimated the cost of long-term total system replacement over 50, 75, and 100 years.
- **Mad River Pipeline Crossing Construction Management for GHD in Eureka, CA -** Oversaw the horizontal directional drilling of an 18-inch potable water line underneath the Mad River. Organized and reviewed construction submittals, change orders, RFIs, and meeting agendas/minutes.
- **FEMA/ Cal-OES Hazard Mitigation Grant Applications for GHD in Eureka, CA -** Composed multiple hazard mitigation grant applications and developed scopes of work, project schedules, cost estimates, benefit cost analyses, and environmental checklists.
- **Biological Monitoring of Created Wetlands for GHD in Eureka, CA -** Collected, organized, and analyzed groundwater depth data from over 50 monitoring wells to demonstrate that wetland conditions were met per California Coastal Commission standards.

Tony Leung, PE

Environmental Engineer

Mr. Leung has over 30 years of experience in environmental engineering design services. He has in-depth knowledge of water quality issues relating to wastewater, stormwater, water supply, petroleum/chemical bulk storage, petroleum spills, and groundwater remediation. Mr. Leung has extensive experience in watershed management and has represented the DEC in various meetings and workgroups such as Long Island Sound Study, Peconic Estuary, and the South Shore Estuary Reserve, as well as other local water quality protection committees. He has managed all aspect of the Region 1 wastewater treatment plant upgrade and their respective state grant resulting in full compliance with the Long Island Sound and Peconic Estuary TMDL. Mr. Leung is highly knowledgeable on projects and grants management, industrial and municipal wastewater treatment systems; erosion and sediment control practices; stormwater pollutants calculation and treatment design; watershed management and the development/implementation of water quality standards for wastewater treatment systems. currently involved with two major initiatives - Long Island Nitrogen Action Plan and the Long Island Sustainability Study to solve surface water and groundwater quality issues on Long Island.

His experience includes:

- **Stony Brook University, Dept. of Civil Engineering, NY -** Mr. Leung was an adjunct Professor for Stormwater Management and Design, as well as for the Dept. of Technology and Societies: Water and Wastewater Treatment Technologies. He effectuated the Water and Wastewater Treatment Technologies class & the Stormwater Management and Design class from the scratch.
- **NYS DEC, Division of Water Region 1 Office, NY –** Mr. Leung was the Regional Water Engineer who managed 18 employees, oversaw day-to-day regulatory activities with a universe of more than 900 facilities and coordinated complex projects. He represented DEC at various committees/workgroups/ meetings, managed human resource related activities, formulated/managed work plan and budget and ensured consistent enforcement actions. Mr. Leung Implemented new enforcement posture against water suppliers and water users. He adopted routine use of short-form consent orders.
- **NYS DEC, Division of Water Region 1 Office, NY -** Mr. Leung was an Environmental Engineer 3, SPDES/Watershed/Grant Supervisor. He Supervised the SPDES section which regulates municipal, industrial and stormwater sectors; ensured design and engineering reports are reviewed, commented, and approved on a timely basis by staff. Mr. Leung's additional duties included the overall management of the Grants program to ensure applications are scored appropriately and are fundable before assigning a ranking for management priorities. He brought about compliance from all POTW's with appropriate enforcement actions, successfully obtaining Commissioner's Order to shut down one industrial facility.
- **Grants Supervisor and Municipal Wastewater Manager –** Mr. Leung was an Environmental Engineer 2. He managed the 1996 Clean Water/Clean Air Bond Act from inception to 2002. Mr. Leung was involved in municipal Wastewater project management duties added around 2000 to ensure grant projects were completed expeditiously and consistently. He established the grants scoring/review procedure statewide and tracking database. Mr. Leung successfully worked with all grant recipients to ensure completion of projects.

Education:
Bachelor of Science
Chemical Engineering
University of Colorado at Boulder, CO

Master of Business Administration
University of Colorado at Boulder, CO

Licenses/Registrations:
Professional Engineer, NY

Years with this Firm: 1

Years with other Firms: 32

CAMERON ENGINEERING

Michael R. Keane, AICP

Manager, Land Use and Environmental Planning

Education:
Master of Urban Planning
Hunter College
City University of New York, 2009

Bachelor of Arts
History
University of Massachusetts - Amherst, 1998

Certifications:
Member
American Institute of Certified Planners (AICP)

Affiliations:
Member
American Planning Association
Urban Land Institute

Speaking Engagements:
New York University
Adjunct Professor of Urban Planning
2012 to Present

APA 2018 National Planning Conference, New Orleans – "The Art of Private Practice Planning"

Years with this Firm: 1

Years with other Firms: 12

As a Manager of our Land Use and Environmental Planning Group, Mr. Keane provides expertise in matters that concern both the natural and built environments. As an Urban Planner with 13 years of private and public sector experience, he has the proven expertise in managing complex land use and environmental planning projects across a broad spectrum of geographies. In land use projects, he addresses social, economic, and environmental issues in a manner that respects community needs, protects the environment, and satisfies fiscal realities.

Mr. Keane's area of expertise includes City and State Environmental Quality Review (CEQR/SEQR), National Environmental Policy Act (NEPA), zoning and land use planning, and site and master plan development. He has a unique understanding of the land use process and the ins and outs of the environmental analysis. He has represented clients before governmental authorities responsible for approving major land use actions undergoing environmental review.

Mr. Keane is a recent addition to Cameron Engineering and brings a wealth of experience and knowledge. His previous work includes serving as the environmental planning lead responsible for overseeing the preparation and review of environmental planning documents for projects undergoing environmental review for the Grand Central Terminal Train Shed Rehabilitation Project, MTA Metro---North Railroad (NEPA), and the Empire Corridor Syracuse Congestion Relief Project, New York State Department of Transportation (NEPA; SEQR).

Serving as a Senior Environmental Planner and Senior Project Manager, Mr. Keane collaborated on dozens of environmental planning projects, including area-wide and site-specific land use actions subject to CEQR and the New York City Uniform Land Use Review Procedure (ULURP) process. Mr. Keane has directed the preparation of environmental assessment and impact statements that resulted in project approval, and advised clients on a wide range of land use, zoning, and regulatory matters to support the use and development of land in New York City. Notable project experience includes Bay Street Corridor Rezoning (CEQR EIS). 69-02 Queens Blvd. Mixed Use Development (CEQR EAS; ULURP), Avenues: The World School (CEQR EAS), 45 Broad Street Development (CEQR EAS; ULURP), and 1125 Whitlock Mixed---Use Development (CEQR EAS; ULURP).

In his earlier career, Mr. Keane collaborated on major planning initiatives throughout the Northeast and internationally, including municipal-wide and regional comprehensive plans, zoning code amendments, and visual impact analyses. This included the Capital City of Hanoi – 2030 Master Plan, City of Stamford Master Plan, Rockland County Master Plan, City of Mount Vernon Master Plan, Nassau County Master Plan, Village of Port Chester Master Plan, and Town of Mamaroneck Inclusionary Housing Zoning Text Amendment and SEQR EIS.

Mr. Keane's experience includes time spent as an Urban Planner with the Office of Manhattan Borough President, Scott Stringer in 2008. In this role he collaborated on the preparation of the Borough President's West Harlem Special District Proposal, several recommendations of which were incorporated into the Department of City Planning's zoning text amendment for the 90-block area in West Harlem. City Council approved the rezoning in November 2012.

Sarah Oral, P.E., LEED AP BD+C

Project Manager

Education:

- B.S. Civil Engineering, Tulane University
  Recipient of Distinguished Honor Scholarship
- Accident Reconstruction Training, The Traffic Institute of Northwestern University

Licenses/Registrations:

Professional Engineer: NY

LEED Accredited Professional with a specialty in Building Design and Construction - U.S. Green Building Council Certification

Affiliations:

- American Society of Civil Engineers
- Institute of Transportation Engineers
- New York Statewide Accident Reconstruction Society
- U.S. Green Building Council, Long Island Chapter Sustainable Transportation Committee, Current Member
- Vision Long Island, Current Board Member
- Village of Roslyn Board of Trustees. Current Trustee
- Village of Roslyn Planning Board, Former Member (2012-2013)
- Roslyn Gardens Board of Directors, Former Director (2010-2013)

Years with this Firm: 4

Years with other Firms: 12

Ms. Oral has 16 years of experience in land development with a focus on civil engineering and traffic engineering. She has been responsible for traffic, transportation, drainage and sanitary system analysis and design, computer aided traffic flow modeling, the preparation and review of traffic impact studies, parking studies, traffic calming studies and signal warrant studies including data collection and engineering analysis. Ms. Oral has created site plans including the design of parking layouts, and has designed various roadway improvements, road diets, Complete Streets design elements, Smart Growth concept integration, bicycle and pedestrian facilities, and maintenance and protection of traffic plans. She has performed access management and design, as well as Transit Oriented Development (TOD) design and analysis. Sarah has expanded her planning expertise in the fields of climate change mitigation and adaptation. She is currently serving as Long Island coordinator for the Clean Energy Communities program for the New York State Energy Research and Development Authority (NYSERDA).

Ms. Oral also provides forensics engineering evaluation of roadway safety, traffic flow, and pavement marking and signage design, and accident reconstruction analysis via vehicle dynamics, mechanics, and road characteristics. Ms. Oral also has experience with field inspection of on-site and off-site drainage and paving, field surveying and data reduction. She possesses a working knowledge of federal, state, and local specifications, standards, and procedures, and all work complies with the Federal MUTCD, NYS Supplement, ADA, & AASHTO standards.

Ms. Oral has been qualified as a traffic engineering expert for multiple Towns and Villages throughout Nassau and Suffolk Counties. She has also been qualified as a roadway design expert by the New York State Court of Claims.

- **ESD Downtown Revitalization Initiative – Round Two - City of Cortland** – Performed background research, site visits, Committee and public engagement meetings; conducted stakeholder interviews; prepared components of the Downtown Cortland Strategic Investment Plan: Downtown Profile and Assessment; Public Engagement Plan; Project Profiles; Logging public response to aspects of the Strategic Investment Plan; Assistance with Project Prioritization; and weekly Project Management with State DRI coordinators.
- **Climate Smart Communities, Long Island** – Long Island Coordinator for Climate Smart Communities. Recruits Long Island municipalities into the program, creating educational handouts and information packets, facilitating several educational workshops and seminars, securing regional experts for presentations, and the establishment of a project website. She also established the Long Island CRS Users Group to support and educate communities about FEMA's National Flood Insurance Program Community Rating System, and distributes highlights and follow up to those involved in the Users Group, including State agencies, within 2-3 days of all meetings.
- **Cortlandt Manor Medical Oriented District (MOD)** – Order of magnitude traffic mitigation for the proposed MOD overlay zone, review proposed MOD zoning requirements and similar local zoning codes for successfully executed regulations.
- **Copiague Commons, Copiague** – Performed an area-wide analysis of traffic impacts to congested intersections, signal mitigation to improve Level of Service, integration of Transit Oriented Development concepts to take advantage of the site's close proximity to the LIRR, and traffic calming and streetscape improvements to support improved conditions for pedestrian and bicycle traffic.
- **Peconic Care, Calverton** - Performed transportation engineering tasks including an analysis of a potential railroad crossing and the subsequent gates and signalization that would be required. Other tasks included analyzing traffic impacts to the local roadway network and potential mitigation measures to offset any negative impacts.
- **Town of Babylon, Alternatives Analysis for the Route 110 Corridor –** Provided engineering services to determine the preferred trunk line alignment along a 5-mile section of Route 110 for Bus Rapid Transit (BRT). Plans included conceptual alignment and typical sections, with stations and connections to local feeder routes.

CAMERON ENGINEERING

David Tepper, AICP

Planning / GIS

Education:
Master of Planning
University of Southern California

Bachelor of Arts
Sociology
University of Southern California

Certifications:
AICP
American Institute of Certified Planners
American Planning Association

Years with this Firm: 7

Mr. Tepper has extensive experience as an Urban and Environmental Planner and serves as the technical lead on SEQRA projects for the firm. Mr. Tepper's SEQRA experience includes preparation of SEQRA documents, environmental analyses and environmental impact statements for a variety of projects, including planning initiatives, development applications and public infrastructure projects. He also serves as lead on the firm's Geographic Information Systems (GIS) projects - providing oversight for the integration of GIS with the firm's ongoing projects. He offers valuable experience in the development of spatial databases for municipal and county governments and regional planning entities including cadastral, transportation, environmental and demographic data. He has utilized GIS extensively in numerous planning initiatives, including: comprehensive/master plan updates, growth management plans, community vision plans, alternatives analyses, buildout analyses and infrastructure needs assessments.

- **Village of Amityville Transit Oriented (TO) Code and DGEIS** – Helped develop the new transit oriented zoning district for the Village of Amityville, including language for zoning amendments/ordinance. Also prepared the Draft GEIS for the TO District, including detailed analyses on land use and zoning, community character, community services, taxes and economic impacts, noise, air quality, and alternatives analyses.
- **Cortland Downtown Revitalization Initiative (DRI)** – Performed project analyses, background research and conducted stakeholder interviews to guide the Cortland DRI planning process. Prepared components of the Downtown Cortland Strategic Investment Plan to describe the City's needs, history, and revitalization potential. Helped to craft and execute a fully-developed Public Engagement Plan and participated in all public meetings in Cortland.
- **Nassau County Infill Redevelopment Feasibility Study** – Created GIS maps, existing conditions reports and performed related analyses for 21 different LIRR stations in Nassau County to assess the overall development infill potential for each station area. Based on these existing conditions reports and several rounds of public input, Nassau County ultimately selected three station areas that showed the most potential for infill development.
- **City of Long Beach Comprehensive Plan Update –** Prepared the majority of the City's Comprehensive Plan update and associated SEQRA-required environmental analyses. Work included detailed land use and economic development recommendations considering downtown revitalization (zoning changes, streetscape enhancements and market analyses), multi-modal traffic enhancements, Complete Streets initiatives, parking management strategies, stormwater management improvements, and various coastal resiliency measures tailored to Long Beach. In addition, detailed development scenarios were prepared and analyzed for key areas including the Central Business District and Civic Core, the Oceanfront and the Bayfront along the north shore of the City. This project involved major public outreach efforts, including open public meetings, targeted focus group sessions, key stakeholder consortiums and an array of online/print/phone campaigns to expand and enhance public participation. **Southampton Sewer Study –** Prepared a Full Environmental Assessment Form (FEAF) and Expanded Environmental Assessment, including a detailed buildout analysis to assess impacts of sewers on downtown growth and development. The preparation of the FEAF and Expanded Assessment incorporated review of prior studies, reports, and memoranda related to potential sewering and development of the Village, review of the Draft GEIS prepared by Suffolk County for non-sewered study areas and the preparation of a Negative Declaration for the Village.
- **New York Rising - Community Reconstruction (NYRCR) Plans** – Provided various GIS mapping services/analyses, drafted conceptual/final NYRCR plans, and participated in numerous committee meetings and public engagement events for all of the Suffolk County NYRCR communities affected by Superstorm Sandy.

Natalie Cloud, LEED AP

Environmental Engineer

Education:
Bachelor of Science
Environmental Engineering
State University of New York at Buffalo

Certifications:
LEED Accredited Professional - U.S. Green Building Council Certification

Affiliations:
New York Water Environment Association

Years with this Firm: 13

Years with other Firms: 5

Ms. Cloud currently assists in the design of the Firm's projects within the areas of new water and wastewater systems and design. Her duties include project engineering analysis and calculations, conceptual design, preparation of plans and specifications, and report writing. Her experience includes water distribution system design and modeling. Ms. Cloud conducts shop drawing reviews and attends meetings on behalf of clients as part of the construction phase services.

Ms. Cloud's experience includes:

- **Sag Harbor On-Call Engineering Service Agreement** – Cameron Engineering was awarded a two-year agreement to provide engineering services to all Sag Harbor village-owned property. Ms. Cloud is currently involved with providing services to the Village of Sag Harbor for its wastewater treatment plant, review of sewer connection applications and data review.
- **Suffolk County Sewer District Capacity Study, Suffolk County, NY:** Manage-Analysis five existing sewered areas: Sag Harbor, Port Jefferson, Patchogue, Riverhead and Calverton. The Study included existing and projected wastewater generation rates on a per parcel basis. A collection system analysis was performed and recommendations for infrastructure upgrades were provided. The Study provided aid to Suffolk County in determining the availability of existing treatment capacities.
- **Rocky Point Sewering Feasibility Study, Rocky Point, NY:** Managed study and contributed research/conceptual design layouts of traditional and alternative sewering within the study area. Included economic feasibility and impact. GIS data compilation, database development and spatial analysis to aid alternative scenarios development and feasibility analysis.
- **Smithtown and Kings Park Feasibility Study, Smithtown, NY:** Build-out Analysis of two downtown business districts with wastewater generation rates. GPS field surveys were performed to determine existing and proposed conditions. Preliminary sewering design layouts were completed which Included vacuum-assisted sewers and the expansion of the existing wastewater treatment plant. GIS was a key component in analyzing the two separate study areas with combined design layouts and recommendations.
- **Forge River Watershed Plan, Mastic-Shirley area, NY:** Compiling watershed inventory and characterization, environmental/spatial analyses, and the development of management strategies through GPS and GIS data.
- **Malverne Stormwater System mapping, Malverne, NY:** GIS modeling of the entire stormwater system of Malverne, including natural features of the system. Assembling a GIS model of the stormwater system via integration of historic plans and diagrams and field-collected inventory data.
- **City of Long Beach Wastewater Treatment Plant Sandfilter Repairs** – In the wake of Superstorm Sandy, Cameron Engineering is assessing in the rehabilitation and construction repairs to the City of Long Beach's Wastewater Treatment Plant's sandfilter building in order to reduce total suspended solids within the treatment process.
- **Greater Atlantic Beach Water Reclamation District - Atlantic Beach, NY**-Preparation of Phase II Facility Improvements Plans and Specifications which address improvements at the facility based on NYSDEC modifications to the plant's permit. Includes the addition of a Dechlorination Facility, sodium bisulfite chemical feed system and a lift station to provide for series flow to the Trickling Filter process in order to reduce ammonia nitrogen concentrations. Provided field supervision during construction.
- **Belgrave Water Pollution Control District** - The project included the upgrade of the District's secondary treatment plant to achieve the NYSDEC requirements for nitrogen reduction by 2014 and Total Residual Chlorine (TRC) limitations.

Stephen Hadjiyane, P.E., BCEE

Senior Associate, Technical Advisor

Education:

Education:

Master of Science
Environmental Engineering
Manhattan College, Bronx, NY

Bachelor of Science
Chemical Engineering
SUNY Buffalo, Buffalo, NY

Associate of Applied Science
SUNY Farmingdale
Farmingdale, NY

Licenses/Registrations:

Professional Engineer:
NY, CT, MA

Certifications:

Board Certified Environmental Engineer (BCEE)

Affiliations:

Past Chair/Member, New York Water Environmental Association Long Island Chapter, 1990 - Current

Member, Long Island Water Conference, 2000 - Current

Awards:

Chapter Achievement Award, New York Water Environmental Association, Long Island Chapter - 2014

Environmental Engineer Award, New York Water Environmental Association - 2016

Years with this Firm: 1

Years with other Firms: 33

Mr. Hadjiyane is a Professional Engineer in New York, Connecticut and Massachusetts and a Board-Certified Environmental Engineer (BCEE) with 30 years of experience. He works with the Water/Wastewater group in designing and managing projects while providing QA/QC oversight for the delivery of high quality work products.

Throughout his 30-year career, Mr. Hadjiyane has played a key role managing and directing strategic wastewater infrastructure projects to protect and enhance New York's water resources. He has been a trusted advisor for Nassau and Suffolk Counties, Rockland County, Westchester County, and for the New York City Department of Environmental Protection.

Responsibilities include providing a technical advisory role on complex projects, performing quality assurance/quality control, and directing and supervising engineering projects for the firm. Specializing in designs for wastewater and water treatment facilities, and stormwater pumping stations, background includes the design of activated sludge, extended aeration, and nitrogen removal treatment systems. Experienced in the design of sludge thickening, solids dewatering, and odor control systems. Also experienced in the design of vertical and horizontal centrifuge pumps, as well as extended shaft and pumps operating on variable frequency drives. Pumping system design experience includes vertical turbine, submersible, progressive cavity, rotary lobe, plunger, and wet- and dry-pit pumping systems. Experience leading thickener system upgrades includes progressive cavity and torque flow pumping systems needed for thickener underflow, transfer, and mixing systems.

His project experience includes:

- **Sag Harbor On-Call Engineering Service Agreement** – Senior Engineer assisting with operational assistance at the Village's sewage treatment plant including evaluating odor controls and UV Disinfection system upgrades, sewer rehabilitation and lining repairs and review of sewer connection applications..
- **SCDPW, Brentwood Sewer Feasibility Study –** Project Manger developing a feasibility report to review the current and future infrastructure to improve the economic, housing opportunities and environmental aspects of the downtown Brentwood area. The purpose of the feasibility study is to evalaute sewer optoins and provide a strategy for commercial development for revitalization efforts.
- **Great Neck Water Pollution Control District, Manhasset Sanitary Sewer Feasibility Study** – Project Manager performing a sewer feasibility studies The first study focuses on the downtown Manhasset commercial area located on Plandome Road. The second study area is the residential area west of Plandome Road from Colonial Parkway to the north and Shore Road to the south. Evaluating sewer options that include gravity/pump stations, and low pressure sewers. Developed construction cost estimated and benefit cost analysis.
- **Village of Hempstead, Sewage Collection Systems –** Senior Engineer performing hydraulic analysis on sewer system to determine if new sewer availability request for connecting to the Village's sewer system can be approved. Developed sewer flow projections for future planning and development.
- **Bay Park Sewage Treatment Plant Improvements, Nassau County, NY, Nassau County Department of Public Works.** Project Director responsible for providing design engineering and construction services for the rehabilitation of the Bay Park sewage treatment plant grit removal facility. Prepared technical design report evaluating grit removal technologies to replace the existing detritus with vortex-style units. Report included a flow assessment of the incoming plant flows, design basis for vortex-style grit removal units, design basis for grit handling equipment, proposed grit removal facility preliminary layout and hydraulic profile, and estimated construction costs. Prepared contract bid documents for improvements to the existing facility including new vortex grit removal systems, grit pumps, grit classifiers and cyclones, new isolation slide gates, new sodium hydroxide and hypochlorite storage and feed systems, new odor control system, hazardous gas monitoring system, new process monitoring control system, and new heating, ventilation, and air-conditioning (HVAC), fire alarm, and electrical systems. Also prepared detailed maintenance of plant operation procedures to maintain operation of the plant during construction.

CAMERON ENGINEERING

Mark P. Rauber

Engineering Director

Education:
Mechanical Engineering Northeastern University

OSHA 1910.120 Hazardous Waste Operations and Emergency Response

OSHA 1910.146 Permit Required Confined Space

Certifications:
Engineer-in-Training (EIT)

Affiliations:
American Society of Mechanical Engineers

New York Water Environment Association

Years with this Firm: 16

Years with other Firms: 16

Mr. Rauber has provided full service construction related services, including review of shop drawing, review/response to RFI's, comprehensive regulatory reporting, review and approval of payment requisitions and change order requests and has provided periodic site visits for project compliance, punchlist, startup and project certification of completion.

As lead Project Engineer, Mr. Rauber has provided comprehensive construction related services for several of the Firm's wastewater treatment facility improvement projects including, but not necessarily limited to, Nassau County Consolidation of Sanitary Sewer Services - Villages of Lawrence and Cedarhurst, Greater Atlantic Beach Water Reclamation District Phase II Facility Improvements, Phase I Facility Improvements at the Village's of Lawrence and Cedarhurst WPCP's and Phase II BNR Facility Improvement Project at the Village of Greenport WPCP. Mr. Rauber has also been instrumental for the design, construction oversight, startup, testing and operation of the Bergen Point WWTP, City of Glen Cove WPCP and Village of Greenport WPCP Ultraviolet (UV) Light Disinfection Systems.

Mr. Rauber's is also primarily responsible for design of the Firm's projects in the areas of wastewater collection, conveyance (i.e., pumping stations) and treatment with the upgrade of several existing and design of several new facilities. He has prepared Engineering Reports/Studies, developed hydraulic profiles/analyses, analyzed unit processes for compliance with regulatory and accepted design standards. He is also responsible for the development of contract plans and specifications, vendor analysis and probable construction cost estimates.

Mr. Rauber has also served as Project Engineer for several Sanitary Sewer Evaluation Studies (SSES) conducted for the Nassau and Suffolk County. His efforts have included flow studies, sewer condition evaluations, CCTV inspections, sewer lining, report preparation and recommendations. Based on his recommendations, Mr. Rauber has developed contract plans and specifications and provided construction oversight of the necessary improvements.

Project Experience includes:

- **Suffolk County Sewer District Capacity Study, Suffolk County, NY:** Manages analysis five existing sewered areas: Sag Harbor, Port Jefferson, Patchogue, Riverhead and Calverton. The Study included existing and projected wastewater generation rates on a per parcel basis. A collection system analysis was performed and recommendations for infrastructure upgrades were provided. The Study provided aid to Suffolk County in determining the availability of existing treatment capacities.
- **Nassau County DPW Consolidation of Villages of Lawrence and Cedarhurst Sewer Infrastructure, Lawrence/Cedarhurst, NY -** Based on recommendations provided by Cameron Engineering to an earlier Consolidation Master Plan, County moved forward with the closure of two aged treatment plants into the County's regional facilities. Cameron Engineering conducted extensive surveys using GIS and ground truthing to map out several routing locations for the proposed force mains.
- **Belgrave Water Pollution Control District, Great Neck, NY** - The project includes the upgrade of the District's secondary treatment plant to achieve the NYSDEC requirements for nitrogen reduction by 2014 and Total Residual Chlorine (TRC) limitations. Cameron Engineering completed an analysis of the District's existing outfall pipe which included both an overland and submarine component.
- **Nassau County DPW Barnes Avenue Sanitary Sewer Overflow Design, NY** – In the wake of Superstorm Sandy, The County directed Cameron Engineering to prepare a detailed Technical Design Report followed by the development of Contract Documents (Plans & Specifications) for a new 12 MGD flow diversion pump station and 3 mile 30" diameter force main to transfer sewage from the Village of Hempstead to North Merrick.

Village of Sag Harbor, NY
Sewer Service Expansion Area - Sewershed "K"
Probable Construction Cost Estimate
Residential Area with Low Pressure Sewers (LPS)

LPS CONSTRUCTION COSTS IN ROW **Date: 3/18/2022**

Item No.	Item Description	Unit	Quantity	Material Cost		Labor Cost		Total Cost
				Unit Cost	Total Cost	Unit Cost	Total Cost	
1	1.50" Dia. HDPE SDR-11 Low Pressure Sewer Pipe	LF	1,205	$3.40	$4,097	$20	$24,100	$28,197
2	2" Dia. HDPE SDR-11 Low Pressure Sewer Pipe	LF	1,005	$3.70	$3,719	$30	$30,150	$33,869
3	2.50" Dia. HDPE SDR-11 Low Pressure Sewer Pipe	LF	655	$5.40	$3,537	$30	$19,650	$23,187
4	3" Dia. HDPE SDR-11 Low Pressure Sewer Pipe	LF	366	$7.10	$2,599	$40	$14,640	$17,239
5	Air Release Valves	Ea	1	$7,000	$7,000	$3,500	$3,500	$10,500
6	Clean Out/Drain Assemblies	Ea	10	$1,500	$15,000	$2,250	$22,500	$37,500
7	Sawcut Roadway	LF	5,730	-	-	$5	$28,650	$28,650
8	Excavation and Backfill	CY	1,915	-	-	$61	$116,316	$116,316
9	Unsuitable Backfill (hauling & disposal)	CY	191	-	-	$42	$8,042	$8,042
10	Dewatering	Days	11	-	-	$15,750	$169,628	$169,628
11	Utility Relocation	LS	1	-	-	-	-	$25,000
12	Maintenance and Protection of Traffic	LS	1	-	-	-	-	$17,000
13	6-inch Aggregate Base Course (assumes 4' wide trench)	CY	240	$25	$6,000	$25	$6,000	$12,000
14	4-inch Asphalt Binder Course	Tons	328	$150	$49,200	$150	$49,200	$98,400
15	2-inch Asphalt Top Course	Tons	164	$150	$24,600	$150	$24,600	$49,200
16	Temporary Asphalt	Tons	164	$25	$4,100	$25	$4,100	$8,200
17	Sediment & Erosion Control	LS	1	-	-	-	-	$25,000
18	Pavement Milling (4' trench)	SY	1,436	-	-	$12	$17,232	$17,232
19	1.5-inch Milled Overlay (4' trench)	Tons	123	$150	$18,450	$150	$18,450	$36,900

	Subtotal	**$762,058**
Insurance	3%	$22,862
	Subtotal	**$784,920**
Overhead	10%	$78,492
Profit	11%	$86,341
	Subtotal	**$949,753**
Design Contingency	10%	$94,975
Escalation to Midpoint of Construction	3%	$28,493
Division 1 General Conditions	5%	$47,488
	LPS Construction Cost in ROW	**$1,120,709**
Engineering Design	LS	$235,000
Construction Management	15%	$168,106
	LPS TOTAL PROBABLE CONSTRUCTION COST IN ROW	**$1,523,815**
	COST PER PARCEL	**$41,184**

Estimate basis is as follows:

1. References such as Means, plus cost adjustment factor for Tri-State Area.
2. Vendor quotes for materials/equipment.
3. Previous unit costs from similar contracts completed.
4. Items 13 thru 16 for trench restoration only. Items 18 and 19 for curb-to-curb mill and paving.
5. Does not include pavement striping, traffic signal loops and sidewalk/curb restoration.

$235,000 Funded by Town CPF for design

LPS CONSTRUCTION COST ON PRIVATE PROPERTY

				Material Cost		Labor Cost		
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**	**Unit Cost**	**Total Cost**	**Total Cost**
1	DH071-93 Grinder Pump Units (i.e., Residential Parcel)	Ea	30	$7,000	$210,000	$9,000	$270,000	$480,000
2	DH152-93 Grinder Pump Units (i.e., Commercial Parcel)	Ea	5	$14,000	$70,000	$9,000	$45,000	$115,000
3	DH152-93 Grinder Pump Units (i.e., Institutional Parcel)	Ea	2	$14,000	$28,000	$9,000	$18,000	$46,000
5	Lateral (Boundary) Kits (i.e., 1 kit/parcel)	Ea	37	$300	$11,100	$1,000	$37,000	$48,100
6	1.25" Dia. HDPE Lateral Sewer Pipe (i.e., 60 lf/parcel)	Ea	2,220	$2.60	$5,772	$20	$44,400	$50,172
7	Concrete Ballast (1.3 cy per DH071-93 Unit)	CY	39	$250	$9,750	$250	$9,750	$19,500
8	Concrete Ballast (2.2 cy per DH152-93 Unit)	CY	15	$250	$3,850	$250	$3,850	$7,700
9	Abandonment of existing onsite system	Ea	37	$585	$21,645	$1,000	$37,000	$58,645
10	6" gravity sewer (50 lf/house waste line to grinder pump)	LF	1,850	$50	$92,500	$15	$27,750	$120,250
11	Excavation and Backfill (i.e., 50 lf of LPS piping/parcel)	CY	740	-	-	$61	$44,955	$44,955
12	Dewatering (per parcel)	Ea	37	-	-	$500	$18,500	$18,500
							Subtotal	**$1,008,822**
						Insurance	3%	$30,265
							Subtotal	**$1,039,087**
						Overhead	10%	$103,909
						Profit	11%	$114,300
							Subtotal	**$1,257,295**
						Design Contingency	5%	$62,865
						Escalation to Midpoint of Construction	3%	$37,719
						Division 1 General Conditions	5%	$62,865
							LPS Construction Cost Private Parcels	**$1,420,743**
						Engineering Design	LS	$242,000
						Construction Management	10%	$142,074
							LPS TOTAL PROBABLE CONSTRUCTION COST ON PRIVATE PROPERTY	**$1,804,818**
							COST PER PARCEL	**$48,778.85**
							GRAND TOTAL (PROBABLE LPS CONSTRUCTION COST IN ROW AND PRIVATE PROPERTY)	**$3,328,633**
							TOTAL COST PER PARCEL	**$89,963**

$242,000 Funded by Town CPF for design

Village of Sag Harbor, NY
Sewer Service Expansion Area - Sewershed "L"
Gravity Sewer Probable Construction Cost Estimate

Date: **2/11/2022**

Item No.	Item Description	Unit	Quantity	Material Cost		Labor Cost		Total Cost
				Unit Cost	Total Cost	Unit Cost	Total Cost	
1	6" Dia. DR-18 Pipe (Gravity Sewer Piping)	LF	660	$15	$9,900	$50	$33,000	$42,900
2	8" Dia. DR-18 Pipe (Gravity Sewer Piping)	LF	3,140	$21	$65,940	$50	$157,000	$222,940
3	Sawcut Roadway	LF	7,600	-	-	$5.00	$38,000	$38,000
4	Excavation Support and Protection (trench boxes)	Days	50	$1,500	$75,000	$1,000	$50,000	$125,000
5	Excavation/Backfill (all piping and manholes)	CY	13,700	-	-	$59	$801,450	$801,450
6	Unsuitable Backfill (hauling & disposal)	CY	1,370	-	-	$42	$57,540	$57,540
7	Precast Concrete Sewer Manhole, 5' diameter, 10' deep	Ea.	3	$15,000	$45,000	$15,000	$45,000	$90,000
8	Precast Concrete Sewer Manhole, 5' diameter, 15' deep	Ea.	14	$20,000	$280,000	$20,000	$280,000	$560,000
9	SCDPW Watertight Frame and Cover	Ea.	17	$550	$9,350	$550	$9,350	$18,700
10	Lateral House Connection Pipe Spurs to ROW	Ea.	40	$1,000	$40,000	$1,000	$40,000	$80,000
11	Utility Relocation	LS	1	-	-	-	-	$250,000
12	Maintenance and Protection of Traffic	LS	1	-	-	-	-	$73,000
13	6-inch Aggregate Base Course	CY	570	$25	$14,250	$25	$14,250	$28,500
14	4-inch Asphalt Binder Course	Tons	769	$150	$115,350	$150	$115,350	$230,700
15	2-inch Asphalt Top Course	Tons	385	$150	$57,750	$150	$57,750	$115,500
16	Temporary Asphalt	Tons	385	$25	$9,625	$25	$9,625	$19,250
17	Sediment & Erosion Control	LS	1	-	-	-	-	$50,000
18	Dewatering	Days	46	-	-	$17,480	$796,214	$796,214
19	Pavement Milling (trench width +2')	SY	3,378	-	-	$12	$40,533	$40,533
20	1.5 inch Milled Overlay (trench width +2')	Tons	289	$150	$43,350	$150	$43,350	$86,700

	Subtotal	**$3,726,927**
Bonds & Insurance	3%	$111,808
	Subtotal	**$3,838,735**
Overhead	10%	$383,874
Profit	11%	$422,261
	Subtotal	**$4,644,870**
Design Contingency	20%	$928,974
Escalation to Midpoint of Construction	3%	$139,346
Division 1 General Conditions	10%	$464,487
	Total Construction Costs	**$6,177,676**
Engineering Design	LS	$306,800
Construction Management/Administration	10%	$617,768
	GRAND TOTAL	**$7,102,244**

Probable Construction Cost Estimate basis is as follows:

1. References such as Means, plus cost adjustment factor for Tri-State Area.
2. Vendor quotes for materials/equipment.
3. Previous unit costs from similar contracts completed.
4. Items 13 thru 16 for trench restoration. Items 19 and 20 for curb-to-curb mill and paving.
5. Does not include pavement striping, traffic signal loops and sidewalk/curb restoration.