

Exhibit A



Opinion of Construction Cost

L.K. McLean Associates, P.C.

Project Name: Agawam Lake - Rain Gardens & Porous Paving

Date: April 2022

Location: Southampton Village

LKMA Project No: 011

Client Name: Southampton Trustees

Description	Quantity	Unit	Unit Price	Amount
SITE WORK				
1 Erosion and Sediment Control measures - temp. silt fence, hay bales	800	LF	\$6.00	\$4,800
2 Site Demolition - concrete island, existing asphalt (1.56 acres)	65,000	SF	\$0.50	\$32,500
3 Storm water drainage system - precast concrete - catch basin, leaching rings, frames, and grates	32	VLF	\$600.00	\$19,200
4 15" dia. Drainage Pipe, HDPE	250	LF	\$25.00	\$6,250
5 Concrete Curb at various location on the site	3,200	LF	\$22.00	\$70,400
6 Concrete Slabs and handicap ramps at cross walks, traffic calming	700	SF	\$10.00	\$7,000
7 Site Earthwork & Grading	65,000	SF	\$0.50	\$32,500
8 Porous Paving area	52,000	SF	\$5.00	\$260,000
9 Embossed Colored Asphalt Crosswalks, (Brick appearance) Orange areas	2,400	SF	\$15.00	\$36,000
10 Topsoil within rain garden areas - shape, grade & compact	16,000	SF	\$2.50	\$40,000
11 Native Coastal Wetland Plantings (Ground Cover) in rain garden areas	16,000	SF	\$4.00	\$64,000
12 Tree plantings in rain garden areas	10	EA	\$2,000.00	\$20,000
13 Small Wetland Shrubs in rain garden areas	100	EA	\$150.00	\$15,000
SUBTOTAL:				\$607,650
General Conditions, insurance & bonding requirements			10%	\$60,765
CONTINGENCY:			10%	\$60,765
CONSTRUCTION COST (Say)				\$730,000

1. Cost estimate based on Exhibit No. 2. Other Exhibits cost will vary slightly

Exhibit B



RAYMOND G. DiBIASE, P.E., PTOE, PTP, PRESIDENT and CEO
ROBERT A. STEELE, P.E., EXECUTIVE VICE PRESIDENT
JAMES L. DeKONING, P.E., VICE PRESIDENT

Associates

CHRISTOPHER F. DWYER
STEVEN W. EISENBERG, P.E.
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MATTHEW C. JEDLICKA, LEED AP
KEITH J. MASSERIA, P.E.
VINCENT A. CORRADO, P.E.
TAMARA L. STILLMAN, P.L.S.

February 17, 2022

William Pell IV
Southampton Town Trustee
116 Hampton Road
Southampton, NY 11968

**Re: Town of Southampton – Lake Agawam, South Parking Improvements
Professional Services Proposal**

Dear Mr. Pell:

As requested by your office and in accordance with our telephone discussions about the parking area on the south end of Lake Agawam, we are pleased to submit our proposal for the Professional Services associated with stormwater management improvements in the Trustee parking area along Gin Lane south of Lake Agawam.

We understand that the Town Trustees, along with support from the Lake Agawam Conservancy, would like to complete the stormwater management improvements which were initially developed by LKMA in 2008 with a portion constructed around 2010. The improvements along the lake were completed during that initial phase. This proposal is to develop the remainder of the stormwater management improvements, including a “rain garden” island in place of the existing concrete along with a pervious parking system.

This proposal is based on the assumption that Exhibit No. 2 – Lake Agawam Parking, dated August 2008 (enclosed), is the closest representation for the desired improvements. Our office can use this as a starting point and develop a specific plan incorporating the pervious paving system.

Assuming these conditions are acceptable, we would recommend the following scope of professional engineering services and budgets:

I. SURVEYING

- Perform topographical and underwater survey of project area for design and permitting (2 Field Days)



- Identify existing physical features and elevations
- Locate the following as applicable:
 - Existing utilities
 - Existing drainage structures and roadway
 - Wetland limits
- Establish survey control points
- Create DTM (Digital Terrain Model)

II. PERMITTING

- Prepare and submit applications to the following agencies:
 - NYSDEC
 - Southampton Trustees
- Preliminary Site Plan & Design
- Preliminary Landscaping Plan
- Permit Drawings
- SEQRA determination will be provided by Town
- Respond to comments and follow up with Regulatory agencies

III. DESIGN

- Prepare construction drawings.
- Prepare construction specifications and bid documents to include:
 - Rain Garden and Landscape Design
 - Stormwater drainage and pervious parking system in the parking lot
 - Traffic elements
- Meet with Trustees and or Town as appropriate to finalize plans
- Prepare bid tabulations
- Verify contractor references
- Recommendation of award

IV. CONSTRUCTION SUPPORT SERVICES

- Pre-construction meeting
- Review submittals and shop drawings
- Provide limited construction monitoring services, up to 2 days per week, for 12 weeks
- Processing of payments
- Preparation of punch list
- Record drawings (1 Field Day)



FEE AND PAYMENT

Our fee estimate for the above services is as follows:

Survey, Permitting, & Design Fee (Tasks I-III) = \$38,800

Construction Support Services Fee (Task IV) = \$32,500

Total Proposed Fee = \$71,300

It is proposed that any additional authorized work (e.g. additional construction monitoring) be negotiated with the Town if and when necessary. No additional work will be performed without prior authorization.

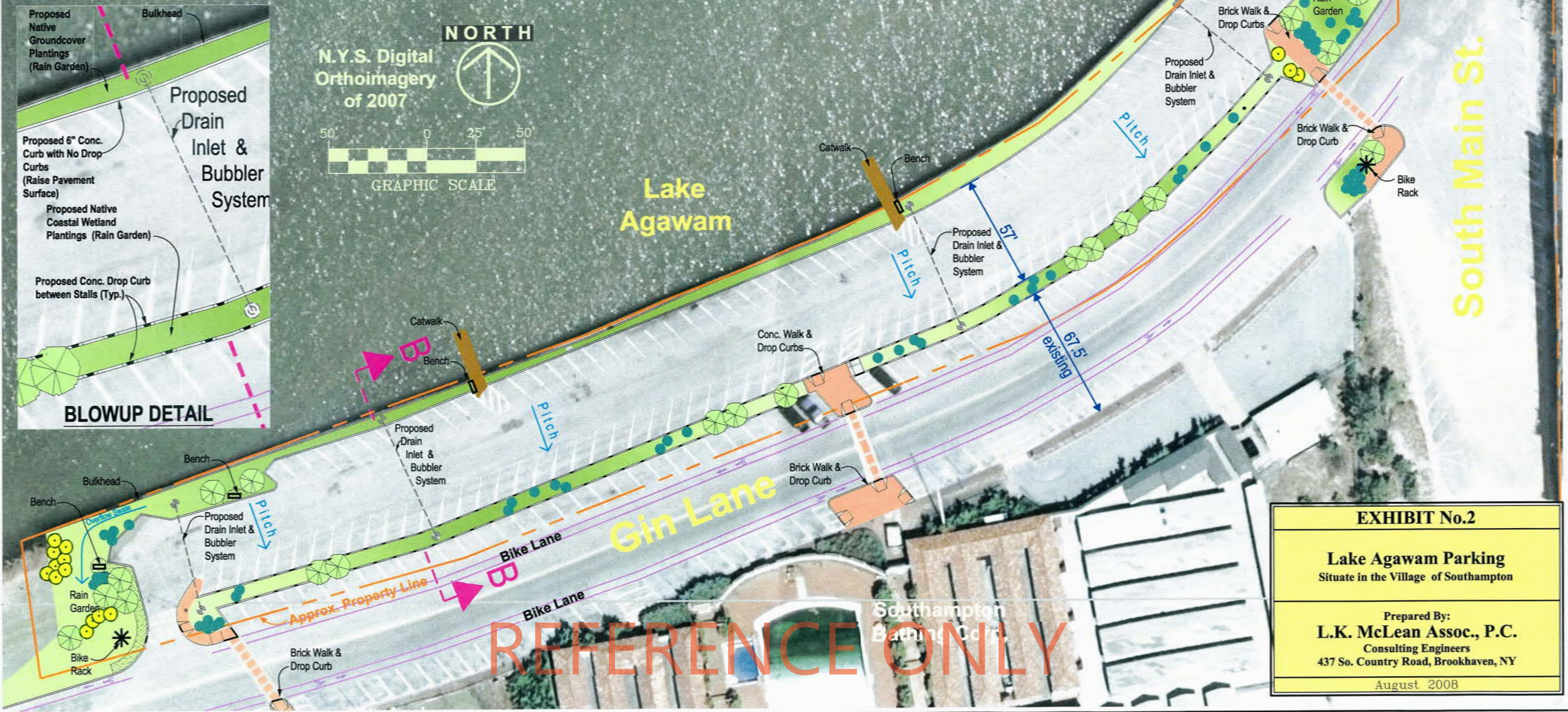
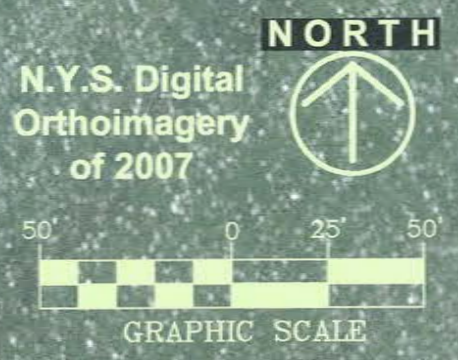
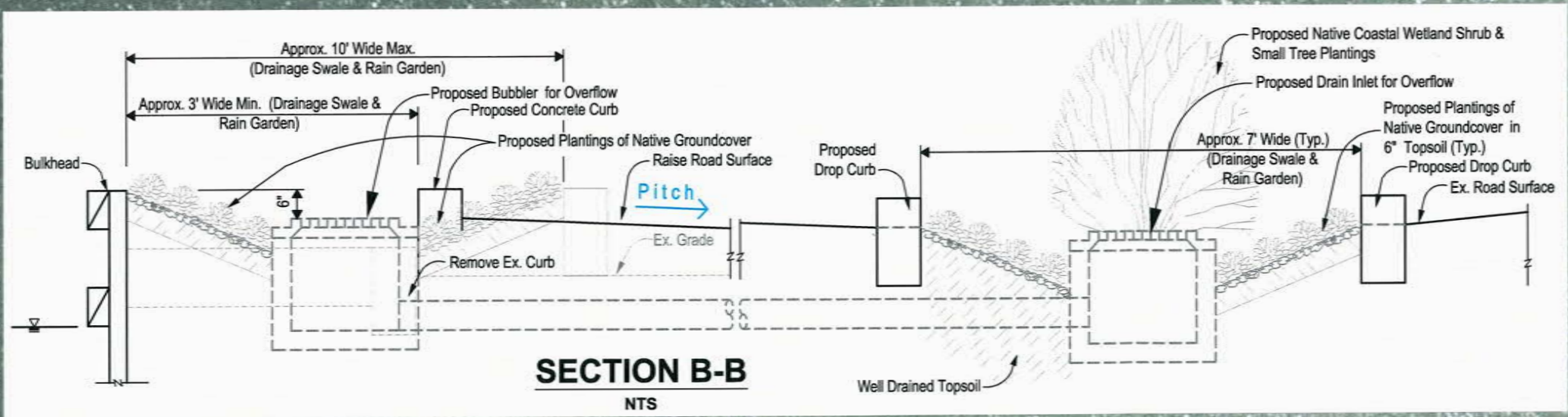
Our office would like to extend our sincere appreciation for the opportunity to serve the Town Trustees on this proposed project. Should you have any questions regarding this proposal please do not hesitate to call me.

Very truly yours,

A handwritten signature in black ink, appearing to read 'M. C. Jedlicka'. The signature is fluid and cursive, with a long horizontal flourish at the end.

Matthew C. Jedlicka, Associate
L.K. McLean Associates, P.C.

Enc: Exhibit No. 2 – Lake Agawam Parking, dated August 2008



REFERENCE ONLY

EXHIBIT No.2

Lake Agawam Parking
Situate in the Village of Southampton

Prepared By:
L.K. McLean Assoc., P.C.
Consulting Engineers
437 So. Country Road, Brookhaven, NY

August 2008

P:\Leigh-Mark\2007 Orthophotos\Town of Southampton\Parking\Lake Agawam Parking\2007_OrthoPhoto-Exhibit No2.dwg 8/28/2008 9:10:40 AM EDT

Exhibit C



COMPREHENSIVE MANAGEMENT PLAN for LAKE AGAWAM



PREPARED FOR:

Village of Southampton
Village Board of Trustees
23 Main Street
Southampton, NY 11968

PREPARED BY:

Nelson, Pope & Voorhis, LLC
572 Walt Whitman Road
Melville, New York 11747
(631) 427-5665

June 2009





Comprehensive Management Plan for Lake Agawam

**Village of Southampton
23 Main Street
Southampton, New York 11968**

Village Board of Trustees

Mark Epley, Mayor
Bonnie M Cannon, Trustee
Nancy C McGann, Trustee
Paul L Robinson, Trustee
Richard Yastrzemeski, Trustee
William F. Bates, Former Trustee

*This document was authorized and funded by the Village
Board of Trustees of the Village of Southampton,
with funding assistance from the Lake Agawam Conservation Association.*

June 2009



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1.0 INTRODUCTION

This document is a Comprehensive Management Plan for Lake Agawam, prepared at the request of the Village of Southampton Board of Trustees, by Nelson, Pope & Voorhis (NP&V), environmental and planning consultants to the Village of Southampton. This report provides a framework for improvements to Lake Agawam, developed through public input, review of literature and analysis of issues and opportunities for recommendations, in a framework that outlines actions, responsibilities, costs and schedule to ensure effective implementation.

1.1 Geographic Context

Lake Agawam is a 60 acre body of water located in the Village of Southampton, Suffolk County, New York. The lake is a focal point within the Village, lying centrally within the Village boundaries and extending from the west part of the Village downtown business district, south of Jobs Lane, to the Southampton Bathing Corporation along Gin Lane, south of which is the Atlantic Ocean. The north side of Lake Agawam is bounded by Agawam Park, and the water body is readily visible from Jobs Lane, Pond Lane, and Gin Lane, thus establishing its prominence as an important feature in the Village. A map depicting the lake and its context within the Village is provided as **Figure 1**, and a figure illustrating the lake and key geographic features is provided as **Figure 2**. *[All figures are contained in a separate section at the end of this report.]*

Figure 3 illustrates a 2004 aerial photograph of the surface watershed contributing area to Lake Agawam. The watershed area lies mostly within the Village of Southampton; however, the northern part of the watershed includes portions in the Town of Southampton, specifically the hamlets of North Sea and Tuckahoe.

1.2 Physical Characteristics

Like a number of other lakes in Southampton Village and along the south shore of Southampton Town, Lake Agawam was likely a basin created as a result of glacial meltwater traversing from the moraines and outwash plains to the north, south to the Atlantic Ocean. The lake was likely once connected to the ocean, but littoral drift along the south shore has created an east-west trending barrier beach which separates many similar water bodies from the ocean. Lake Agawam is now a freshwater body, and the only connection to the ocean is an outflow pipe used to relieve lake water levels by controlled release to the ocean through a manually operated valve.

1.3 Historic Context and Cultural Importance

Lake Agawam has played an important role in the history of the Village. The lake has historically been used mostly for recreation including sailing, boating, fishing and ice skating, and has been a source of enjoyment for Village residents since Village incorporation in 1894 and before.



Local resident accounts indicate the construction of new homes on the lake in 1882 (Memories of Southampton by Marion McKeever Thompson contained in Southampton Long Island 1640/1965, 325th Anniversary, 1965). Photographs generously provided by the Southampton Historical Museum and Research Center depict piers north of the Dune Church and the lake being used for small boat sailing. Celebrations and events, and boat landings along the lake were evident in the 1890's through the early 1900's. The lake was used by residents for row and sail boat transportation to go out at night and travel to the village or the beach. Other accounts recall Captain Pyrrhus Concer, who sailed an antique catboat ferry that carried people back and forth from the village to the beach (Treyor, unpublished manuscript, 1932). **Appendix A** of this report provides a photographic account of the importance of Lake Agawam and its historical context within the community; photographs were provided by the Southampton Historical Museum and Research Center located at 17 Meetinghouse Lane, Southampton. Agawam Park is and has been used for summer concerts and recreational enjoyment. Over time, the lake front has been developed with private residences with the exception of those noted stretches along Agawam Park, Pond Lane and Gin Lane. As a result, many Village residents now share their rear yards with the lake shore.

1.4 Identification of Issues of Concern

Water quality problems in Lake Agawam began in 1954, when fish kills provided evidence of depleted oxygen levels. There have been several notable fish kills in recent decades that have been a source of aesthetic and emotional impact, noted as follows:

- *July 20, 1954* - Many carp, white perch and bullheads killed in July by oxygen depletion (Oxygen as low as 0.5 ppm at 7' depth)
- *June 1981* - Fish kill; 225,000 fish died.
- *June 15, 2000* - Hundreds of white perch found dead, and firefighters used 4 pumper trucks to aerate the lake.
- *Fall 2005* - Fish kill due to cyanobacteria bloom.

Fish kills are generally preceded by algae blooms which occur as phytoplankton feed on excess nutrients (typically nitrogen and phosphorous) caused by groundwater and/or stormwater influx. The biological decomposition which occurs after an algae bloom uses up oxygen in the water, resulting in hypoxic conditions which cause fish kills. Hypoxic conditions can also occur as a result of long periods of stagnation (lack of mixing) during warm weather, when the water does not readily retain oxygen. Algae blooms have been documented on Lake Agawam and have been a primary cause of oxygen depletion with resulting impacts to the lake. Current concerns which are addressed by this study include:

- Stormwater discharge
- Groundwater outflow
- Pet waste management
- Waterfowl populations
- Fertilization and runoff
- Shoreline and buffer management
- Sediment accumulation and resuspension



Recommendations are provided to address these and other issues to assist in implementing the plan for improvements to Lake Agawam.

1.5 Purpose of Study

The purpose of this study is to address water quality problems of Lake Agawam, in order to improve the environmental health of the lake, and restore its prominence as a recreational and cultural resource. The study will raise the awareness of the lake and problems which confront it, and will provide a basis for actions by various levels of government to implement measures to improve water quality and aesthetics. An important part of the study is to include public input and participation, in order to gain the full benefit of available local knowledge and information, and to provide a platform for consensus building. The Lake Agawam Conservation Association has played a vital role in the dissemination of information, and their interest, input and commitment to improving Lake Agawam is acknowledged and appreciated.

The Comprehensive Management Plan will assemble all available information to date, so that it will form a comprehensive baseline of data and information for use in tracking the implementation of recommendations and lake improvements. It is the purpose of this study to provide an action plan for the lake's future, by identifying projects, preliminary budgets, funding sources, responsibilities and a tentative schedule for improvements.

1.6 Jurisdictional Entities

There are several jurisdictional entities which will play key roles in implementing improvements to Lake Agawam. The Village Board of Trustees of the Village of Southampton has commissioned this study, which is funded by the Village Board in concert with the Lake Agawam Conservation Association. The Village Board is committed to implementing improvements for the health of the lake, and has played a vital role in increasing public education and in taking actions to remedy water quality concerns. To date, the Village Board has been engaged in a number of activities to improve Lake Agawam. These include:

- Prior funding of water quality studies by Southampton College
- Installation of bubblers to add oxygen to the water
- Installation of additional stormwater recharge facilities within the watershed
- Public information and outreach through televised Village Board meetings
- Mailing a brochure on buffers to owners of lakefront property and Village residents

The current Village Board has taken a keen interest in ensuring that a meaningful plan which results in actual improvements to the lake is implemented; this Comprehensive Management Plan for Lake Agawam is the result of that commitment. The Village of Southampton was incorporated from the Town of Southampton in 1894, giving the Village jurisdiction over land use within the corporate boundaries of the Village. The Village's primary role is to ensure that the areas surrounding the lake result in reduced influx of pollutants to the lake. This will occur through public education, direct actions and legislative initiatives for those aspects of Lake Agawam that can be addressed through the jurisdiction of the Village Board.



The Village of Southampton Zoning Board of Appeals (ZBA) has legislative powers to review and approve applications for development and land use within certain setbacks of Village defined wetlands. This authority is granted under Chapter 116 Article IIIA of the Village code, and establishes setbacks of 200 feet for sanitary systems, 150 feet for structures and 125 for landscape limitations. Regulated activity occurring within these setbacks requires a permit from the ZBA. The Board has taken initiatives to reduce fertilizer dependent landscaping and increase and maintain natural buffers adjacent to Lake Agawam and other lakes, ponds and wetlands in the Village, as well as ensuring that development retains and recharges stormwater and conforms to required setbacks to the greatest extent practicable. The ZBA will continue to play a vital role in ensuring that land use within the required setback areas is reasonably controlled through their current authority, and does not cause adverse impacts to Lake Agawam or other Village wetlands.

The Town of Southampton plays a key jurisdictional role with respect to Lake Agawam. The Board of Trustees of the Freeholders and Commonalty of the Town of Southampton, referred to as the Town Trustees, are the stewards of the lake itself. The Town Trustees gain this jurisdiction through the Dongan Patent of 1686, a King's grant through his General Governor Thomas Dongan, which granted the Board of Trustees access, rights and stewardship of common underwater land and marshland within the Town. The Dongan Patent also guarantees every Town Freeholder the right to access and use this land and its resources. The Town Trustees have engaged in lake improvement activities in the past, including: removal of 5,000 pounds of carp in 2004; and, installation of four (4) bubblers at the south end of the lake. The Town Trustees have been actively involved with public outreach associated with this study by addressing the Village Board during public information meetings, and have provided input during the course of it's preparation. The Town Trustees control the parking area for the Southampton Bathing Corporation at the south end of the lake, and are encouraged through this study to explore parking lot improvements to provide more effective public access, aesthetic and environmental qualities and stormwater runoff control.

The Town of Southampton has also prepared an overall Stormwater Management Program (SWMP) which includes the Village of Southampton in accordance with the New York State Department of Environmental Conservation (NYSDEC) Stormwater Phase II regulations. These regulations were established in 2003 (and updated in May 2008), and require that municipalities in proximity to certain water bodies obtain permit coverage under the program for stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s). The Town and the Village as regulated MS4s prepared a SWMP which includes the development of public outreach programs on stormwater impacts, evaluation of best management practices for municipal operations (i.e., road salting, street sweeping, roadway drainage design, etc.), mapping of existing stormwater outfalls and drainage features, and establishing a program for review of construction sites for proper erosion controls and stormwater containment and local implementation of the construction stormwater permits. The SWMP also established a schedule for implementation of the first cycle of the program (March 2003 - March 2008) and required the preparation of annual reports on the implementation of the program to the NYSDEC.



Under the SWMP, the Town retained a stormwater manager that has sought grants and identified potential stormwater improvements in the Village of Southampton. Under the second cycle of the program (May 2008 – January 2013), the Town will be required to update the SWMP to meet the new General Permit (GP-0-08-002) requirements. Conformance to the SWMP will be required on an ongoing basis, and coordination with the Town of Southampton to ensure conformance to the multi-year improvement programs is critical.

Additionally under the NYSDEC Stormwater Phase II Program, General Permits are also required for stormwater discharges from construction activities which involve more than 1-acre of disturbance in areas which may contribute to a receiving water body. The General Permit (identified as SPDES GP-0-08-001), requires the preparation of a Stormwater Pollution Prevention Plan (SWPPP) designed to ensure proper erosion control and stormwater control measures are implemented during the construction period and that the post construction stormwater management system is properly designed and maintained. The SWPPP must be submitted for review by the local municipality prior to filing of a Notice of Intent for coverage under the General Permit prior to commencing the activity and a Notice of Termination when activities are complete with NYSDEC.

NYSDEC typically regulates activities within 100 feet of State designated freshwater wetlands under the statutory authority of Article 24 of the NYSECL and the enabling regulations of 6NYCRR Part 663. This jurisdiction applies to other lakes, ponds and wetlands in the Village; however, for Lake Agawam this authority does not exist and as of 1991, all permitting activities lie with the Village ZBA. **Appendix B** contains a letter from the NYSDEC indicating the freshwater wetland permit authority for Lake Agawam as delegated to the Village of Southampton pursuant to the enabling regulations of 6NYCRR Part 665.

The Suffolk County Department of Health Services (SCDHS) is an agency which regulates subdivision of land and density of land use under Article 6 of the Suffolk County Sanitary Code (SCSC) for the purpose of ensuring that properly designed and installed sanitary systems or sewage treatment are in place for land use projects, and to ensure that excess nitrogen loading does not occur from sanitary waste. SCDHS reviews and acts on subdivision applications and permits to construct sanitary systems. In addition, the SCDHS Board of Review considers sanitary transfer credit applications. This agency is important in ensuring groundwater and surface water protection from sanitary discharge.



2.0 LITERATURE SEARCH

There are a significant number of studies, reports and news items which are important for consideration in the development of the Comprehensive Management Plan for Lake Agawam. This section is intended to identify the programs, studies, reports and references that have been reviewed with respect to water quality, past management efforts and future recommended efforts. **Appendix C** includes a review of both news items and research studies, which are the product of a data mining effort to compile a comprehensive reference list of information related specifically to Lake Agawam. Resources and information were compiled by reviewing Village and office resource files for past studies which may have contained recommendations for Lake Agawam, as well as by meeting with Town of Southampton officials, NYSDEC, SUNY Southampton education/research professionals, and community representatives. The overall review and resulting information have been considered and utilized in development and evaluation of management recommendations. Applicable information from these studies, reports and references are briefly summarized below and identified in **Appendix C**.

The earliest known ecological study on Lake Agawam was a fish inventory performed by the NYS Conservation Department (presently known as NYSDEC) in July 1938, which identified the presence of largemouth bass, rock bass, white perch and carp in the lake (**NYSCD, 1938**). The inventory also noted that carp were overly abundant and the fish were being seined out in an attempt to reduce their population in the lake. A second fish inventory conducted by NYS Conservation Department in July 1954 noted the presence of brown bullhead (catfish) and banded killifish in addition to white perch and carp (**NYSCD, 1954**). The inventory further reported a hypoxic event followed by a fish kill on July 20th, 1954, just a few days after the fish inventory was conducted. Fish population control measures (poisoning) were slated to be conducted by the Town of Southampton that same fall, but control measures were not performed due to a September hurricane event which flooded Lake Agawam. The 1970 fish inventory noted the common presence of pumpkinseed in addition to white perch, European carp, and an abundant brown bullhead population (**NYSCD, 1970**). The 1982 fish inventory had similar results, but with largemouth bass also being observed (**NYSDEC, 1982**). A NYSDEC permit was issued in April 2003 to remove carp with the intention of balancing nuisance and recreational game fish (**NYSDEC, 2004**). In July 2003, a NYSDEC fish stocking permit was also issued to increase largemouth bass populations in the lake (**NYSDEC, 2003**). In 2007, the NYSDEC indicated that no fish are presently stocked in Lake Agawam, as it contains naturally reproducing populations of largemouth bass, bluegill, pumpkinseed, white perch, carp and brown bullhead (**NYSDEC, 2007**).

Fish kills within the lake were reported in multiple articles within the New York Times in 1981 and 2000 (**NY Times, 1981a, 1981b; Wright, 2000**). In 1984, a local newspaper reported a wetland improvement project in the southwest corner of the lake which involved the removal of extensive water lily vegetation. Efforts to improve the condition of Lake Agawam sparked up again in 2002 with a discussion on the general needs of the lake published in The Southampton Press (**Wright, 2002**). A proposal for gunderbooms and storm drain filters was put forth in 2002 with Hildreth's Department Store pledging their support.



The SCDHS conducted sediment monitoring within Lake Agawam to assess whether sediment traps installed by the Village had a significant impact on metal concentrations in bottom sediments of the lake (SCDHS, 2003). Baseline sediment samples from 2000 were compared with samples collected in 2003 and determined that metal levels were consistent with other freshwater sediments in Suffolk County and posed no threat to public health. No significant volatile organic compounds were detected in the samples. The report concluded that it was unclear whether the sediment traps had made a significant impact on metal concentrations, as it could take more than ten years before sediment contamination levels significantly changed. The SCDHS recommended that the traps be inspected and maintained regularly, but that no further sediment sampling be considered until at least 2008.

The health of Lake Agawam is a public concern and the distasteful green color of overly enriched and polluted Lake Agawam waters even became a topic of discussion on David Patrick Columbia's New York Social Diary (2006). In 2007, the installation of Solarbees for aeration of the lake was pushed for by local residents to combat algal problems, and the removal of carp was again considered (Wright, 2007). The Town of Southampton indicated their dedication of stormwater fund money to conduct outfall and infrastructure mapping as well as install new catch basins and leaching pools to protect three of the Village's ponds. Also in 2007, Professor Christopher Gobler expressed his concern regarding the bubblers which were installed within Lake Agawam, as their circulation of water could potentially cause more harmful conditions by promoting the growth of toxic cyanobacteria (Hamptons.com, 2007). In the Fall 2007 issue of The Village News, the Town's plan for stormwater retention in the Lake Agawam watershed was reported and NP&V was retained, with funding from the Village and the newly formed Lake Agawam Conservation Association, to prepare a comprehensive management plan for the lake.

No water quality monitoring had been known to occur in Lake Agawam until 2003, when Professor Christopher Gobler, Ph.D., of Southampton College (currently State University of New York, Southampton and Stony Brook) began conducting a preliminary assessment of water quality in the lake with weekly sampling conducted from April through August. Measured parameters included dissolved oxygen, temperature, salinity, chlorophyll *a*, nutrients, water clarity, coliform bacteria, cyanobacteria and bottom sediment sampling. Preliminary results indicated extremely high levels of nutrients and bacteria were entering the lake from storm drains (Gobler, 2003). The final report, released in May 2004, concluded the lake was a biologically stressed, hypereutrophic ecosystem which experienced high algal growth, varying levels of bacteria and low levels of oxygen (hypoxia) along the lake bottom in summer months.

Data from 2003 also indicated that harmful toxins produced by cyanobacteria were present in Lake Agawam, with the highest levels being observed from late July through October (Gobler, 2004). Cyanobacteria are a common family of blue green algae which are typically associated with over-enriched eutrophic and poorly flushed waters. There are several potentially toxic subspecies of these algae capable of producing harmful cyanotoxins, such as hepatoxins (e.g. microcystin) which target the liver. The abundance of these toxins in aquatic ecosystems has serious implications for wildlife and human health, as multitudes of sicknesses and even deaths have been associated with the consumption of contaminated water. Nutrient loading combined with warm temperatures is known to increase algal blooms in summer months, and is therefore also thought to increase the potential growth of harmful varieties of cyanobacteria in poorly



flushed waters (**Gobler, 2007**). A warning of harmful cyanobacteria algal blooms was posted at Lake Agawam by the Board of Trustees in August 2004 to inform the public of these hazards.

Additional sampling in 2004 was aimed at identifying the drivers of cyanobacterial growth (**Gobler et al., 2007**) and the dominance of microcystin-producing *Microcystis sp.* blooms during summer were linked to nutrient saturated conditions and suppression of mesozooplankton grazing. Bloom decline was associated with nutrient limitation, which reduced growth rates and toxin production by *Microcystis* and in turn may have permitted zooplankton to graze cells (**Gobler et al., 2007**). Part of a larger study among New York and the Lower Great Lakes Ecosystems finds that microcystin toxins are the most common cyanobacterial toxin encountered in the region, with nearly 60% of samples containing detectable levels of microcystins (**Boyer, 2007**).

A four year study of 20 lakes throughout Suffolk County was undertaken by Professor Gobler to assess the presence of toxic cyanobacteria blooms in recreational areas and the factors which are associated with promoting these blooms (**Gobler, 2007**). While the majority of the lakes studied had levels below the threshold considered to be a low recreational risk by the World Health Organization (WHO), Lake Agawam was identified as a lake which posed moderate-to-high risks to human health for recreation at various times during the study. The guidelines established for municipalities by the WHO for microcystin concentrations in natural water bodies are $1 \mu\text{L}^{-1}$ for drinking water supplies, 2 to $4 \mu\text{L}^{-1}$ for low recreational risk, and $20 \mu\text{L}^{-1}$ for moderate recreational risk. Water quality samples obtained from 2005 revealed an average annual microcystin concentration of $5.30 \pm 1.19 \mu\text{L}^{-1}$ in Lake Agawam, with concentrations ranging from 0.567 to $11.8 \mu\text{L}^{-1}$ over the summer months. High risk concentrations are indicated to be cyanobacteria mats which can form near the shore, and are to be avoided. A warning was posted at Lake Agawam in August 2004 to notify the public of precautions to take during harmful cyanobacteria algal bloom events to reduce the risk of illness.

As toxic blue green algae blooms are associated with stagnant, eutrophic waters, the following two approaches should be tested as methods for reducing the occurrence and risk of toxic cyanobacteria blooms in afflicted lake systems (**Gobler, 2007**):



Photo: Chris Gobler, MSRC

1. Install water circulators to push surface dwelling cyanobacteria to the bottom of the lake, potentially preventing bloom occurrence; and
2. Target the reduction of primary sources of nutrients into Lake Ronkonkoma in conjunction with monitoring to assess the relation of nutrient loads on algal blooms.



As part of an ongoing study (**Davis & Gobler, 2007**), additional water quality sampling was conducted weekly to biweekly from May through November 2007 in Lake Agawam by Professor Gobler's laboratory (**Harke et al., 2008**). In addition to sampling, an attempt was made to assess the relative sources and quantities of nutrients flowing into Lake Agawam using data collected from June through October 2007 (**Harke et al., 2008**). Nutrient sources for the lake were determined to be a large storm drain at the northwest corner of the lake, benthic fluxes of nutrients from bottom sediment, groundwater, atmospheric deposition and surface runoff from adjacent land uses. Among these sources, groundwater, stormwater and benthic sediments were found to be the greatest contributors of pollutants to the lake. Although groundwater appears to be a large contributor of nutrients to the lake, remediation of groundwater provides a challenge both from the standpoint of potential sewerage and maintenance/upgrade of existing sanitary systems. Control of additional density increases within the watershed should be carefully monitored and limited where possible. Given the challenge of groundwater remediation, **Harke et al.** suggest that remediation tactics to reduce the nutrient loads may best be focused on sediment dredging and diversion of stormwater runoff.



3.0 INVENTORY OF WATERSHED/LAND USE CONDITIONS

The following section describes the current conditions of the Lake Agawam Watershed and land use within the watershed.

3.1 Watershed Area

The Lake Agawam surface watershed area encompasses approximately 1,145 acres within the Village of Southampton, as well as portions in the Town of Southampton, specifically the hamlets of North Sea and Tuckahoe (**Figure 1**). The northernmost point of the watershed is located just south of the intersection of Majors Path and Henry Avenue. The watershed is more particularly described by the following:

Beginning at the intersection of Ox Pasture Road and First Neck Road, heading southwest approximately 150 feet, heading south along the west side of First Neck Road approximately 1,000 feet, before heading southeast approximately 800 feet to the east side of First Neck Road, before heading southwest approximately 300 feet, before heading southeast approximately 1,400 feet to Dune Road, before heading east approximately 880 feet, before heading south approximately 150 feet, before heading northeast approximately 700 feet to the east side of Atlantic Avenue, before heading north approximately 200 feet along the east side of Atlantic Avenue, before heading northeast approximately 850 feet along the beach line, before heading north approximately 720 feet south of Gin Lane, before heading northwest approximately 770 feet to the west side of South Main Street, before heading northeast approximately 690 feet to south of Foster Crossing, before heading northwest approximately 780 feet to north of Foster Crossing, before heading northeast approximately 3,100 feet to just south of Hampton Road, before heading northwest approximately 2,500 feet to Pulaski Road, before heading north approximately 630 feet to Powell Road, before heading northwest approximately 1,500 feet to County Road 39, before heading northwest approximately 1,000 feet to east of North Main Street, before heading west approximately 1,200 feet to west of North Main Street, before heading northwest approximately 1,200 feet, before heading northwest approximately 1,400 feet to just east of Majors Path, before heading southwest approximately 1,000 feet just south of Henry Road and east of County Road 38, before heading south approximately 1,800 feet to north of State Route 27, before heading southwest approximately 260 feet, before heading southeast approximately 400 feet, before heading south approximately 1,700 feet to Windward Way, before heading southeast approximately 1,300 feet to just north of White Street, before heading south approximately 2,100 feet to Montauk Highway between Breese Lane and Vahradian Lane, before heading southeast approximately 750 feet to west of First Neck Lane, before heading south approximately 750 feet, before heading southeast approximately 450 feet, before heading south approximately 700 feet to just north of Ox Pasture Road, then bearing southwest approximately 250 feet to the commencing position at the intersection of Ox Pasture Road and First Neck Road.

3.2 Topography

Topography within the watershed is illustrated in **Figure 4** with a Digital Elevation Model obtained from USGS. As illustrated, topography generally decreases from north to south. Within the northern portion of the watershed, areas of higher relief exist closer to the boundaries of the watershed while the center of the watershed has a lower relief. Topography within the remainder of the watershed shows the general downslope trend of the land surface toward the lake.



3.3 Soils

Soils within the watershed can be generally described as soils of the Bridgehampton-Haven association, which are deep, nearly level to strongly sloping, well drained to moderately well drained, moderately coarse textured and medium-textured soils found on moraines. Specific soil types within the watershed are illustrated in **Figure 5**. Bridgehampton soils (BgA, Bm) and Haven soils (HaA, HaB, He) are predominant within the watershed, and are characterized by the larger soil association described above.

Areas within the center of the watershed generally display the highest soil diversity. Riverhead soils (RdA, RdB) and Plymouth-Carver soils (PIB, PIC) are the predominant soils within the center of the watershed. Riverhead soils are generally deep, well-drained, moderately coarse textured soils. Plymouth-Carver soils are generally deep, excessively drained, coarse-textured soils. Other soils found within the watershed consist of Berryland mucky sand (Bd), Cut and Fill Land, gently sloping (CuB), Dune Land (Du), Fill Land, sandy (Fs), Urban Land (Ur), and Walpole sandy loam (Wd).

3.4 Subdrainage Areas

In total, fourteen subdrainage areas were identified within the Lake Agawam watershed, and are illustrated in **Figure 6**. The subdrainage areas were delineated using Digital Elevation Model data from USGS and the Spatial Analyst extension in ArcView. It should be noted that these areas are based upon topography only. Generally, the larger drainage areas are located within the northern portion of the watershed, while the smaller areas are located within the southern portion of the watershed.

3.5 Hurricane Hazard Areas

Information regarding areas within the watershed that would be affected by hurricanes was obtained from FEMA. Sea, Lake, and Overland Surges from Hurricanes (SLOSH) data, which determines which areas will be most impacted by varying categories of hurricanes, is illustrated in **Figure 7**.

Generally, areas within approximately 100 feet of the lake will be affected by Category 1 and greater hurricanes. Areas within approximately 200 feet of the lake will be affected by Category 2 hurricanes and greater. Areas which are affected by Category 3 hurricanes and greater vary in distance from the lake, and seem to be dependent upon topography. Areas which are affected by Category 5 hurricanes and greater also vary surrounding the lake, but extend as far north as just south of the intersection of White Street and Windmill Lane.



3.6 Groundwater

Groundwater elevation is illustrated in **Figure 8** and ranges from 0 to 3.8 feet above sea level (asl). Groundwater elevation generally increases from south to north. Depth to groundwater within the watershed is illustrated in **Figure 9**. The depth to groundwater ranges from 0 feet asl in the southern portion of the watershed to 36 feet asl in the northernmost portion of the watershed. Generally, depth to groundwater is less in the center of the watershed, while areas towards the boundaries of the watershed and in the northern portion have a greater depth to groundwater.

3.7 Land Use

Land use within the watershed area is comprised of eleven categories. The most prevalent land use within the watershed consists of Residential use, which encompasses approximately 45.42 percent of the watershed. Roadway use and Commercial use follow Residential use in terms of magnitude, which encompass 12.31 percent and 12.11 percent of the watershed, respectively. Agricultural, Community Service, Vacant uses and the lake each encompass approximately 7 percent of the watershed. Finally, Public Service, Recreation and Entertainment, Wild, Conservation and Public Parks, and Unknown uses each encompass less than 2 percent of the watershed. **Table 1** below details the acreages and percents of land use for each category.

TABLE 1
LAND USES WITHIN THE LAKE AGAWAM WATERSHED

Land Use Type	Area (Acres)	Percent
Agricultural	80.51	7.03
Commercial	138.67	12.11
Community Service	89.65	7.83
Lake	64.76	5.66
Public Service	23.75	2.07
Recreational & Entertainment	5.93	0.52
Residential	520.08	45.42
Road	140.96	12.31
Vacant	74.84	6.53
Wild, Forested, Conservation Lands & Public Parks	5.42	0.47
Unknown	0.60	0.05
Total	1,145.16	100.00



3.8 Zoning

Figure 12 illustrates zoning within the watershed. Fifteen zoning categories are represented within the watershed boundary, and consist of residential zoning, commercial zoning, and industrial zoning. The area within the watershed is dominated by residential zoning. Zoning surrounding the lake itself is entirely residential, with the majority of the zoning consisting of R-120. Generally, areas near the boundary of the watershed are residentially zoned. Commercial zoning primarily occurs within the interior of the watershed, and consists of OD – Office District, VB – Village Business District, and HB – Highway Business District. Two areas of industrial zoning occur within the watershed, which consist of LI – Light Industrial and LI40 – Light Industrial (40,000 sq. ft. lots). These areas are located within the northern portion of the watershed and both are surrounded by business and commercial zoning.

3.9 Publicly Owned Lands

Publicly owned lands within the watershed consist of both Town-owned and Village-owned lands, which are illustrated in **Figure 13**. Only a small portion of the land within the watershed is publicly owned. The Town owns two parcels used for recreation in the northern portion of the watershed, one vacant parcel along State Route 27A, one parcel used for institutional purposes near the eastern boundary of the watershed, on low density residential use adjacent to the northern end of the lake, and Lake Agawam itself. Village-owned lands include three commercial parcels to the north of the lake, several institutional parcels to the north of the lake, several vacant parcels north of the lake, and a park adjacent to the north end of the lake.

3.10 Stormwater Inventory

Stormwater infrastructure within the watershed was inventoried in May 2008 by Safi Sammi, a Village intern. NP&V coordinated the data sheets and gathering of information completed during the internship. The results of the inventory are depicted in **Figure 10**, which illustrates the locations of each structure as well as the structure type. The survey included observations on condition and maintenance needs associated with observed structures.

In total, 140 catch basins were identified within the watershed. Three areas in particular have large concentrations of catch basins. The first area occurs just north of the lake along State Route 27A. The second area occurs on North Main Street between Layton Avenue and the Long Island Railroad. The final concentration of catch basins occurs along North Sea Road between Miller Road and Valorie Road. It is expected that the first grouping of catch basins drains to the Lake, while the second and third grouping provide for direct recharge. In total, 36 catch basins are in need of maintenance or repair.

Two areas of significant flooding were identified during the stormwater inventory. The first area is located at the southern boundary of the watershed, while the second area is located at the intersection of Cameron Street and South Main Street. Two areas of overland flow were also identified within the watershed, both of which are located on the north side of Dune Road at the bulkhead at the southern end of the Lake.



4.0 Inventory of Lake Conditions

The following section describes both historical and current conditions of the lake.

4.1 Shoreline Vegetation Inventory

An inventory of the vegetation within the lake and within a 100 foot buffer, or riparian area, surrounding the lake was performed by NP&V in November of 2007. Five vegetation categories were identified within the lake and its riparian area, which are illustrated in **Figure 14**. Areas of lawn predominantly surround the lake, with the exception of the pavement which dominates the southernmost buffer of the lake. In total, 17.1 acres (67.2 percent) of lawn is located within the 100 foot riparian area surrounding the Lake. Common reed (*Phragmites australis*), is an invasive plant which currently encompasses approximately 0.9 acres (3.4 percent) of the riparian area along the lake's edges. Comparatively, native vegetation catalogued along the shoreline made up approximately 1.4 percent of the buffer area and included native assemblages of wetland plants, such as sedges, rushes, willow and sweet pepperbush. Other vegetation totaled 12.3 percent of the riparian buffer and included wooded areas as well as areas of lower shoreline vegetation where native species were highly mixed with invasive species, such as porcelainberry. Additionally, a small area of denuded shoreline on the west side of the lake, where all vegetation had been physically removed, totaled approximately 0.1 acres (0.3 percent of the buffer area). Within the lake, aquatic water lily vegetation was only observed in two areas of the lake during the November inventory, along the western shoreline and along the southwestern corner of the lake.

TABLE 2
LAND COVER WITHIN 100 FEET OF LAKE AGAWAM

Land Cover Type	Area (Acres)	Percent
Lawn	17.1	67.2
Pavement	3.7	14.6
Other Vegetation	3.1	12.3
Phragmites	0.9	3.4
Native Vegetation	0.4	1.4
Buildings	0.2	0.8
Denuded	0.1	0.3
Total	25.4	100.00

4.2 Bathymetry and In-Lake Features

Bathymetry of the lake is depicted in **Figure 14** and was obtained from soundings performed by NP&V in November 2007. Depth within the lake ranges from 0 to 10 feet. Gradual sloping along the lake bottom is greatest near the shoreline and the bathymetry remains more constant near the center of the lake.



Fountains and bubblers which had both been installed within the lake were also inventoried by NP&V in November 2007 (**Figure 14**). GPS coordinates were obtained for locating the bubblers. Three fountains were identified within the northern portion of the lake, and are maintained by the Village for aeration of the lake, as well as for aesthetic purposes. Sixteen bubblers were located within the lake during the December survey. Six of the bubblers were grouped in the northern portion of the lake, three within the middle of the Lake, and seven in the southern end of the lake.

4.3 Inlets and Outlets

Stormwater inputs and outfalls within the lake are illustrated in **Figures 10 and 14**. Inlets generally result from direct flow into the lake from the surrounding watershed. Holes located in the bulkhead along the southern shoreline of the lake also contribute runoff directly to the lake. Four outfalls were identified by NP&V in November 2007 within the lake. Three of these stormwater outfalls are located on the northern shoreline of the lake. The fourth pipe structure is an outlet located at the southeast corner of the lake and solely serves as an overflow conveyance that can be manually opened to discharge lake water to the Atlantic Ocean when water levels within the lake become too high. The main stormwater outfalls are considered a single storm drain at the northwest corner of the lake, which contains two outflow openings that both release water during rain fall events. This structure is a large pipe which extends up Windmill Lane to North Sea Road and collects runoff within the upper and lower reaches of the watershed, for discharge to the lake. The exact alignment and limit of this conveyance system, as well as connected catch basins is not clear at this time. Water quality sampling was conducted at these outflow pipes in 2007 by Professor Gobler's laboratory group (**Harke et. al., 2008**) and is further discussed in **Section 6.1**.

4.4 Waterfowl

Canada geese have been observed both in the lake and in the area surrounding the lake. Feces as a result of Canada geese are a known pollutant to freshwater systems, as the feces result in additional nitrogen inputs to the lake. Excess nutrients such as nitrogen within freshwater systems can cause harmful algal blooms (HAB's) which are a known problem in Lake Agawam (**Gobler 2007**).



5.0 PUBLIC PARTICIPATION

5.1 Public Input

The Southampton Village Board of Trustees requested a proposal from NP&V to prepare the Comprehensive Management Plan for Lake Agawam. NP&V, as environmental planning consultant to the Village, had been involved with the study of the lake through meetings with the Trustees and community members, and reports to the Board at public board meetings for several years prior to this study. During the course of discussions, owners of property in the Village interested in Lake Agawam formed the Lake Agawam Conservation Association (LACA) which includes interested stakeholders with lakefront property and members of the Southampton Bathing Corporation. On the date that the Village Board accepted the proposal for preparation of this plan (September 12, 2007), the Lake Agawam Conservation Association had been involved and was sufficiently organized and committed to the project to pledge monetary assistance for the study. The study commenced and the LACA has been involved since that time.

The LACA held a meeting in New York City on November 15, 2007, at which Mayor Mark Epley presented the resident group with information and an update on the study. The objectives and status of the study were discussed.

A presentation on the progress of the study to date was provided to the Board of Trustees at a public meeting on April 10, 2008. A PowerPoint Presentation was given by Charles J. Voorhis, CEP, AICP of NP&V, at which time, progress to date and preliminary recommendations were shared with the public. Included in the presentation was the following information:

- a summary of the Lake Agawam watershed;
- mapping including sub-drainage areas, depth to groundwater, hurricane inundation zones, aerial photography and land use;
- the results of an inventory of lake conditions (shoreline conditions, lake bathymetry, installed bubbler systems, inventoried lake vegetation, etc.); and
- Preliminary recommendations for the watershed area, the riparian buffer areas, and lake management recommendations for the water body itself.

The presentation was augmented with information provided by Dr. Chris Gobler, Ph.D., professor at the State University of New York (SUNY), Marine Science Research Center (MSRC) (Stony Brook and Southampton Campuses), who has been involved with graduate studies in the study of water quality in Lake Agawam since 2003. Dr. Gobler was in the process of completing an updated report on recent water quality and pollution source findings for the lake and provided a supplemental PowerPoint Presentation of their findings to date. Fred Havemeyer, Trustee of the Town of Southampton, attended and spoke at the meeting to provide input from the perspective of the Town Trustees. The presentation was followed by a question and answer period, and the video-recorded event was later televised on Channel 18 for further public information.



On May 2, 2008, Dr. Gobler and the MSRC hosted a Marine Science Symposium at the Southampton College Campus of SUNY at which he presented a summary of findings from the Lake Agawam water quality research. Representatives of NP&V were in attendance at this symposium.

The Lake Agawam Conservation Association held a member meeting on July 12, 2008, to update the membership on the status of the study and to gain further input to provide to the Village Board of Trustees and the consultant prior to finalization of the report. This input was incorporated to ensure participation of interested stakeholders.

The Village Board held a public meeting on July 10, 2008, at which NP&V presented the Draft Comprehensive Management for Lake Agawam for further public input and discussion. Input received during questions and answers at the meeting were further incorporated into the final report, as necessary. Similar to the April meeting, this event was televised for public information purposes.

5.2 Public Outreach

As a result of meetings conducted between NP&V and the Lake Agawam Conservation Association, a “Buffer Zone Kit” was prepared to educate land owners surrounding the lake. The kit includes a pamphlet created by NP&V, “An Owner’s Guide to Lake Agawam,” which contains basic information regarding the water quality of the lake, and what residents can do to improve the quality of the lake. Suggestions include native plantings within the 100 foot buffer zone surrounding the lake, reduction of lawn fertilization, and maintenance of septic systems. In addition to the pamphlet, a sign to delineate a “No Mow Zone” area on individual properties was designed by the LACA and is also included so that landscapers would not mow within the buffer zone. ‘An Owner’s Guide to Lake Agawam’ and ‘Buffer Zone’ signs, which were distributed to homeowners around the lake by Lake Agawam Conservation Association in June 2008. Information and status updates regarding the lake will continue to be provided to residents surrounding the lake.



6.0 ANALYSIS OF CONDITIONS

Two main issues were identified regarding the conditions of the lake. Problems regarding both surface water quality and groundwater quality have been identified within Lake Agawam and its watershed, and are further summarized below.

6.1 Surface Water Quality

Surface water quality has been studied extensively by Christopher J. Gobler, Ph.D. since 2003. His studies resulted in the identification of harmful cyanobacteria within the lake. Cyanobacteria are a common family of blue green algae which are typically associated with over-enriched, eutrophic and poorly flushed waters. There are several potentially toxic sub-species of these algae capable of producing harmful cyanotoxins, such as hepatoxins (e.g. microcystin) which target the liver, as well as neurotoxins (e.g. anatoxin-a) which target the neurological system. The abundance of these toxins in aquatic ecosystems has serious implications for wildlife and human health, as multitudes of sicknesses and even deaths have been associated with the consumption of contaminated water. Nutrient loading combined with warm temperatures is known to increase algal blooms in summer months, and is therefore also thought to increase the potential growth of harmful varieties of cyanobacteria in poorly flushed waters (**Gobler, 2007**). Dr. Gobler's water quality findings illustrate Lake Agawam exhibits levels of chlorophyll and nutrients (nitrogen and phosphorus) that deem it a hypereutrophic water body by EPA guidelines.

Sampling of Lake Agawam in 2004 was aimed at identifying the drivers of cyanobacterial growth (**Gobler et al., 2007**) and the dominance of microcystin-producing *Microcystis sp.* blooms during summer were linked to nutrient saturated conditions and suppression of mesozooplankton grazing. Bloom decline was associated with nutrient limitation, which reduced growth rates and toxin production by *Microcystis* and in turn may have permitted zooplankton to graze algal cells (**Gobler et al., 2007**).

A four year study of 20 lakes throughout Suffolk County was undertaken by Professor Gobler to assess the presence of toxic cyanobacteria blooms in recreational areas and the factors which are associated with promoting these blooms (**Gobler, 2007**). While the majority of the lakes studies had levels below the threshold considered to be a low recreational risk by the World Health Organization (WHO), Lake Agawam was identified as a lake which posed moderate-to-high risks to human health for recreation at various times during the study. The guidelines established for municipalities by the WHO for microcystin concentrations in natural water bodies are $1 \mu\text{L}^{-1}$ for drinking water supplies, 2 to $4 \mu\text{L}^{-1}$ for low recreational risk, and $20 \mu\text{L}^{-1}$ for moderate recreational risk. Water quality samples obtained from 2005 revealed an average annual microcystin concentration of $5.30 \pm 1.19 \mu\text{L}^{-1}$ in Lake Agawam, with concentrations ranging from 0.567 to $11.8 \mu\text{L}^{-1}$ over the summer months. High risk concentrations are indicated to be cyanobacteria mats which can form near the shore, and are to be avoided. A warning was posted at Lake Agawam in August 2004 to notify the public of precautions to take during harmful cyanobacteria algal bloom events to reduce the risk of illness.



As part of an ongoing study (**Davis & Gobler, 2007**), additional water quality sampling was conducted weekly to biweekly from May through November 2007 in Lake Agawam by Professor Gobler's laboratory (**Harke et al., 2008**). In addition to sampling, an attempt was made to assess the relative sources and quantities of nutrients flowing into Lake Agawam using data collected from June through October 2007 (**Harke et al., 2008**). Nutrient sources for the lake were determined to be a large storm drain at the northwest corner of the lake, benthic fluxes of nutrients from bottom sediment, groundwater, atmospheric deposition and surface runoff from adjacent land uses. Among these sources, groundwater, stormwater and benthic sediments were found to be the greatest contributors of pollutants to the lake.

Lake Agawam is not currently listed as a priority waterbody on the Final New York State 2006 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy¹. The 303(d) List identifies those waters that do not support appropriate uses and that may require development of a Total Maximum Daily Load (TMDL) or other restoration strategy to attain quality standards. At this time, development of the 2008 Section 303(d) List is in progress and the NYSDEC has indicated they will be conducting a reassessment of water quality conditions at Lake Agawam during the summer of 2008; until the Final 2008 list is approved by the USEPA, the 2006 Section 303(d) List is considered to be the most current List of Impaired/TMDL Waters.

The analysis that supports the 303(d) List is provided in a NYSDEC report entitled the Waterbody Inventory/Priority Waterbodies List (PWL) Report. The most recent NYSDEC Waterbody Inventory/Priority Waterbodies List Report for the Long Island region was published in April of 2002 and includes inventory and assessments for each waterbody in the area.

A March 2001 waterbody assessment prepared for Lake Agawam lists the lake as having minor impacts. The assessment identifies dissolved oxygen/oxygen demand and nutrients as the pollutants impacting lake water quality and which are suspected of stressing aquatic life support (see **Appendix D**). Urban runoff is listed as the suspected source of pollutants.

6.2 Groundwater Quality

As previously noted, groundwater quality is one of the greatest contributors of pollutants to the lake (**Harke et al. 2008**). Water quality data from two USGS monitoring wells (S-8836 and S-48441) within the watershed was consulted in order to gather information regarding groundwater quality. It should be noted that data from these wells is currently very limited. Even though well S-52652 is located in close proximity to the lake (approximately 440 feet to the north of the lake), only water level data was recorded from this well. Well S-8836 has 5 water quality samples which were collected in the 1970s. Results of analysis from these samples found low chlorides (no saltwater intrusion) and small but detectable nitrates (even for lab procedures in the 1970's which could not detect low concentrations). Nitrate values were found at concentrations in the range of 5.4–14 mg/L, where 10 mg/L is the drinking water standard, and pH values were found to be 5.3 to 6.1.

¹ Section 303(d) refers to Section 303(d) of the Federal Clean Water Act which requires states to periodically assess and report on the quality of waters in their state.



Well S-48441 has 24 water quality samples which were collected between 1973 and 1998. Results from analysis of these samples indicates medium to low chlorides, which tended to decrease with time. Sulfate results mirror the same trend as the chlorides. It should be noted that sulfate is not an EPA listed contaminant, but is a secondary contaminant (<http://www.epa.gov/safewater/contaminants/unregulated/sulfate.html>). The EPA considers the Maximum Contaminant Level (MCL) for sulfates to be 250 mg/L and the highest measured value was 87.5 mg/L from the 24 water quality samples. Samples analyzed from 1981-1998 were analyzed for Volatile Organic Carbon's (VOC's) which were not found. The highest nitrate value recorded from these samples was 32 mg/l (filtered), and was found on August 28, 1974. Samples measured after 1976 averaged much lower concentrations than the values measured earlier. All values recorded during 1977 and later were collected and analyzed by SCDHS; values from prior to 1977 were collected and analyzed by USGS. As previously stated, the drinking water standard for nitrate is 10 mg/L. Typical pH values recorded ranged from 5.6 to 7.0, with a mode of 6.1. It is interesting to note that the sample analyzed in 1973 found 53 pCi/L (picoCuries per liter), which is greatly above the 5 pCi/L MCL listed in the EPA's drinking water contaminant list (<http://www.epa.gov/safewater/contaminants/index.html>).



7.0 RECOMMENDATIONS

The following section provides recommendations for improving water quality within the lake and within the watershed in consideration of the extensive body of information gathered for this report. Recommendations are divided into sections including: Shoreline Improvements which address primarily Riparian (buffer) areas; Stormwater Improvements which address primarily watershed area improvements; Lake Aeration and Water Quality Improvements which primarily address lake management; and Water Quality Monitoring and research. A major emphasis of this study is education of residents, stakeholders and visitors that enjoy the lake and have a deep desire to improve the aesthetic and ecological characteristics of Lake Agawam. Recommendations are further examined in **Section 8.0**, which provides an action plan identifying responsible entities, project timing (short term and long term), potential funding and preliminary costs to implement the recommendations of this report.

7.1 Shoreline Improvements

Riparian (Buffer) Area Recommendations

- Control waterfowl populations through management practices.
 1. Discourage lawns fronting lake shore areas.
 2. Discourage feeding of waterfowl populations.
- Encourage homeowners to remove fertilizer dependent vegetation and establish native planting areas.
 1. Naturalized meadow, woodland and shrub planting areas intercept and filter stormwater and reduce fertilizer/nutrient input.
 2. Village laws encourage natural plantings within 125 feet of wetlands through ZBA issued wetland permits.
 3. Place shade trees near shore that will provide soil stability, biological uptake and shading of surface water to maintain lower water temperatures allowing higher dissolved oxygen levels.
- Remove invasive vegetation in favor of natural habitat areas under controlled re-vegetation restoration programs.
- Examine municipally owned lakefront areas for improvement opportunities (control direct stormwater overflow from paved surfaces in close proximity to the lake; establish lake front walking trails in areas where public access can be provided; provide public education and interpretive signage in appropriate lakefront areas).
 1. Consider installation of a drainage swale and subsurface detention along Pond Lane in connection with pedestrian walks, landscape improvements and sitting areas for lake enjoyment.
 2. Consider potential for invasive species removal, stormwater control and lake front walking trails for Gin Lane area at south and southeast part of the lake.



3. Work cooperatively with the Town Trustees to improve the Gin Lane and Bathing Corporation parking area by reducing pavement, installing a “rain garden” along the shoreline, installing a low sill bulkhead along the southern shoreline (to retain parking capacity), subsurface drainage improvement, pedestrian circulation/traffic calming and providing aesthetic improvements through landscaping (see **Figure 14** for example).
- Provide educational opportunities in form of pamphlets, newsletters, web site information and other media tools through the Village of Southampton and the Lake Agawam Conservation Association (see **Appendix E**).
 - Examine potential for removal of existing hardened shorelines; discourage expansion of new hardened shoreline structures.

7.2 Stormwater and Watershed Improvements

Watershed Area Recommendations

- Intercept and recharge stormwater runoff in higher elevations of the watershed.
 1. Install more street catch basins such as is being done on Hill Street.
 2. Examine Village/Town owned land opportunities for recharge facilities such as Windmill Lane.
 3. Coordinate with Town (Walter Bundy) on Grants and stormwater Phase II implementation.
 4. Consider maximum stormwater retention and on-site recharge for any site plans and subdivisions in the watershed area; ensure compliance with SPDES GP 0-08-001.
 5. Review Village parking areas for potential subsurface stormwater detention installation in connection with parking lot improvement plans.
- Continue to maintain catch basins and leaching pools on a regular basis by removing accumulated sediment.
- Continue to maintain roads on a regular basis through street sweeping to reduce potential for sediments to accumulate and/or enter the lake.
- Explore potential for sewerage in areas of the watershed with commercial downtown development and shallow depth to groundwater.
- Encourage homeowners to regularly inspect and maintain sanitary systems in high groundwater areas and elsewhere in the watershed.
- Encourage and enforce when appropriate, upgrade of malfunctioning sanitary systems.



- Ensure appropriate land use density within the Village and the watershed area for Lake Agawam, through coordination with SCDHS on the implementation of Article 6 of the SCSC; sanitary credit transfers to the Lake Agawam watershed area should be reviewed and limited based on nitrogen load.
- Encourage and facilitate “pick up after your pet” practices
 1. Educational pamphlets, Village newsletter and public information media.
 2. Install dispensers in Village parks and key areas for convenience.

7.3 Lake Aeration and Water Quality Improvements

Lake Management Recommendations

- Provide equipment to improve dissolved oxygen levels in the lake.
 1. Maintain and install forced air bubblers to further the coverage already achieved by this cooperative Town/Village effort.
 2. Consider discontinuing fountains in favor of bubblers, particularly during algae blooms.
- Improve fish populations in the lake favoring native fish assemblages.
 1. Stock bass, perch and bluegill fish assemblages, if necessary. [*Naturally reproducing populations of largemouth bass, bluegill, pumpkinseed, white perch, carp and brown bullhead currently exist in lake (NYSDEC, 2007)*].
 2. Remove or reduce carp populations in the lake, as necessary, ensuring that harvested fish are managed in a manner that considers public health and safety.
- Maintain, but don't expand areas of aquatic vegetation on the west side of the lake; such vegetation provides fish habitat, food source and shading.
- Examine wetland biological treatment options for north end of lake near stormwater outfall
- Examine potential for removal of organically enriched surface sediments from the lake bottom in order to reduce the release of nutrients into the water column.

7.4 Water Quality Monitoring and Research

- Continue water quality monitoring to determine effectiveness of implementation of management recommendations and track trends in water quality.
- Continue monitoring for cyanotoxins levels and associated ecological-based studies (e.g. chemical, physical and biological factors) to further elucidate the factors which promote the presence of these toxins.
- Implement an adaptive management approach for Lake Agawam as the understanding of cyanotoxins is expanded, and strive to improve water quality while minimizing health risks to humans and animals.



8.0 ACTION PLAN FOR LAKE IMPROVEMENTS

The following implementation matrix (**Table 3**) is designed to provide a framework for improvements to Lake Agawam through implementation of an effective Comprehensive Management Plan. This strategy essentially consists of a schedule of specific activities, capital projects and policy or legislative actions that need to be enacted and implemented in order to ensure adequate management of the watershed in accordance with the recommendations set forth in **Section 7.0**.

Lake Agawam lies within multiple governmental jurisdictions, and each agency is responsible for a different type of activity that affects the watershed or directly affects the water body. This Management Plan is designed to facilitate inter-governmental coordination and cooperation among these agencies so as to ensure that all actions work to the benefit of the watershed. The purpose of this section is to identify the sphere of jurisdiction exercised by each relevant agency, as well as to identify the specific actions that each agency can take to help implement the recommendations set forth in **Section 7.0**.

The matrix is divided into the same four sub-sections as the recommendations. *Section 8.1* of the action plan matrix identifies Shoreline Improvements which should be implemented by the parties responsible for the lands surrounding the shoreline. These parties consist of Town, Village, SCDHS and surrounding residents. Educational materials have already been provided to residents regarding appropriate plantings within the buffer zone. As the Town is responsible for the roadway along the southern shoreline of Lake Agawam, it will be up to the Town to improve the parking area and implement the recommended low sill bulkhead. This Plan provides concepts and recommendations to assist the Town in this important endeavor. Permits from the Town Trustees and the Village Zoning Board of Appeals will be required for the installation of the shoreline modifications on the south side of the lake.

Section 8.2 of the matrix identifies an action plan for Stormwater and Watershed Improvements. Stormwater improvements are already underway, with production of 'An Owner's Guide to Lake Agawam' and 'Buffer Zone' signs, which were distributed to homeowners around the lake by Lake Agawam Conservation Association in June 2008. The Village of Southampton is also applying for a Transportation Enhancement Program Grant with the goal of improving stormwater infrastructure at two key locations within the Lake Agawam watershed (Windmill Lane and the Lake Agawam parking lot).

Section 8.3 focuses on Lake Aeration and Water Quality Improvements, encompassing sediment, vegetation and fish management strategies for improved water quality and aquatic habitat, including reducing the occurrence of harmful algal blooms. A warning sign for harmful cyanobacteria algal blooms was posted at Lake Agawam by the Board of Trustees in August 2004. This sign should remain for as long as problem persists.

Section 8.4 outlines water quality monitoring and research strategies which should be aggressively pursued until such a time when the water quality of the lake has been shown to be restored to pristine levels. After such a time, monitoring of the lake should be maintained to ensure high water quality. Monitoring and research should be continued by Dr. Chris Gobler and



associated lab members at SUNY Southampton, who have been studying the lake system for several years. Grants to continue this monitoring and research through Village, Town, State, and Federal funding should be strongly considered.



TABLE 3
LAKE AGAWAM ACTION PLAN MATRIX

No.	Recommendation	Type of Action	Responsible Entity	Short-Long Term/ Tentative Schedule	Funding Sources	Possible Vendors	Public Budget/ Product
8.1 Shoreline Improvements							
<u>Riparian (Buffer) Area Recommendations</u>							
1.	Control waterfowl populations through management practices.						
1a.	- Discourage lawns fronting lake shore areas.	Education; Individual Implementation	Village; Residents	Short Term/ Immediate & Ongoing	1, 3, 4, 5, 6, 8 & 9	Village; Consultant; Printer	\$10,000 per yr*/ Literature-Web
1b.	- Discourage feeding of waterfowl populations.	Education; Individual Implementation	Village; Residents	Short Term/ Immediate & Ongoing	1, 3, 4, 5, 6, 8 & 9	Village; Consultant; Printer	\$10,000 per yr*/ Literature-Web
2.	Encourage homeowners to remove fertilizer dependent vegetation and establish native planting areas.						
2a.	- Naturalized meadow, woodland and shrub planting areas intercept and filter stormwater and reduce fertilizer/nutrient input.	Education; Permit; Private Implementation	Village ZBA; Residents	Short Term/ Immediate & Ongoing	1, 3, 4, 5, 6, 8 & 9	Landscape Contractors	Private Funds/ Buffer Plantings
2b.	- Village laws encourage natural plantings within 125 feet of wetlands through ZBA-issued wetland permits.	Education; Permit; Private Implementation	Village ZBA; Residents	Short Term/ Immediate & Ongoing	1, 3, 4, 5, 6, 8 & 9	Landscape Contractors	Private Funds/ Buffer Plantings
2c.	- Place shade trees near shore that will provide soil stability, biological uptake and shading of surface water to maintain lower water temperatures and allow higher dissolved oxygen levels.	Education; Permit (if necessary); Private Implementation	Village ZBA; Residents	Short Term/ Immediate & Ongoing	1, 3, 4, 5, 6, 8 & 9	Landscape Contractors	Private Funds/ Tree Plantings
3.	Remove invasive vegetation in favor of natural habitat areas under controlled re-vegetation restoration programs.						
4.	Examine municipally owned lakefront areas for improvement opportunities (control direct stormwater overflow from paved surfaces in close proximity to the lake; establish lake front walking trails in areas where public access can be provided; provide public education and interpretive signage in appropriate lakefront areas).						
4a.	- Consider installation of a drainage swale and subsurface detention along Pond Lane in connection with pedestrian walks, landscape improvements and sitting areas for lake enjoyment.	Direct Government Action	Village of Southampton	Long Term/ 5-10 years	1, 3, 4, 5, 6, 8 & 9	Village; Consultant; Highway Department; Contractors	\$500,000/ Stormwater Management and Aesthetics
4b.	- Consider potential for invasive species removal, stormwater control and lake front walking trails for Gin Lane area at south and southeast part of the lake.	Direct Government Action	Village of Southampton	Long Term/ 5-10 years	1, 3, 4, 5, 6, 8 & 9	Village; Consultant; Highway Department; Contractors	\$350,000/ Biological Productivity and Aesthetics/Views



No.	Recommendation	Type of Action	Responsible Entity	Short-Long Term/Tentative Schedule	Funding Sources	Possible Vendors	Public Budget/Product
4c.	- Work cooperatively with the Town Trustees to improve the Gin Lane and Bathing Corporation parking area by reducing pavement, installing a “rain garden” along the shoreline, installing a low sill bulkhead along the southern shoreline (to retain parking capacity), installing subsurface drainage improvements, pedestrian circulation/traffic calming and providing aesthetic improvements through landscaping (see Figure 14 for example).	Direct Government Action	Town Trustees Town of Southampton	Intermediate Term	Capital Budget And/or Grants 1, 3, 4, 5, 6, 8 & 9	Town; Consultant; Highway Department; Contractors	\$650,000/ Stormwater; Pedestrian/Traffic Improvements; Aesthetics; Shoreline Stabilization
5.	Provide educational opportunities in form of pamphlets, newsletters, web site information and other media tools through the Village of Southampton and the Lake Agawam Conservation Association (see Appendix E).	Education	Village; Town; Non-Profit LACA	Short Term/ Immediate & Ongoing	Non-Profit Donations 1, 3, 4, 5, 6, 8 & 9	Village; Consultant; Printer	\$10,000 per yr*/ Literature-Web Information
6.	Examine potential for removal of existing hardened shorelines; discourage expansion of new hardened shoreline structures.	Direct Government; Education; Permit; Private Implementation	Village Education/Permit; Town Beach Club	Short & Intermediate Term; Immediate & Ongoing	1, 3, 4, 5, 6, 8 & 9	Construction Contractors	Dependent Upon Specific Project
8.2 Stormwater and Watershed Improvements							
<u>Watershed Area Recommendations</u>							
7.	Intercept and recharge stormwater runoff in higher elevations of the watershed.	Direct Government Action	Village Trustees; Town of Southampton	Short, Intermediate & Long Term	2, 3, 4, 6, 7, 8 & 9	Drainage Contractors	Dependent Upon Specific Project
7a.	- Install more street catch basins along Hill Street, and other streets where feasible.	Direct Government Action	Village Trustees	Completed	Capital Budget 2, 3, 4, 6, 7, 8 & 9	Drainage Contractor	\$160,000/ Drainage Retention
7b.	- Examine Village/Town owned land opportunities for recharge facilities such as Windmill Lane and Nugent Street; the west side of Windmill Lane; and north of Bowden Square.	Government Action	Village Trustees; Town of Southampton	Intermediate Term; Grant Pending	2, 3, 4, 6, 7, 8 & 9	Drainage Contractor	\$1,900,000/ Drainage Retention
7c.	- Coordinate with Town (Walter Bundy) on Grants and stormwater Phase II implementation.	Government Action	Village Trustees; Town of Southampton	Short Term; Immediate & Ongoing	2, 3, 4, 6, 7, 8 & 9	Village Personnel & Consultants	Dependent Upon Specific Project
7d.	- Consider maximum stormwater retention and on-site recharge for any site plans and subdivisions in the watershed area; ensure compliance with SPDES GP 0-08-001.	Legislative Review	Village Planning Board & ZBA	Short Term; Immediate & Ongoing	2, 3, 4, 6, 7, 8 & 9	Village Personnel & Consultants	Private Expenditure/ Drainage Retention
7e.	- Review Village parking areas for potential subsurface stormwater detention installation in connection with parking lot improvement plans.	Government Action	Village Trustees	Intermediate Term/ 3-5 years	2, 3, 4, 6, 7, 8 & 9	Drainage Contractors	\$1,000,000/ Drainage Retention
8.	Maintain catch basins and leaching pools on a regular basis by removing accumulated sediment.	Maintenance	Village Highway Department	Short Term; Immediate & Ongoing	Annual Budget 2, 3, 4, 6, 7, 8 & 9	Highway Department Personnel	\$10,000 per yr; Approx. Prorated/ Sediment Control
9.	Maintain roads on a regular basis through street sweeping to reduce potential for sediments to accumulate and/or enter the lake.	Maintenance	Village Highway Department	Short Term; Immediate & Ongoing	Annual Budget 2, 3, 4, 6, 7, 8 & 9	Highway Department Personnel	\$10,000 per yr; Approx. Prorated/ Sediment Control



No.	Recommendation	Type of Action	Responsible Entity	Short-Long Term/Tentative Schedule	Funding Sources	Possible Vendors	Public Budget/Product
10.	Explore potential for sewerage in areas of the watershed with commercial downtown development and shallow depth to groundwater.	Government Action	Village Trustees	Intermediate Term/ 3-5 years	2, 3, 4, 6, 7, 8 & 9	Village Consultant; Consultants	\$75,000/ Sewage Treatment Feasibility Study
11.	Encourage homeowners to regularly inspect and maintain sanitary systems in high groundwater areas and elsewhere in the watershed.	Education	Village; Town; Non-Profit LACA	Short Term/ Immediate & Ongoing	Non-Profit Donations 2, 3, 4, 6, 7, 8 & 9	Village; Consultant; Printer	Private Funds/ Improved Sanitary System Function
12.	Encourage, and enforce when appropriate, upgrade of malfunctioning sanitary systems.	Education & Enforcement	Village; Town; Non-Profit LACA	Short Term/ Immediate & Ongoing	Non-Profit Donations 2, 3, 4, 6, 7, 8 & 9	Village; Consultant; Printer	Private Funds/ Improved Sanitary System Function
13.	Ensure appropriate land use density within the Village and the watershed area for Lake Agawam through coordination with SCDHS on the implementation of Article 6 of the SCSC; sanitary credit transfers to the Lake Agawam watershed area should be reviewed and limited based on nitrogen load.	Legislative	SCDHS & Village Trustees; Planning Board; ZBA	Short Term/ 1-3 years	Annual Budget 2, 3, 4, 6, 7, 8 & 9	Village Boards and Consultants	\$2,000 per yr/ Improved Coordination & Policy
14.	Encourage and facilitate “pick up after your pet” practices	Education & Government Action	Village Trustees & Town Trustees	Short Term/ 1-3 years	Annual Budget 2, 3, 4, 6, 7, 8 & 9	Village; Consultant; Printer	Dependent Upon Specific Project
14a.	- Educational pamphlets, Village newsletter and public information media.	Education & Government Action	Village Trustees	Short Term/ 1-3 years	Annual Budget 2, 3, 4, 6, 7, 8 & 9	Village; Consultant; Printer	\$10,000 per yr*/ Literature-Web
14b.	- Install dispensers in Village parks and key areas for convenience.	Education & Government Action	Village Trustees & Town Trustees	Short Term/ 1-3 years	Annual Budget 2, 3, 4, 6, 7, 8 & 9	ProPet.org; Poopaway.com; Curbappealsigns.com	\$5,000 per yr/ Dispensers (\$500/station)
8.3 Lake Aeration and Water Quality Improvements							
<u>Lake Management Recommendations</u>							
15.	Provide water circulation equipment to improve dissolved oxygen levels in the lake.	Direct Government Action	Village Trustees & Town Trustees	Short & Intermediate Term; Immediate & Ongoing	Capital Budgets 3, 4, 6, 7 & 8	Water Circulator Contractor	Dependent Upon Specific Project
15a.	- Maintain and install forced air bubblers to improve dissolved oxygen levels and further the coverage already achieved by this cooperative Town/Village effort.	Direct Government Action	Village Trustees & Town Trustees	Short & Intermediate Term; Immediate & Ongoing	Capital Budgets 3, 4, 6, 7 & 8	Aquascape Designs, or similar	\$8,500/six units + install & yearly operating cost
15b.	- Consider discontinuing fountains in favor of bubblers, particularly during algae blooms.	Government Action Management Option	Village Trustees	Short Term/ 1-3 years	3, 4, 6, 7 & 8	N/A	No Cost/ Discontinuance of Practice
16.	Improve fish populations in the lake favoring native fish assemblages.	Direct Government Action	Village Trustees	Intermediate & Long Term	Capital Budget 3, 4, 6, 7 & 8	Village; Consultant	Dependent Upon Specific Project
16a.	- Stock bass, perch and bluegill fish assemblages, if necessary.	Direct Government Action; DEC Fish Stocking Permit	Village Trustees	Intermediate & Long Term	Capital Budget 3, 4, 6, 7 & 8	Obtain list of NYS-certified hatcheries from NYSDEC	\$5,000-12,000/yr Fish Stocking
16b.	- Remove or reduce carp populations in the lake, if necessary, ensuring that harvested fish are managed in a manner that considers public health and safety.	Direct Government Action; DEC Fish Control Permit	Village Trustees	Intermediate & Long Term	Capital Budget 3, 4, 6, 7 & 8	Commercial Fishermen/ SUNY MSRC Fish Bio-Assay	\$5,000/yr Carp Removal



No.	Recommendation	Type of Action	Responsible Entity	Short-Long Term/Tentative Schedule	Funding Sources	Possible Vendors	Public Budget/Product
17.	Maintain, but do not expand areas of aquatic vegetation on the west side of the lake; such vegetation provides fish habitat, food source and shading.	Government Action Management Option	Town Trustees	Short Term/Immediate	3, 4, 6, 7 & 8	N/A	N/A
18.	Examine wetland biological treatment options for north end of lake near stormwater outfall	Direct Government Action	Town Trustees	Long Term/5-10 years	3, 4, 6, 7 & 8	Consultant Design; Contractor Install	\$300,000/Wetland Treatment Area
19.	Evaluate potential for removal of organically enriched surface sediments from the lake bottom in order to reduce the release of nutrients into the water column.	Direct Government Action	Town Trustees	Long Term/5-10 years	3, 4, 6, 7 & 8	Consultant Design & Permits; Contractor Dredge & Disposal	\$500,000/Sediment Removal; Beneficial Reuse
8.4 Water Quality Monitoring and Research							
20.	Continue water quality and cyanobacteria monitoring to determine effectiveness of implemented management recommendations and to track trends in water quality.	Government Sponsored Research	Village Trustees & Town Trustees	Short Term/Immediate & Ongoing	SUNY MSRC; 3, 4 & 8	SUNY MSRC	\$17,500 per yr/Monitoring Data & Reports
21.	Continue associated ecological-based studies and research (e.g. chemical, physical and biological factors) to further elucidate the factors which promote the presence of cyanotoxins.	Government Sponsored Research	Village Trustees & Town Trustees	Short Term/Immediate & Ongoing	SUNY MSRC; 3, 4 & 8	SUNY MSRC	\$17,500 per yr/Monitoring Data & Reports
22.	Implement an adaptive management approach for Lake Agawam as the understanding of cyanotoxins is expanded, and strive to improve water quality while minimizing health risks to humans and animals.	Cooperative Effort	Town, Village, Research Institutions, LACA and Citizens	Long Term/5-10 years	3, 4 & 8	Consultant Assistance; SUNY MSRC	\$75,000/Lake Agawam Comprehensive Plan Update

Notes:

* \$5,000 per yr is combined educational budget for educational materials using consultant assistance for pamphlet design, printing and distribution, part of Village newsletters and web site maintenance.

All budget estimates are in current 2008 dollars, and do not account for inflation or increased costs which may occur over time.

Definition of Terms/Schedule: Short Term – 1-3 years Intermediate Term – 3-5 years Long Term – 5-10 years

Definition of Abbreviations: N/A - Not Applicable yr – Year SUNY MSRC – State University of New York Marine Sciences Research Center

List of potential funding sources to offset cost of implementing Agawam CMP and associated number abbreviation: Note that funding availability varies according to annual budget cycles and legislative action.

(1) NYS Office of Parks, Recreation and Historic Preservation Parks Development Grants under the EPA and LWCF- <http://www.nysparks.com/grants/>

(2) NYS Dept. of Transportation- Transportation Enhancements Program (TEP)- <https://www.nysdot.gov/portal/page/portal/programs/tep>

(3) NYS Dept. of State- Local Waterfront Revitalization Program (LWRP)- <http://www.nyswaterfronts.com/request.html>

(4) NYS Department of Environmental Conservation- Water Quality Improvement Program- <http://www.dec.ny.gov/pubs/4774.html>

(5) NYS Department of Environmental Conservation- Terrestrial Invasive Species Eradication Grant Program- <http://www.dec.ny.gov/animals/33358.html>

(6) NYS Environmental Facilities Corporation, *et al.*-NYS Water & Sewer Infrastructure Co-funding Initiative- <http://www.nycofunding.org/DotNetNuke/>

Note: NYS EFC provides financing and technical assistance. Funding sources vary and historically major sources have been the US Environmental Protection Agency’s Drinking Water State Revolving Fund (DWSRF) and Clean Water Revolving Fund (CWSRF)

(7) NYS Energy Research and Development Authority (NYSERDA)- Municipal Water and Wastewater Treatment Plan Programs (various)- <http://www.nyserda.org/Programs/Environment/muniwaterwwt.asp>

(8) NYS Department of State- Shared Municipal Services Incentive Program- For programs that achieve cost savings through shared services involving two or more municipalities-

<http://www.dos.state.ny.us/lgss/smsi/stateassistance.html>

(9) Suffolk County- Suffolk County Water Quality Protection and Restoration Program

Potential funding sources information provided by Jennifer Mesiano, Village Grants Coordinator.



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Exhibit D



Department of
Environmental
Conservation

HARMFUL ALGAL BLOOM ACTION PLAN LAKE AGAWAM

April 2020



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1. Introduction

1.1 Purpose

New York State's aquatic resources are among the best in the country. State residents benefit from the fact that these resources are not isolated but can be found from the eastern tip of Long Island to the Niagara River in the west, and from the St. Lawrence River in the north to the Delaware River in the south. These resources, and the plants and animals they harbor, provide both the State and the local communities a wealth of public health, economic, and ecological benefits including potable drinking water, tourism, water-based recreation, and other ecosystem services. Harmful algal blooms (HABs), primarily within ponded waters (i.e., lakes and ponds) of New York State, have become increasingly prevalent in recent years and have impacted the values and services that these resources provide.

This HABs Action Plan for Lake Agawam has been developed by the Village of Southampton in conjunction with NYSDEC and other Lake Agawam stakeholders to:

- Describe existing physical and biological conditions
- Summarize the research conducted to date and the data it has produced
- Identify the potential causative factors contributing to HABs
- Provide specific recommendations to minimize the frequency, duration, and intensity of HABs to protect the health and livelihood of its residents and wildlife.

This Action Plan represents a key element in New York State's efforts to combat HABs now and in the future, both in Lake Agawam and in other lakes of similar morphology, hydrology, and background water quality.

1.2 Scope, Jurisdiction and Audience

The New York State HABs monitoring and surveillance program was developed to evaluate conditions for waterbodies with a variety of uses (public, private, public water supplies (PWSs), non-PWSs) throughout the State. The intended audiences for this HABs Action Plan are as follows

- Members of the public interested in background information about the development and implications of the HABs program
- Local and regional agencies involved in the oversight and management of Lake Agawam
- New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH), and New York State Department of Agriculture and Markets (NYSDAM) officials
- State agency staff who are directly involved in implementing or working with the NYSDEC HABs monitoring and surveillance program
- Lake residents, managers, consultants, and others that are directly involved in the management of HABs in Lake Agawam
- Academic and other researchers interested in the water quality of Lake Agawam and/or Harmful Algal Blooms
- As well as local governments which play a significant role in water quality restoration and protection efforts. Local governments have land use authority, storm water management responsibility, operate waste water treatment plants, and are responsible for engineering and implementing roadway and public infrastructure projects.

Analyses conducted in this Action Plan provide insight into the processes that potentially influence the formation of HABs in Lake Agawam, and their spatial extents, durations, and intensities. Implementation of the mitigation actions recommended in this HABs Action Plan are expected to reduce blooms in Lake Agawam.

1.3 Background

Harmful algal blooms in freshwater generally consist of visible patches of cyanobacteria, also called blue-green algae (BGA). Cyanobacteria are naturally present in low numbers in most marine and freshwater systems. Under certain conditions, including adequate nutrient (e.g., phosphorus) availability, warm temperatures, and calm winds, cyanobacteria may multiply rapidly and form blooms that are visible on the surface of the affected waterbody. Several types of cyanobacteria can produce toxins and other harmful compounds that can pose a public health risk to people and animals through ingestion, skin contact, or inhalation. The NYSDEC has documented the occurrence of HABs in Lake Agawam and has produced this Action Plan to identify the primary factors triggering HAB events, and to facilitate decision-making to minimize the frequency, intensity, and duration of HABs as well as the effects that HABs have on both lake users and resident biological communities.

2. Lake Background

2.1 Geographic Location

Lake Agawam watershed is located in the Village of Southampton, in the Shinnecock Bay-Atlantic Ocean hydrologic unit (HUC12) in Suffolk County. The HUC12 watershed is comprised of fourteen (14) sub-drainage areas, including the drainage basin for Lake Agawam, which is approximately 1,400 acres (Figure 1). The watershed includes 2 municipalities; the Village of Southampton, and the Town of Southampton. Lake Agawam is also adjacent to the South Shore Estuary Reserve (SSER), which encompasses the tidal waters and associated watersheds between the Nassau-Queens County line and the eastern boundary of Shinnecock Bay.

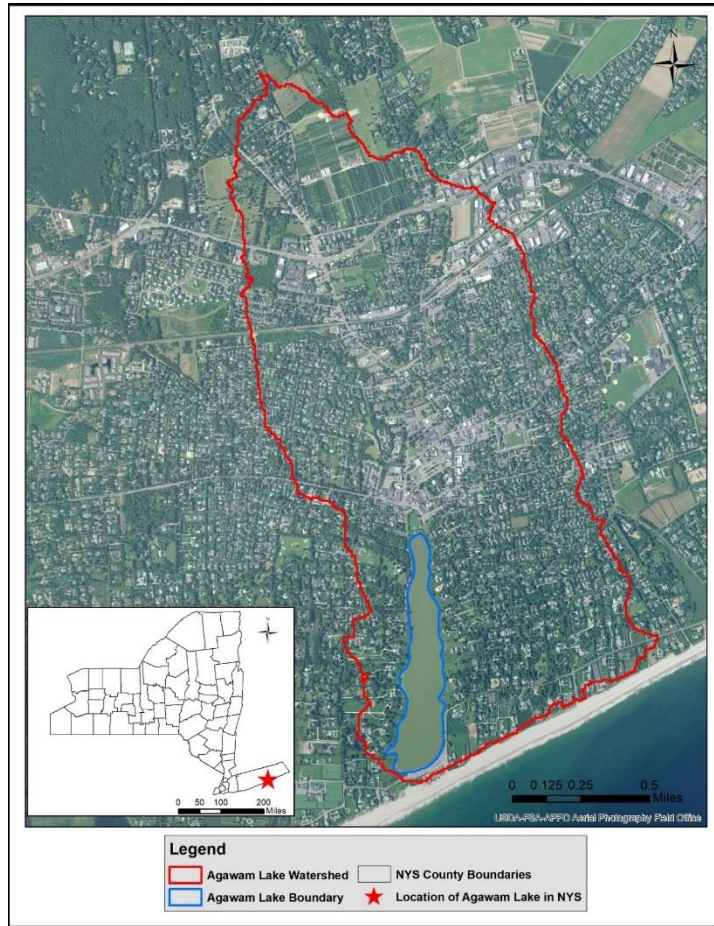


Figure 1: Lake Agawam Watershed

2.2 Morphology

Lake Agawam is a 64-acre freshwater lake, in Suffolk County. Lake Agawam has an average depth of 10 feet, and the volume is approximately 208 million gallons. The surrounding watershed encompasses approximately 1,145 acres in the Village of Southampton (Nelson, Pope & Voorhis, LLC 2009). The shoreline length of Lake Agawam is approximately 1.92 miles, with a fetch length of approximately 1,300 meters, or 0.82 miles. The depth remains relatively constant at the mid sections of the lake, with higher slopes towards the shoreline. The wind rose in **Appendix A. Wind and Wave Patterns** indicates that stronger prevailing wind directions potentially influencing Lake Agawam were generally out of the southwest, as measured from both the Easthampton and Westhampton airports. These wind patterns, combined with the orientation of the lake, likely result in a large area where wind and wave action may mix the water and drive water-borne nutrients and cyanobacteria towards the northeast shore of the lake.

The quantity of soft sediment in the north end of Lake Agawam has been measured by Nelson, Pope and Vorhis, and is approximately 65,000 cubic yards, made up of greater than 10% fine sand and silt (Nelson, Pope and Vorhis, 2019).

2.3 Hydrology

There are 14 sub-drainage basins in the Lake Agawam watershed (Nelson, Pope & Voorhis, LLC 2009). Stormwater inflows were identified in 2007 within the lake and consist of a single system at the northern side of the lake, with two drain openings that discharge during rain events. Three outfalls are located along the northern shoreline, and the fourth along the southern shoreline. The depth to groundwater within the watershed ranges from 0 feet to 36 feet above sea level (Nelson, Pope & Voorhis, LLC 2009).

A stormwater inventory, coordinated by Nelson, Pope & Voorhis, identified a total of 140 catch basins in the watershed. Two areas of concern were also identified as significant flooding zones, including one at the southern end of the lake (Nelson, Pope & Voorhis, LLC 2009). Three outfalls are located along the northern shoreline, and the fourth along the southern shoreline.

Nelson, Pope & Voorhis also conducted an inventory of installed bubblers in 2007, maintained by the Village. Three large fountains, and sixteen bubblers were located, distributed along the length of the lake (Nelson, Pope & Voorhis, LLC 2009).

2.4 Lake Origin

According to Nelson, Pope & Voorhis (2009), Lake Agawam was formed by a glacier and was likely once connected to the ocean, however it is an entirely freshwater lake today, separated from the ocean by a barrier beach. The only existing connection to the ocean is a water level outflow pipe, controlled by a manual release valve (Nelson, Pope & Voorhis, LLC 2009).

3. Designated Uses

3.1 Water Quality Classification – Lake and Major Tributaries

Lake Agawam is a Class C waterbody according to the New York Codes, Rules, and Regulations (NYCRR). Class C waterbodies are best utilized for fishing (6 NYCRR 701.8). Lake Agawam was assessed as an impaired waterbody due to recreational uses that are known to be impaired by phosphorus and low dissolved oxygen. These conditions result in frequent and severe harmful algal blooms in the lake. No specific pollutant or sources were identified, but land use suggests failing onsite wastewater treatment systems and urban non-point source runoff contribute to the impacts.

3.2 Recreation Uses

Recreation uses are known to be impaired due to shoreline harmful algal blooms (NYSDEC 2016). Algae (chlorophyll-a) levels in the open water were well above the 15 µg/l that has been associated with stressed recreational conditions during 2014. (https://www.dec.ny.gov/docs/water_pdf/asmtmeth17.pdf).

Since 2004, Lake Agawam has periodically closed during the summer for recreation and fishing, (Gobler 2017).

3.3 Fish Consumption/Fishing Uses

NYSDEC's website lists Largemouth Bass, Bluegill, Pumpkinseed, White Perch, Carp, Brown Bullhead as fish species in Lake Agawam (<https://www.dec.ny.gov/outdoor/24147.html>).

Fish consumption use is listed as unassessed. Although there are no specific restrictive advisories or records of tissue analysis for fish from Lake Agawam due to the presence of shoreline algae toxins, the statewide NYDOH advice regarding fish consumption should be followed

(https://www.health.ny.gov/environmental/outdoors/fish/health_advisories/regional/long_island.htm#fresh).

3.4 Aquatic Life Uses

Lake Agawam is designated as a Class C water, suitable for fish propagation and survival. Water quality monitoring conducted by the NYSDEC focuses primarily on support of aquatic life and secondary contact recreation. Aquatic life use is considered to be stressed based on nutrient levels and low dissolved oxygen (NYSDEC 2016). NYSDEC's website lists Largemouth Bass, Bluegill, Pumpkinseed, White Perch, Carp, Brown Bullhead as fish species in Lake Agawam (<https://www.dec.ny.gov/outdoor/24147.html>).

Fish kills were observed in 1954, 1981, 2000, 2005 (Nelson, Pope & Voorhis 2009), and 2006 (Gobler 2017).

4. User and Stakeholder Groups

Lake Agawam is used by all age groups of residents and tourists who enjoy the myriad of recreational opportunities that are available. Access to Lake Agawam is available via the adjacent green park and sitting area, owned by the Village of Southampton. Identified stakeholders are as follows:

- Village of Southampton
- Town of Southampton
- SUNY Stony Brook University School of Marine and Atmospheric Sciences
- Lake Agawam Conservancy
- Southampton Village Clean Water Committee
- Southampton Village Board of Trustees
- Town of Southampton Board of Trustees

Much of the property around the Lake is privately owned and considered low density residential, with commercial and medium density ownership around the north and south ends of the lake.

5. Monitoring Efforts

5.1 Lake Monitoring Activities

DEC's earliest monitoring on Lake Agawam occurred in 1938, with additional fish surveys in 1954, 1970 (NYSDEC), 1982, 2003, 2004 and 2007 (NYSDEC). In 1954, there was also a record of a fish kill due to hypoxic conditions, as well as additional reports from 1981 and 2000.

Regular water quality sampling of Lake Agawam was conducted by researchers at SUNY Stony Brook from 2011 to 2015. Annual monitoring by SUNY SB was conducted since 2003, for the following parameters (Gobler 2017):

- Chlorophyll a
- Dissolved oxygen
- Temperature
- Salinity
- Nutrients
- Water clarity
- Coliform bacteria

Sampling sites were at the north and south ends of the lake (Figure 2). Additionally, SUNY Stony Brook monitored visible shoreline scums in 2016 concurrently with in-lake sampling.

SUNY Stony Brook also conducted sampling at stormwater outflow pipes in 2007. And in 2008, a study estimating nitrogen and phosphorus loads into the lake included volumetric loading estimates, benthic nutrient flux and storm runoff estimates (Harke, et al. 2008).

6. Water Quality Conditions

6.1 Physical Conditions

A bathymetric study by Nelson, Pope & Voorhis in 2019 sampled at 6 stations around the lake (Figure 3). Physical results indicated that sediments were generally comprised of sand and silt, with a mix of gravel and sand in the middle of the lake. Sediment depth

ranged from 0-8.2 ft, with the total volume of sediment in the study area at 65,000 cubic yards. Preliminary analysis indicated that the north end of the lake samples contained lead and arsenic, which would necessitate review with NYS DEC's Materials Management group for disposal if dredging were to take place.

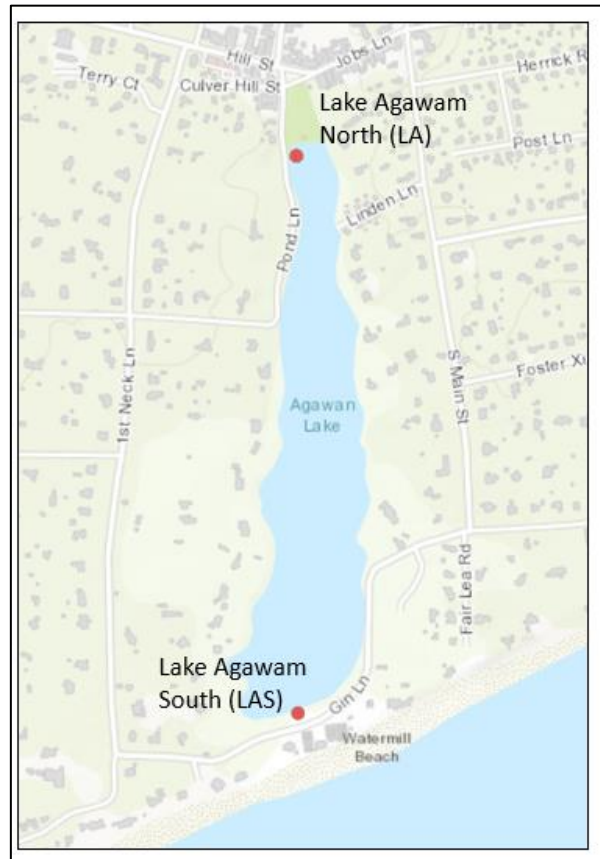


Figure 2: SUNY SB sampling locations, at the north (LA) and south (LAS) end of the lake



Figure 3: Sediment sampling locations for NP&V 2019 Bathymetric study.

Water clarity can be related to the amount of suspended material in the water column including sediment, algae, and cyanobacteria. Water clarity measurements, as represented by Secchi depth (m) measured by SUNY Stony Brook at the north and south ends of the lake were rarely greater than 0.5 m (Figure 4).

6.2 Chemical Conditions

Average yearly levels of chlorophyll a (Figure 5), as well as, dissolved oxygen indicate a consistently eutrophic, oxygenated system since the beginning of the SUNY Stony Brook studies. However, it is important to note that periods of low oxygen may have contributed to fish kills recorded in 2006, when hypoxic levels occurred at night, and outside of the monitoring window (Gobler, 2017).

Further ambient monitoring at the north and south ends of the lake from 2014 to 2019 below (Figure 4) show little difference in the yearly bottom vs. surface DO measurements (Table 1), which indicates Lake Agawam is most likely a well-mixed, non-stratified system. For surface DO, the south end of the lake sampling location (LAS) yearly averages were slightly lower than the north end of the lake sampling location (LA). There was little difference between the surface and bottom temperatures by year, however both LA and LAS were ± 1 degree higher in 2019 vs. 2016, while temperature averages for 2017 for surface and bottom were the lowest

measured in the study. A snapshot of the SUNY Stony Brook sampling regime by year is in Figure 7: Summary datasets provided by SUNY SB for Lake Agawam (2014-2019).

Table 1: Yearly averages measured by SUNY SB from 2014-2019.

Year	Name	Temp: Surface	Temp: Bottom	DO (mg/L): Surface	DO (mg/L): Bottom	pH	Secchi Depth (m)
2014	Lake Agawam	22.04826	22.23450	11.14478	10.259500	NaN	0.3891304
2015	Lake Agawam	23.74545	22.76364	11.05478	9.532381	NaN	0.5227273
2016	Lake Agawam	22.86391	22.28043	10.60652	9.722174	9.2	0.3966667
2016	Lake Agawam South	23.20000	22.90000	9.70000	9.200000	NaN	0.5000000
2017	Lake Agawam	18.33226	18.77667	11.33000	11.034333	NaN	0.3283333
2018	Lake Agawam	23.65000	23.32667	11.43625	10.066000	NaN	0.1973333
2019	Lake Agawam	23.19091	23.94500	10.92636	10.096500	NaN	0.3357143
2019	Lake Agawam South	22.53750	23.48571	10.09375	11.101429	NaN	0.2375000

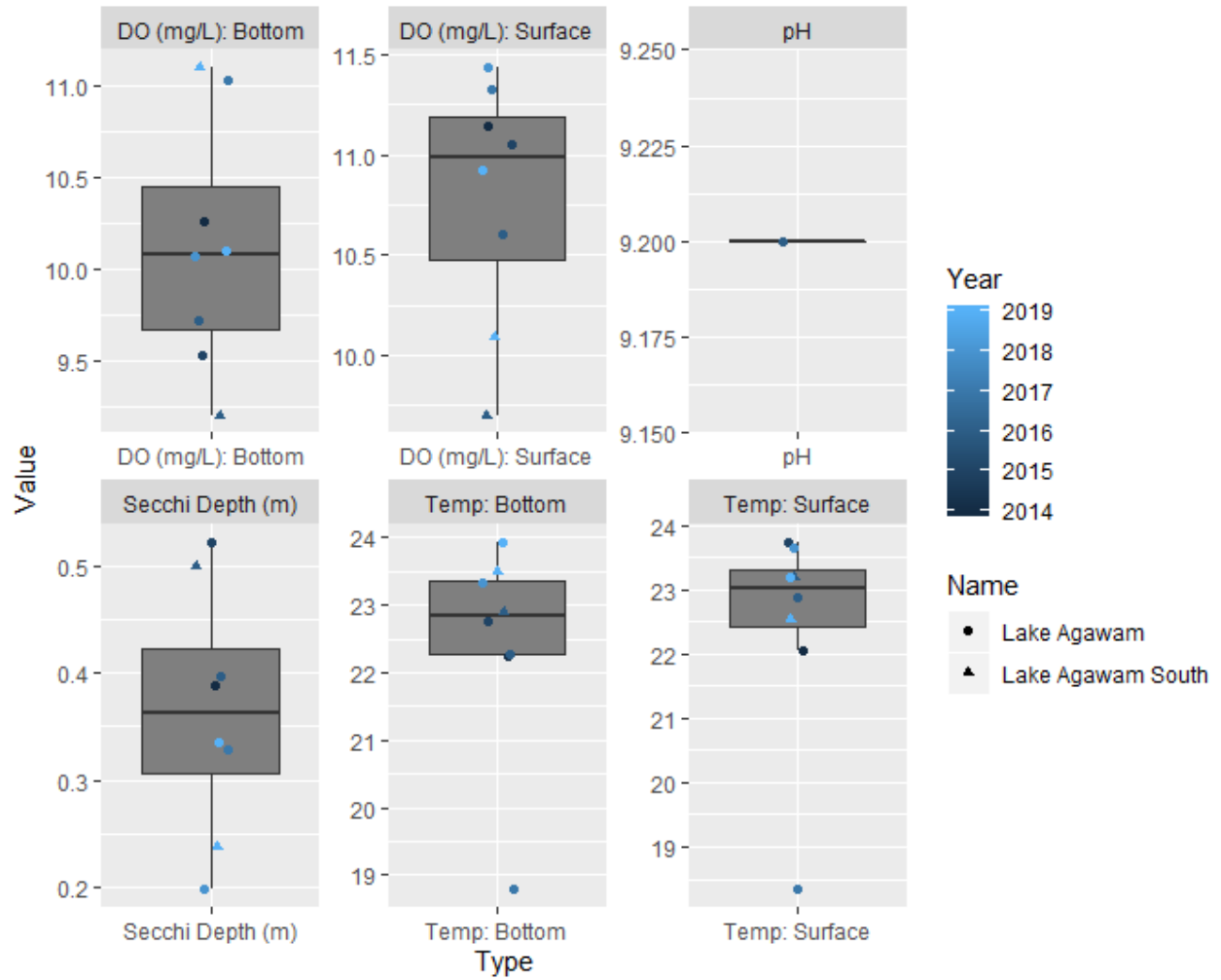


Figure 4: Boxplots and points of yearly summary data for LA and LAS measurements provided by SUNY SB.

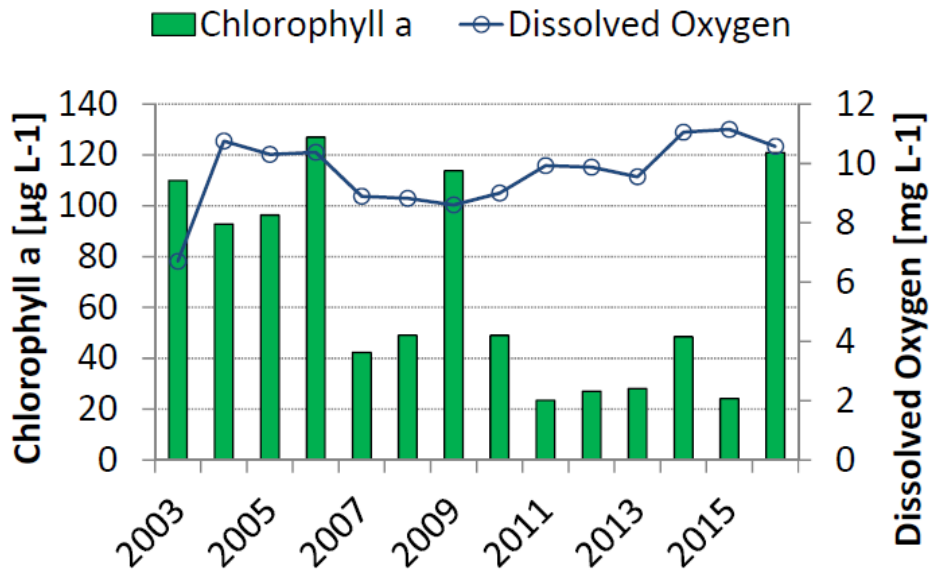


Figure 5: Chlorophyll a and dissolved oxygen (daytime) in Lake Agawam (Gobler 2017).

6.3 Biological Conditions

Sampling conducted by SUNY Stony Brook recorded *Microcystis* and *Anabaena* genera that have dominated Lake Agawam’s HAB community since 2004. Regular sampling for phosphorus, by SUNY Stony Brook, was routinely measured above 20 $\mu\text{g/L}$ (Figure 5). These levels are associated with an elevated risk of HABs occurrence-including potential toxin formation and other water clarity issues. Fluoroprobe measurements from SUNY Stony Brook indicate cyanobacteria dominate the yearly phytoplankton assemblages (Figure 6). Further experimental analysis indicates that nitrogen loading may be a larger contributor to HAB biomass in Lake Agawam than phosphorous loading (Davis et al., 2010). Storm drain runoff monitoring indicated higher levels of phosphorous and coliform bacteria at the north end of the lake vs. the south end (Gobler, 2007).

Estimated loading of nitrogen and phosphorus indicated that groundwater nitrogenous inputs greatly exceeded those from stormwater or atmospheric sources (Harke, et al., 2008), however, this study may have overlooked the contribution of particulate matter to the availability of the system’s nutrient balance.

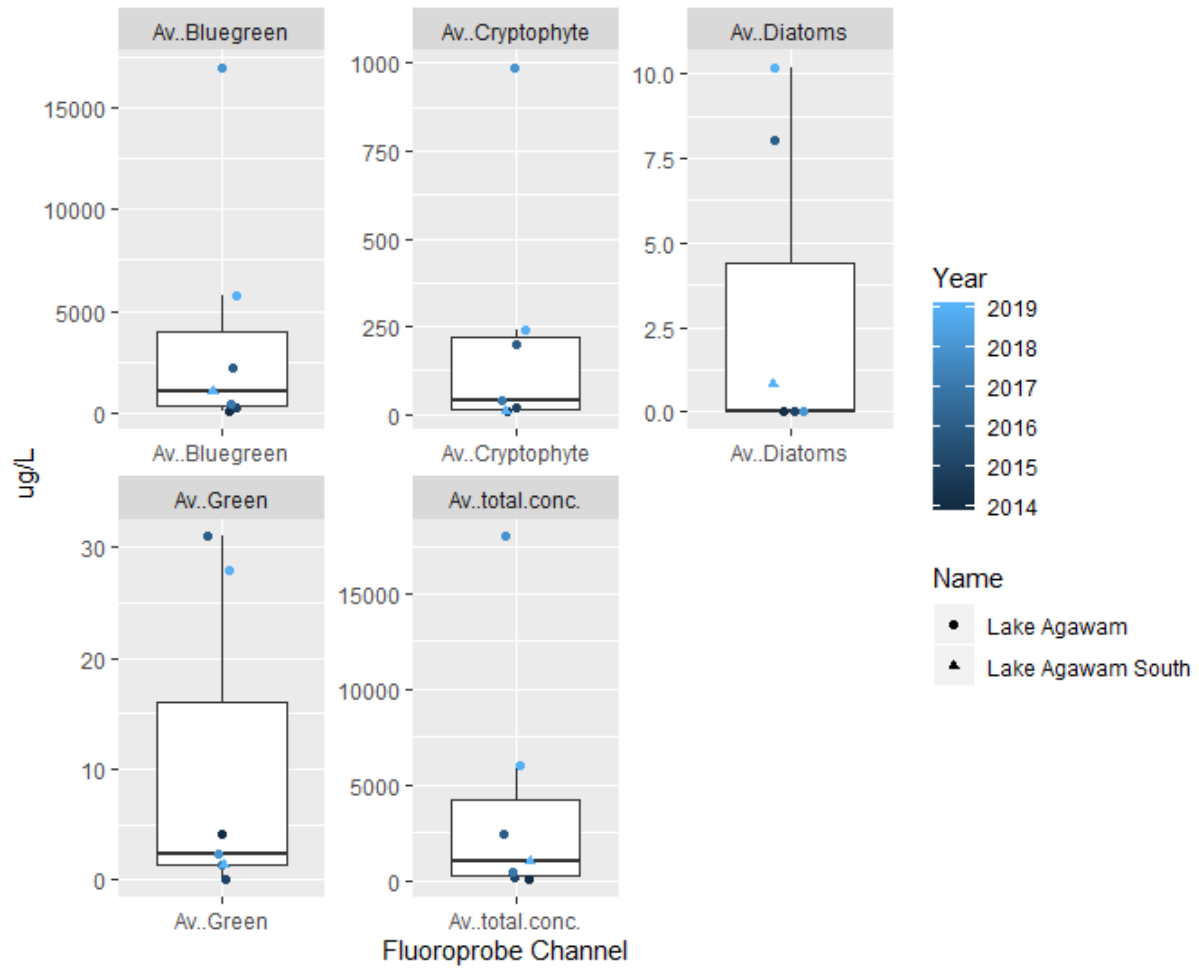


Figure 6: Boxplots of Yearly Fluoroprobe channel measurements at LA and LAS by SUNY SB (2014-2019).

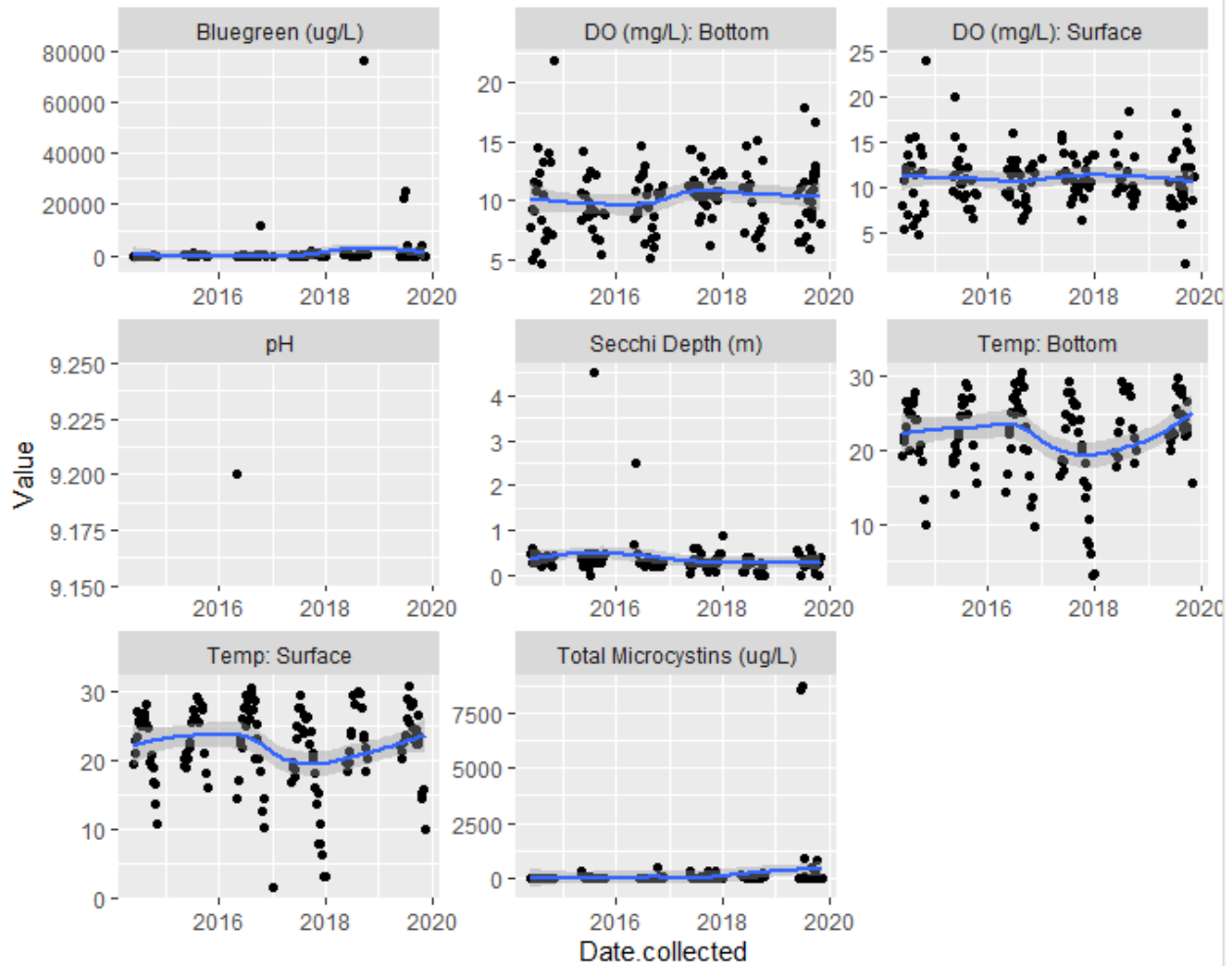


Figure 7: Summary datasets provided by SUNY SB for Lake Agawam (2014-2019).

7. Summary of HABs in the Lake

New York State possesses one of, if not the most comprehensive HABs monitoring and notification programs in the country. The NYSDEC and NYSDOH collaborate to document and communicate with New Yorkers regarding HABs. Within NYSDEC, staff in the Division of Water, Lake Monitoring and Assessment Section oversee HAB monitoring and surveillance activities; identify bloom status; communicate public health risks; and conduct outreach, education, and research regarding HABs. The NYSDEC HABs Program has adopted a combination of visual surveillance, algal concentration measurements, and toxin concentration to determine bloom status. This process is unique to New York State and has been used consistently since 2012.

The NYSDEC HABs Program has established four levels of bloom status:

- **No Bloom:** evaluation of a cyanobacteria bloom (HAB) report indicates low likelihood that a cyanobacteria bloom is present

- **Suspicious Bloom:** NYSDEC staff determined that conditions fit the description of a HAB, based on visual observations and/or digital photographs. Laboratory analysis has not been done to confirm if this is a HAB. It is not known if there are toxins in the water.
- **Confirmed Bloom:** Water sampling results have confirmed the presence of a HAB which may produce toxins or other harmful compounds (BGA chlorophyll concentrations $\geq 25 \mu\text{g/L}$ and/or microscopic confirmation that majority of sample is cyanobacteria and present in bloom-like densities). For the purposes of evaluating HABs sample, chlorophyll-a is quantified with a Fluoroprobe (bbe Moldaenke) which can effectively differentiate relative contributions to total chlorophyll-a by phytoplankton taxonomic group (Kring et al. 2014). BGA chlorophyll-a concentrations (attributed to most types of cyanobacteria) are utilized by the NYSDEC HABs Program for determining bloom status. This method provides an accurate assessment of cyanobacteria density and can be accomplished more quickly and cost effectively than traditional cell counts.
- **Confirmed with High Toxins Bloom:** Water sampling results have confirmed that there are toxins present in sufficient quantities to potentially cause health effects if people and animals come in contact with the water through swimming or drinking (microcystin $\geq 20 \mu\text{g/L}$ (shoreline samples) or microcystin $\geq 10 \mu\text{g/L}$ (open water samples)).

The spatial extent of HABs are categorized as follows:

- **Small Localized:** Bloom affects a small area of the waterbody, limited from one to several neighboring properties.
- **Large Localized:** Bloom affects many properties within an entire cove, along a large segment of the shoreline, or in a specific region of the waterbody.
- **Widespread/Lakewide:** Bloom affects the entire waterbody, a large portion of the lake, or most to all of the shoreline.
- **Open Water:** Sample was collected near the center of the lake and may indicate that the bloom is widespread and conditions may be worse along shorelines or within recreational areas.

7.1 Ambient Lake HABs History

Lake Agawam has received considerable attention by state agencies, nongovernmental organizations, community interest groups, lake users, and other stakeholders because of the long history of documented HABs in the lake. HABs have been reported to DEC primarily by Dr. Gobler's research team from Stony Brook University, School of Marine and Atmospheric Sciences. HABs in Lake Agawam have primarily been sampled along the northern shoreline. Samples were collected weekly when HAB conditions were present, 2013-2019. The frequency at which HABs samples exceeded NYSDEC blooms status thresholds are summarized in Table below.

Table 2: Lake Agawam HAB monitoring data (DEC 2019).

Year	Earliest Sample Date	Latest Sample Date	Average of BGA Chlorophyll	Average of microcystin	Number of Confirmed	Number of Confirmed with High Toxins
2013	7/15/2013	10/8/2013	48	15	6	3
2014	5/28/2014	10/14/2014	52	14	15	3
2015	5/3/2015	10/22/2015	218	56	15	8
2016	4/27/2016	1/5/2017	1770	150	17	11
2017	5/8/2017	12/26/2017	270	70	15	17
2018	5/7/2018	10/16/2018	4492	316	7	17
2019	6/17/19	10/30/19	1086	1090	18	18

7.2 Other Bloom Documentation

Cyanobacteria Chlorophyll-a

Cyanobacteria cell counts and/or chlorophyll-a concentrations can be used to trigger HABs alerts and advisory systems. BGA chlorophyll-a concentrations were quantified at a laboratory at Stony Brook University, School of Marine and Atmospheric Sciences with a Fluoroprobe (bbe Moldaenke) for all samples collected from 2013 to 2019.

Cyanotoxins

Some cyanobacteria taxa also produce toxins (cyanotoxins) that are harmful to people and pets. As a result, several different toxins are monitored during blooms. Microcystin is the most commonly detected cyanotoxin in New York State (NYSDEC 2017). The 20 µg/L microcystin “high toxin” threshold for shoreline blooms was, like the BGA chlorophyll-a criterion, established based on WHO criteria. Since 2003, microcystin has been continually detected in Lake Agawam. Further, microcystin was found in all samples taken by Gobler Lab between 2013 and 2016, and 40% of those samples exceeded the 20 µg/L threshold for DEC’s bloom threshold criteria (Gobler 2017; and http://www.dec.ny.gov/docs/water_pdf/habsprogramguide.pdf). Lake Agawam microcystin levels are consistently higher than what is currently prescribed by NYSDOH guidance to allow a regulated bathing beach to reopen. NYSDOH and NYSDEC believe that all cyanobacteria blooms should be avoided, even if measured microcystin levels are less than the recommended threshold level. Other toxins may be present, and illness is possible even in the absence of measured toxins.

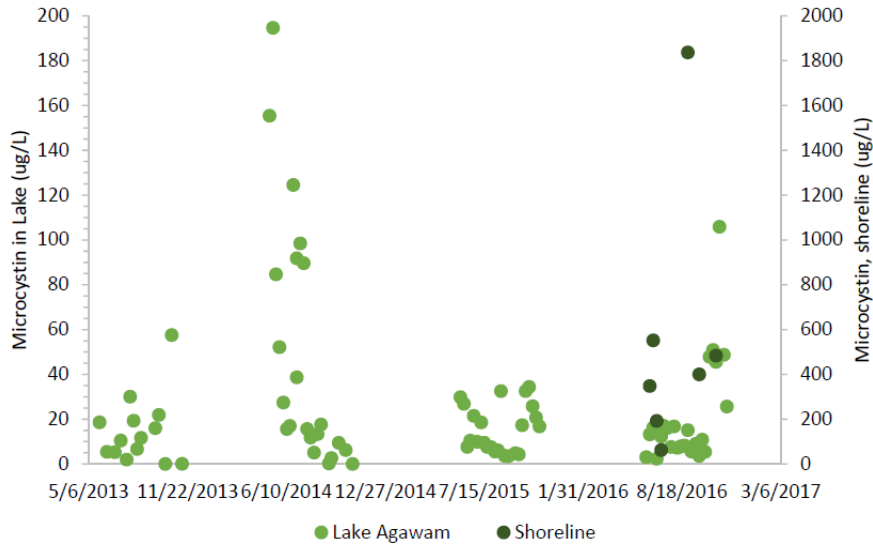


Figure 8: Microcystin in Lake Agawam from 2013-2016 (Gobler 2017).

Cyanobacteria Taxa

Multiple genera of cyanobacteria were identified in samples collected from 2013 to 2017; however, *Microcystis* is the most common genus in qualitative microscopy samples analyzed. *Microcystis* cells can regulate their buoyancy, moving up into the water column to harvest light for photosynthesis, and move down into the water column towards the metalimnion to acquire nutrients (Mantzouki et al. 2016).

Other genera of cyanobacteria documented in Lake Agawam samples include *Dolichospermum*, *Oscillatoria*, *Planktothrix*, and *Aphanizomenon*. Some of these genera are able to fix nitrogen (N₂), providing a competitive advantage over non-nitrogen fixing algae during periods when nitrogen is limiting (Mantzouki et al. 2016). Further research and analysis is warranted to document how the cyanobacteria assemblage in Lake Agawam contributes to documented HABs.

7.3 WI/PWL Assessment

The Waterbody Inventory/Priority Waterbodies List (WI/PWL) is an inventory of water quality assessments that characterize known/and or suspected water quality issues and determine the level of designated use support in a waterbody. It is instrumental in directing water quality management efforts to address water quality impacts and for tracking progress toward their resolution. In addition, the WI/PWL provides the foundation for the development of the state Section 303(d) List of Impaired Waters Requiring a Total Maximum Daily Load (TMDL). The WI/PWL assessments reflect data and information drawn from numerous NYSDEC programs (e.g. CSLAP) as well as other federal, state and local government agencies, and citizen organizations. All data and information used in these assessments has been evaluated for adequacy and quality as per the NYSDEC Consolidated Assessment and Listing Methodology (CALM). The current WI/PWL assessment for Lake Agawam (Appendix E) reflects monitoring data collected in 2015. Lake Agawam is assessed as an impaired waterbody for recreational uses, and stressed for aquatic life uses, due to HABs and nutrients (phosphorus and low dissolved oxygen).

Lake Agawam is currently included on the NYS Section 303(d) List of Impaired/TMDL Waters for phosphorus, and related low dissolved oxygen.

8. Conditions Triggering HABs

Resilience is an important factor in determining an ecosystem's ability to respond to and overcome negative impacts (Zhou et al. 2010), including the occurrence and prevalence of HABs. Certain lakes may not experience HABs even though factors hypothesized to be "triggers" (e.g., elevated P concentrations) are realized (Mantzouki et al. 2016), and conversely, lakes that have historically been subject to HABs may still be negatively affected even after one or more triggers have been reduced. Thus, phytoplankton dynamics may cause the presence of HABs to lag behind associated triggers (Faassen et al. 2015). Further, unusual climatic events (e.g., high TP input from spring runoff and hot calm weather in fall) may create unique conditions that contribute to a HAB despite implementation of management strategies to prevent them (Reichwaldt and Ghadouani 2012).

Ecosystems often exhibit a resistance to change that can delay outcomes associated with HABs management. This system resilience demands that prevention and management of these triggers be viewed long-term through a lens of both watershed and in-lake action. It may take significant time following implementation of recommended actions for the frequency, duration, and intensity of HABs to be reduced.

A dataset spanning 2012 to 2017 of 163 waterbodies in New York State has been compiled to help understand the potential triggers of HABs at the state-scale (CSLAP data). This dataset includes information on several factors that may be related to the occurrence of HABs, e.g., lake size and orientation (related to fetch length, or the horizontal distance influenced by wind); average total phosphorus and total nitrogen concentrations; average surface water temperatures; as well as the presence of invasive zebra and quagga mussels (i.e., dreissenid mussels). This data set has been analyzed systematically, using a statistical approach known as logistic regression, to identify the minimum number of factors that best explain the occurrences of HABs in NYS. A minimum number of factors are evaluated to provide the simplest possible explanation of HABs occurrences (presence or absence) and to provide a basis for potential targets for management. One potential challenge to note with this data set is that lakes may have unequal effort regarding HABs observations which could confound understanding of underlying processes of HABs evaluated by the data analysis.

Across New York, four of the factors evaluated were sufficiently correlated with the occurrence of HABs, namely, average total phosphorus levels in a lake, the presence of dreissenid mussels, the maximum lake fetch length and the lake compass orientation of that maximum length. The data analysis shows that for every 0.01 mg/L increase in total phosphorus levels, the probability that a lake in New York will have a HAB in a given year increases by about 10% to 18% (this range represents the 95% confidence interval based on the parameter estimates of the statistical model). The other factors, while statistically significant, entailed a broad range of uncertainty given this initial analysis. The presence of dreissenid mussels is associated with an increase in the annual HAB probability of 18% to 66%. Lakes with long fetch lengths are associated with an increased occurrence of HABs; for every mile of increased fetch length, lakes are associated with up to a 20% increase in the annual probability of HABs. Lastly, lakes with a northwest orientation along their longest fetch length are 10% to 56% more likely to have

a HAB in a given year. Each of these relationships are bounded, i.e., the frequency of blooms cannot exceed 100%, meaning that as the likelihood of blooms increases the marginal effect of these variables decreases. While this preliminary evaluation will be expanded as more data are collected on HABs throughout New York, these results are supported by prior literature. For example, phosphorus has long been known to be a limiting nutrient in freshwater systems and a key driver of HABs, however the potential role of nitrogen should not be overlooked as HABs mitigation strategies are contemplated (e.g., Conley et al. 2009). Similarly, dreissenid mussels favor HABs by increasing the bioavailability of phosphorus and selectively filtering organisms that may otherwise compete with cyanobacteria (Vanderploeg et al. 2001). The statistically-significant association of fetch length and northwest orientation with HABs may suggest that these conditions are particularly favorable to wind-driven accumulation of cyanobacteria and/or to wind-driven hydrodynamic mixing of lakes leading to periodic pulses of nutrients. While each of these potential drivers of HABs deserve more evaluation, the role of lake fetch length and orientation are of interest and warrant additional study.

There is continuing interest in the possible role of nitrogen in the occurrence and toxicity of HABs (e.g., Conley et al. 2009), and preliminary analysis of this statewide data set suggests that elevated total N and total P concentrations are both statistically significant associates with the occurrence of toxic blooms. When total N and total P concentrations are not included in the statistical model, elevated inorganic nitrogen (NH₄ and NO_x) concentrations are also positively associated with toxic blooms. The significant association of inorganic N forms with toxic blooms may provide a more compelling association than total N, which may simply be a redundant measure of the biomass associated with toxins. It should be noted that while this analysis may provide some preliminary insight into state-scale patterns, it is simplistic in that it does not account for important local, lake-specific drivers of HABs such as temperature, wind, light intensity, and runoff events.

9. Sources of Pollutants

Nutrients enter waterbodies via overland flow, tributaries, and other nonpoint sources, as well as point sources, where they become available for use by cyanobacteria and aquatic plants or are deposited and stored in lakebed sediments.

Two different tools were used to estimate nutrient loading from the watershed. Land use and potential phosphorus pollutant loading data provided in this section were estimated using NYSDEC's Loading Estimator of Nutrient Sources (LENS) screening tool (NYSDEC, undated). Nitrogen loading analysis was completed using the Nitrogen Load Model (NLM) in Dr. Christopher Gobler's study to evaluate the potential impact on water quality with the creation of a sewer district (Gobler 2017).

9.1 Land Uses

Based on NYSDEC's LENS model analysis, the watershed comprises the following land use types (Figure 5):

- Developed land = 85%
- Forest = 6%
- Pasture/Hay = 5%

- Open Water = 4%

The distribution of the land use is depicted in Figure 9. Much of the watershed is assessed as developed, and several high intensity septic density areas are present on the northern side of the watershed (Figure 11).

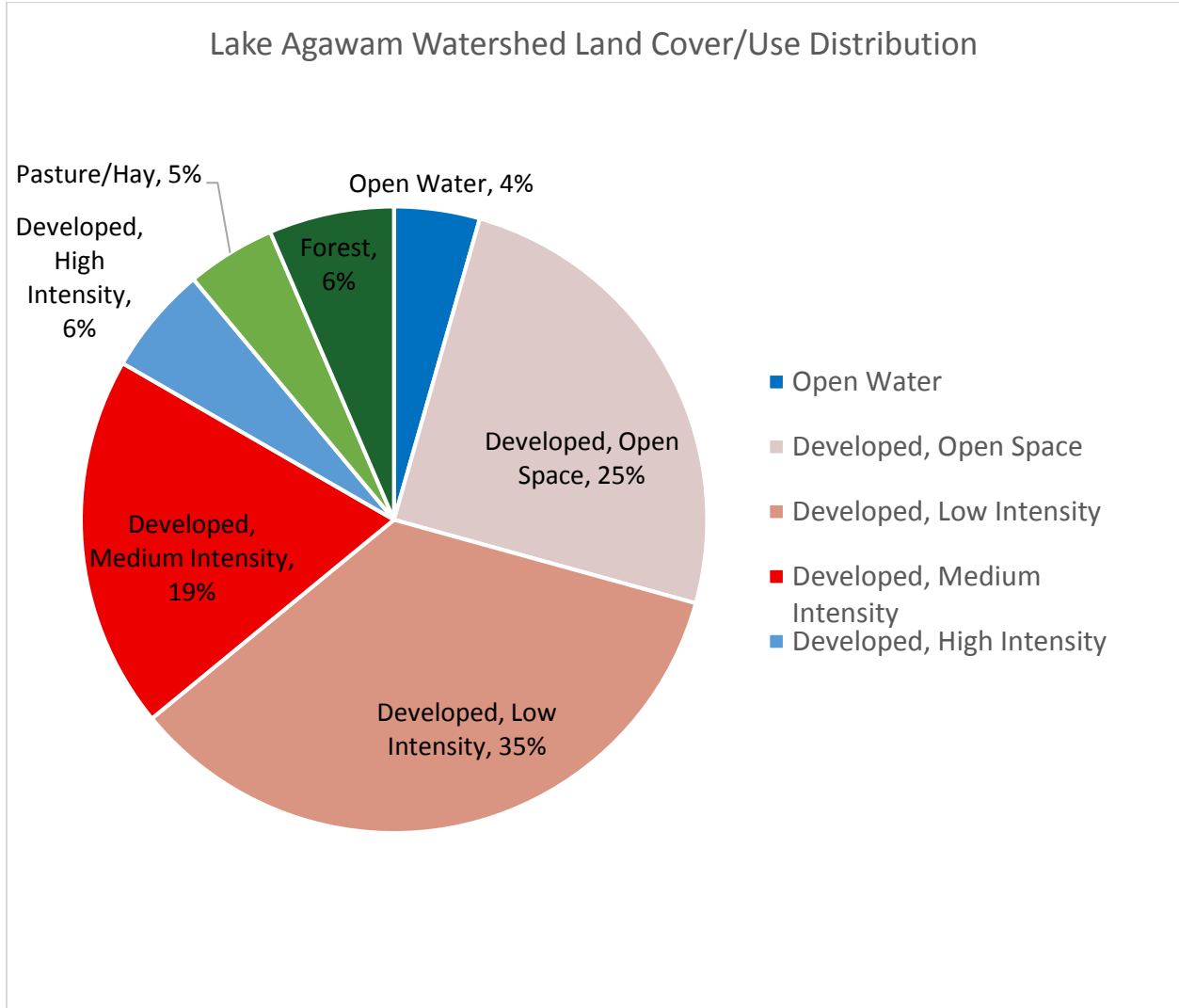


Figure 9: Land use categories and percentages for the Lake Agawam watershed.

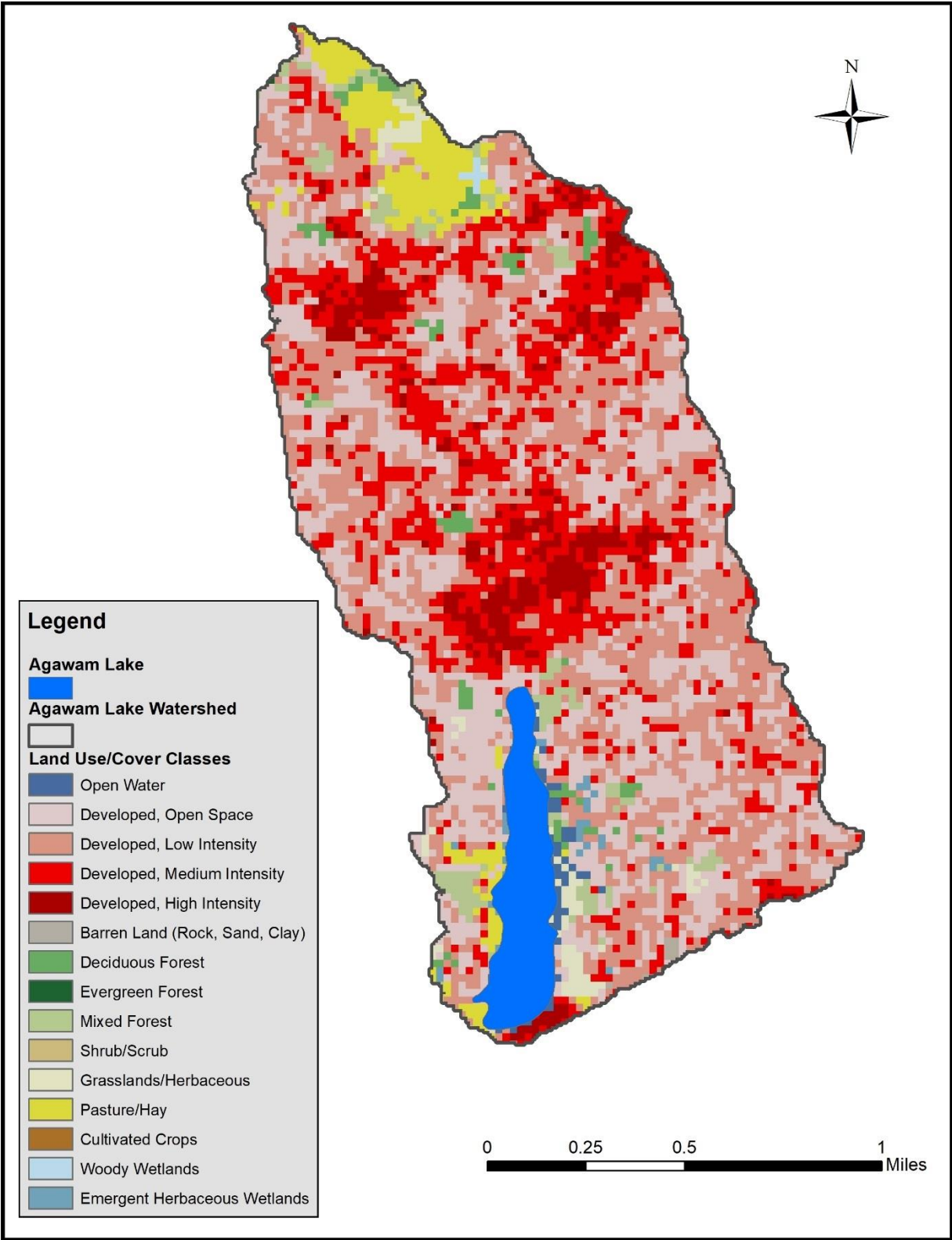


Figure 10: Lake Agawam watershed land use.

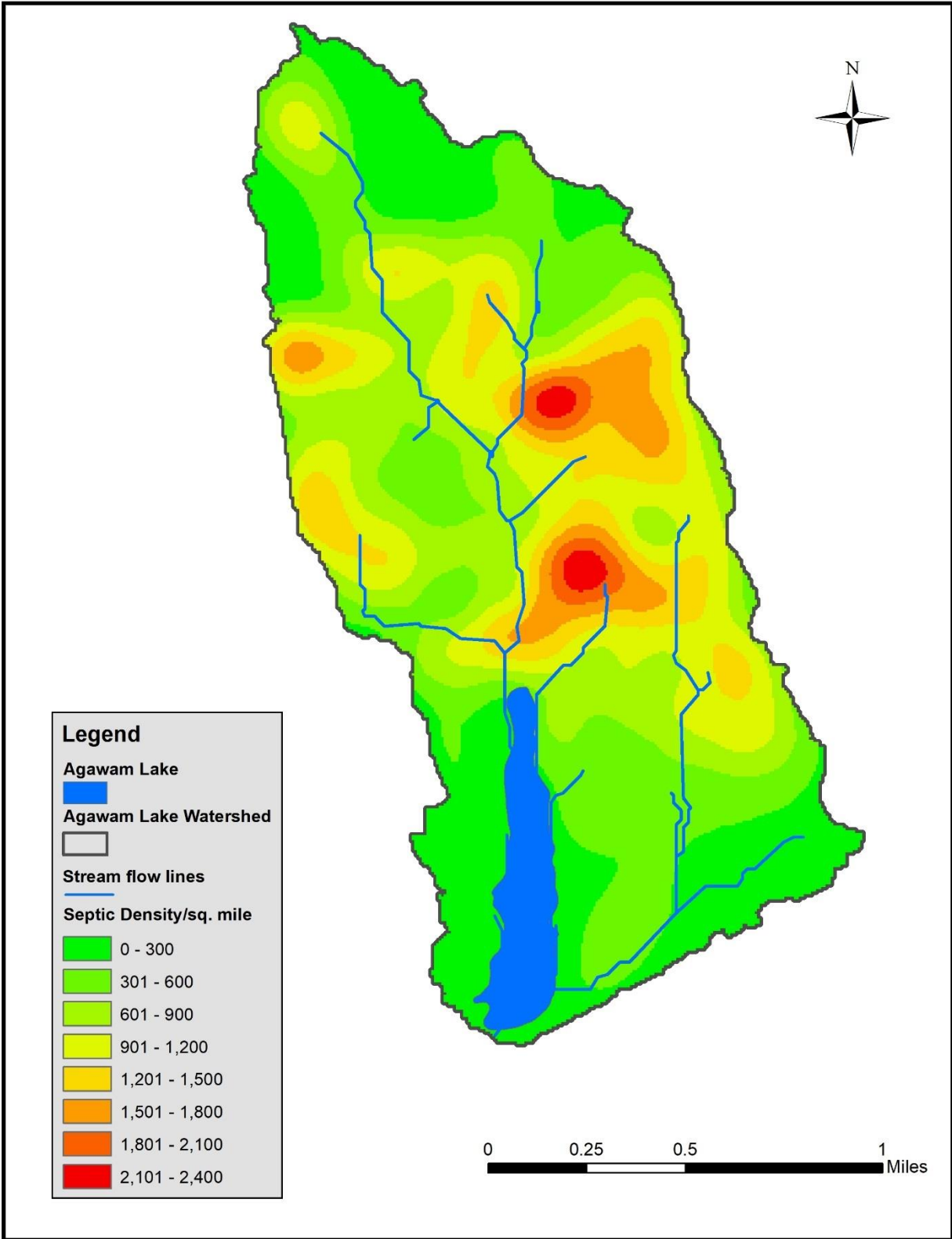


Figure 11: Sanitary/septic system density in the Lake Agawam watershed.

9.2 External Pollutant Sources

According to the LENS model, developed land contributes to the majority of external phosphorous loading in the lake (Figure 12). Phosphorus loading from developed land is categorized by stormwater runoff, including fertilizer, atmospheric deposition, phosphorus transport from soil, and particulate matter (pet waste, plant material).

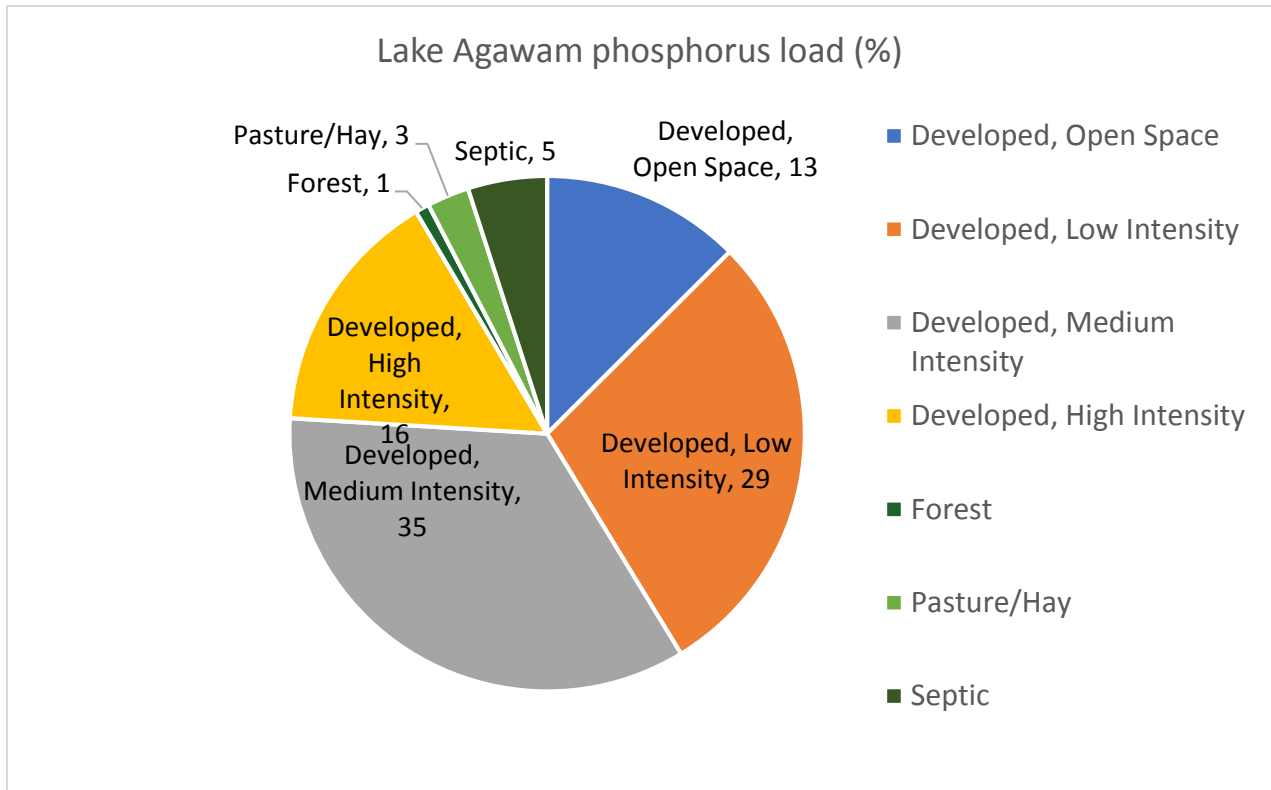


Figure 12: Phosphorus load into Lake Agawam.

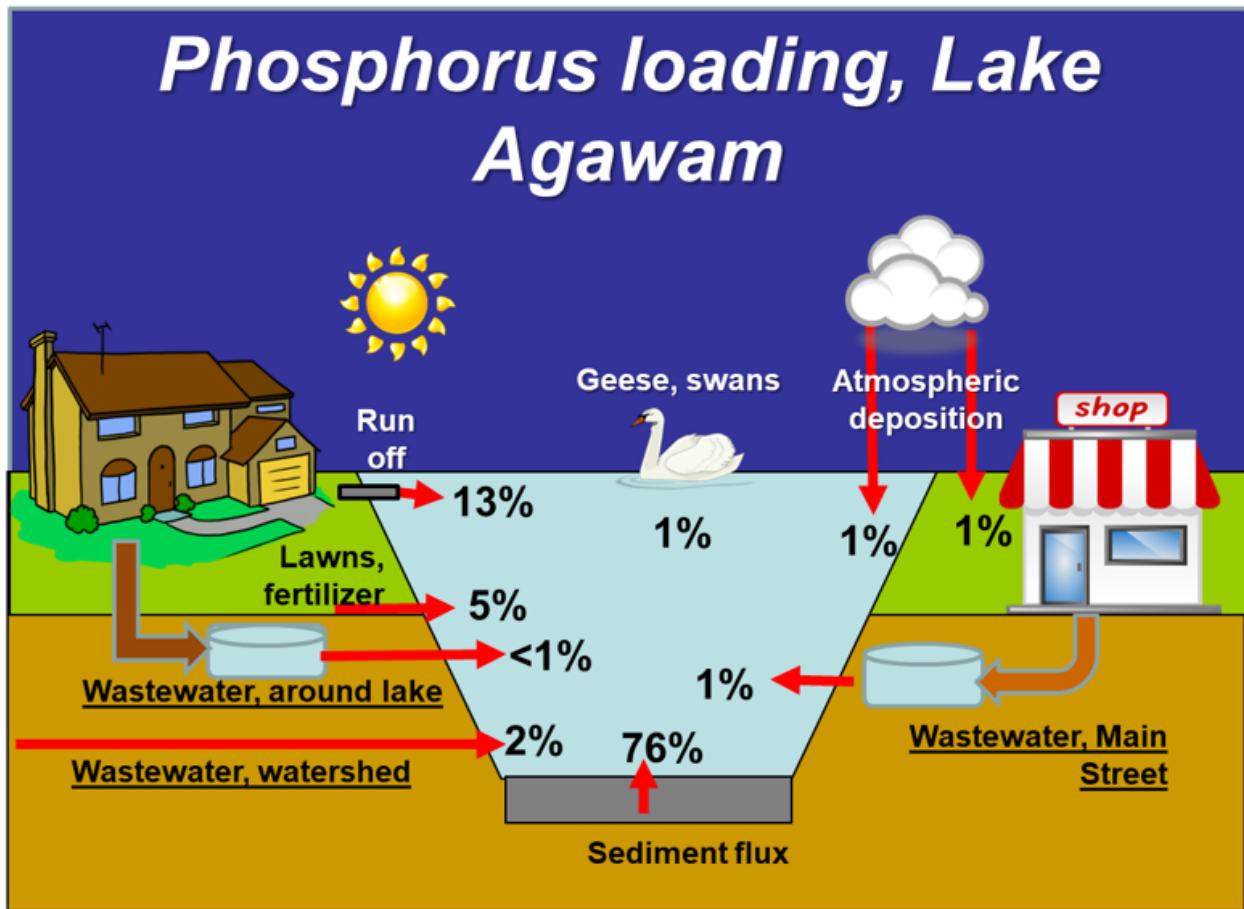


Figure 13: Phosphorus Loading to Lake Agawam (Gobler, 2017)

Models developed by SUNY SB indicate the majority of the phosphorus load to Lake Agawam is legacy nutrients released from lake sediment (“sediment flux”) (Figure 13). Excess phosphorus within the lake sediments may be released back into the lake waters when conditions are favorable. Such conditions can include resuspension of sediments by wind mixing or fish activity (e.g. feeding off bottom of lake), sediment anoxia (i.e. low dissolved oxygen levels near the sediment water interface), high pH levels, die-offs of heavy growths of rooted aquatic plants, and other mechanisms that result in the release of phosphorus (Wetzel 2001). Other sources of phosphorus include runoff during rain events and fertilizer applications.

SUNY SB’s Nitrogen Loading Model (NLM) model indicates that wastewater from sanitary on-site septic systems (groundwater) contribute the majority of nitrogen loading to the lake (Figure 14).

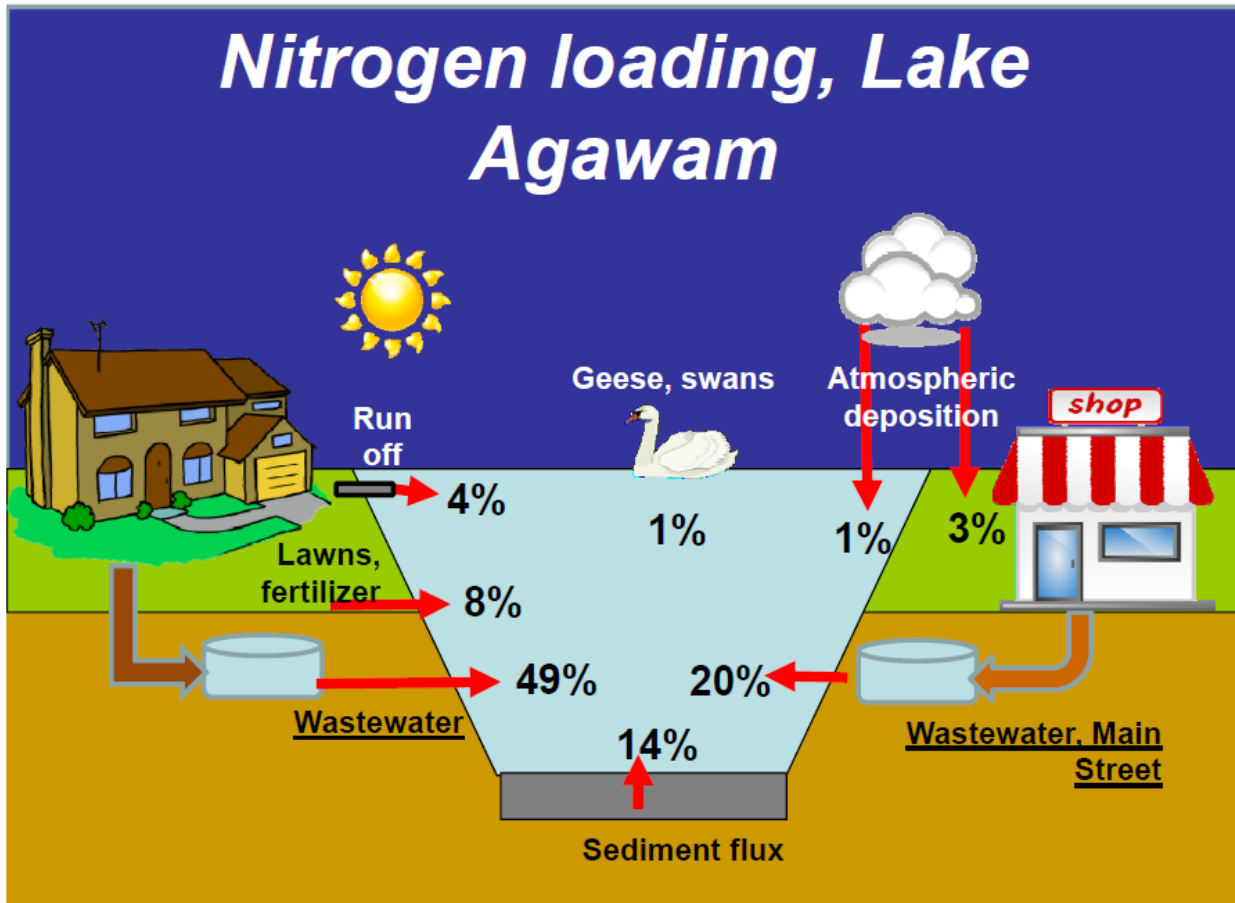


Figure 14: Nitrogen loading to Lake Agawam (Gobler 2017).

Gobler's "Quantifying Nitrogen Loading to from Southampton Village to Surrounding Water Bodies and their Mitigation by Creating a Sewer District," further specifies external sources as the main source of nitrogen loading entering the Lake Agawam watershed, specifically:

- Wastewater from sanitary/septic systems = 70%
- Fertilizer = 8%
- Atmospheric deposition = 4%
- MS4 drain at the north-end of Lake Agawam = 4%

Waterfowl were also identified as a source of nutrient pollution (Nelson, Pope & Voorhis, LLC 2009).

9.3 Internal Pollutant Sources

Internal sources were estimated to be 14% of the nitrogen loading to Lake Agawam, using the NLM model. Internal phosphorus loads have not been estimated by DEC, however measurements in 2008 (Harke et al., 2008) suggested that both organic and inorganic phosphorus loading from storm drain runoff contribute to only 12% of the total P flux of the

system, with the majority originating from the lake bottom. Note that the Village has made several improvements to the stormwater system.

9.4 Summary of Priority Land Uses and Land Areas

As discussed in **Section 9.1**, nitrogen loading occurs predominately through groundwater contamination from sanitary/septic systems, while phosphorus loading is primarily due to internal loading with some external loading through stormwater runoff. Predominant land use categories are developed, with dense septic density areas in the northern portion of the watershed. See Appendix F: Parcels abutting Lake Agawam.

10. Lake Management / Water Quality Goals

The primary lake management/water quality goal for Lake Agawam is to implement proactive management to minimize the potential for HABs occurring in the future.

The lake has been studied in five (5) prior reports that involve recommendations to address issues to assist in restoring Lake Agawam. These reports are summarized below and are listed in the references to this document.

Nelson, Pope & Voorhis completed the “Comprehensive Management Plan for Lake Agawam” for the Village of Southampton in 2007. This plan provided a full assessment of the lake as well as complete recommendations for improvements to lake water quality, habitat and conditions. A total of twenty-two (22) recommendations were provided for incremental water quality improvements. These recommendations included buffer area recommendations; watershed area recommendations; lake management recommendations; and, water quality monitoring and research. The plan provided an action plan matrix for implementation of recommendations. This plan remains valid for lake management. Dredging of lake sediments was identified as a control measure to improve lake water quality and conditions. Specifically, recommendation 19 of the report was as follows: “Evaluate potential for removal of organically enriched surface sediments from the lake bottom in order to reduce the release of nutrients into the water column.” (Nelson, Pope & Voorhis, 2007).

Lombardo Associates Inc. (LAI) developed the “Lake Agawam Water Quality Restoration Action Plan” for the Peconic Baykeeper in 2013. This plan addressed phosphorus as primary water quality concern and estimated phosphorus and other nutrient inputs. The plan provided recommendations to reduce phosphorus in the lake to improve quality (LAI, 2013).

H2M prepared the “Map and Plan for the Formation of the Inc. Village of Southampton Sewer System” for the Village in November, 2015. The report established a plan to create a service area (sewer district) including options to provide treatment and conveyance to a treatment facility for the downtown area. The report indicates: “The existing onsite sanitary wastewater disposal systems within the core commercial area are impacted by shallow groundwater and are identified as a contributor to the degradation of Lake Agawam. Establishing a sewer system to collect and treat the sanitary wastewater generated within this core commercial area will help improve the quality of Lake Agawam and the South Shore Estuary, protect public health, and also allow change of use and business expansion to occur within the Village.” The Map and Plan provided

information regarding service area boundaries, sanitary flow, engineering, cost information and associated tax implications for residents/business as related to the construction, operation and maintenance of sanitary treatment facilities in the Village (H2M, 2017).

Stony Brook University (SBU) prepared the report “Quantifying Nitrogen Loading to from Southampton Village to Surrounding Water Bodies and their Mitigation by Creating a Sewer District” report for the Village of Southampton in 2017. This report supported the prior finding that nitrogen is the primary nutrient contributing to HABs in Lake Agawam. The document quantified nitrogen loading to the lake and provided recommendations, most notably wastewater treatment for the downtown Southampton Village area. The SBU report summarized the status of recommendations in the NP&V action plan matrix finding that some had been completed and others remained (SBU, 2017).

Nelson, Pope & Voorhis completed the document, “Dredging Assessment Report, Lake Agawam, Village of Southampton” for the Village of Southampton in November 2019. The report addressed lake sediments as related to recommendation 19 of the 2007 Nelson, Pope & Voorhis Comprehensive Management Plan for Lake Agawam. The report determined the sediment depth in the north part of the lake by using hard and soft bottom measurements, and further characterized the material through analytical testing. The report identifies options for removal of sediment material from the lake. The scope of the report was to examine hard and soft bottom depths in the north end of Lake Agawam and determine the quantity of soft sediment. The second phase was to screen sediments for quality based on sediment testing to determine contaminant levels and potential disposal options. The final phase was to examine sediment removal options and cost (Nelson, Pope & Voorhis, 2019). Recommendations include continued sampling to define limits of the elevated concentrations of organics and some minor contaminants (pesticides, arsenic, lead and mercury) found in 2 sampling locations, in preparation of a sediment testing work plan for submission of applicable permits to DEC. NP&V also suggested using lead as a potential indicator for contaminant levels, and TOC as an indicator of organic content. In the northern end of the lake only, there is an estimated soft sediment volume of 65,000 cubic yards that would need to be dredged.

11. Summary of Management Actions to Date

11.1 Local Management Actions

Several local management actions have been implemented by the local communities in the Lake Agawam Watershed. In 2009 the Comprehensive Management Plan for Lake Agawam was developed by Nelson, Pope & Voorhis, LLC (NP&V, 2019) to guide management actions within the watershed. Local management actions implemented within the Village/watershed include several of the projects below (Gobler 2017). Please see appendix C for completed, partially implemented and proposed projects included in 2019. Highlights include:

- Stormwater infrastructure improvements.
 - The village highway department continues to install drainage infrastructure in village roads within the Lake Agawam watershed, with the Village coordinating and securing grant funding.
- Incorporation of water quality provisions into local municipality zoning codes.
- Community outreach for homeowner Best Management Practices (BMPs).
- In-waterbody BMPs, including

- Pond Lane Bioswale installation: on the Wyman property. This BMP will reduce stormwater overflow from a sloped bank toward the lake.

11.2 Funded Projects

Local funding has supported the implementation of BMPs within the Lake Agawam Watershed.

Suffolk County Grant Drainage Projects

- Culver/Ox Pasture/Pond Lane (completed)
- Bowden Square (completed)
- Hill Street (completed)
- Gin Lane (anticipated completion Spring 2020): This project will eliminate the outfall pipe at Gin Lane through the installation of a rain garden and 13 leaching basins at the south end of Lake Agawam.

The Lake Agawam Conservancy Aquatic Invasive Species (AIS) Removal Project, Buoy deployment and educational outreach

- The Lake Agawam Conservancy has been issued permits by the Village and Town Trustees to remove native water lily from the southwest part of the Lake to reduce the biomass that decays annually in the lake, thus reducing nutrient accumulation in sediments.
- The Lake Agawam Conservancy has committed to purchase an up-graded real-time monitoring buoy to be maintained and deployed by Dr. Gobler out of SUNY Stonybrook for the 2020 season.
- The Conservancy has also prepared and scheduled several public outreach sessions.
 - January 17, 2020; Toxic Free Landscapes: A Professional Seminar
 - Oct 2020 – Doug Tallamy (entomologist; University of Delaware)

Community Preservation Fund Drainage Projects

- Jobs Lane
- Railroad Plaza

11.3 NYSDEC Issued Permits

Article 17 of New York’s Environmental Conservation Law (ECL) entitled “Water Pollution Control” was enacted to protect and maintain the state’s surface water and groundwater resources. Under Article 17, the State Pollutant Discharge Elimination System (SPDES) program was authorized to maintain reasonable standards of purity for state waters. NYSDEC issues Municipal Separate Storm Sewer System (MS4s) under the SPDES Program for stormwater discharges from MS4s. The Village of Southampton (ID: NYR20A456) is a regulated MS4, and therefore stormwater discharges from their MS4 system may influence water quality in Lake Agawam.

For more information about NYSDEC’s SPDES program and to view permits issued in the Lake Agawam watershed visit <http://www.dec.ny.gov/permits/6054.html>.

The Village also issues wetland permits for activities surrounding Lake Agawam. The Village seeks expanded natural buffers, removal of fertilizer dependent vegetation and installation of

Innovative/Alternative Onsite Wastewater Treatment Systems (I/A OWTS) wherever possible in connection with permit issuance.

11.4 Research Activities

As stated previously, SUNY Stony Brook's monitoring comprises much of the research on Lake Agawam to date. HAB monitoring and reporting through DEC has also been performed by SUNY Stony Brook since 2012. Under Governor Cuomo's HABs Initiative, an innovative new project to combat harmful algal blooms (HABs) was piloted in Lake Agawam. The algae harvester successfully removed cyanobacteria and toxins during the 10-day pilot. DEC is continuing to review and evaluate the results. DEC, Southampton Village, and Lake Agawam stakeholders continue to work together to identify solutions to address the long-term health of Lake Agawam.

11.5 Clean Water Plans (TMDL, 9E, or Other Plans)

Lake Agawam was listed on Part 1 of the NYS Section 303(d) List of Impaired Waters requiring the development of a TMDL or other strategy to address impairments due to phosphorus/low dissolved oxygen. The models used in Section 10 to estimate nutrient loading are a starting point for the development of a clean water plan. Clean water plans are a watershed-based approach to outline a strategy to improve or protect water quality. Total maximum daily load (TMDL) and 9E Plans are examples of clean water plans; these plans document the pollution sources, pollutant reduction goals and recommend strategies/actions to improve water quality:

- A TMDL calculates the maximum amount of a single pollutant that a waterbody can receive and still meet water quality standards. TMDLs are developed by determining the amount that each source of a pollutant can discharge into the waterbody and the reductions from those sources needed to meet water quality standards. A TMDL is initiated by NYSDEC for waterbodies that are on the 303d impaired waters list with a known pollutant.
- 9E Watershed Plans are consistent with the USEPA's framework to develop watershed-based plans. USEPA's framework consists of nine key elements intended to identify the contributing causes and sources of nonpoint source pollution, involve key stakeholders in the planning process, and identify restoration and protection strategies that will address the water quality concerns. The nine minimum elements to be included in these plans are:
 - A. Identify and quantify sources of pollution in watershed.
 - B. Identify water quality target or goal and pollutant reductions needed to achieve goal.
 - C. Identify the best management practices (BMPs) that will help to achieve reductions needed to meet water quality goal/target.
 - D. Describe the financial and technical assistance needed to implement BMPs identified in Element C.
 - E. Describe the outreach to stakeholders and how their input was incorporated and the role of stakeholders to implement the plan.
 - F. Estimate a schedule to implement BMPs identified in plan.

- G. Describe the milestones and estimated time frames for the implementation of BMPs.
- H. Identify the criteria that will be used to assess water quality improvement as the plan is implemented.
- I. Describe the monitoring plan that will collect water quality data need to measure water quality improvement (criteria identified in Element H).

Nine Element Plans are best suited for waterbodies where the pollutant of concern is well understood and nonpoint sources are likely a significant part of the pollutant load; the waterbody does not need to be on the 303d impaired waters list to initiate a 9E Plan.

12. Proposed HABs Actions

12.1 Overarching Considerations

When selecting projects intended to reduce the frequency and severity of HABs, lake and watershed managers may need to balance many factors. These include budget, available land area, landowner willingness, planning needs, community priorities or local initiatives, complementary projects or programs, water quality impact or other environmental benefit (e.g., fish/habitat restoration, flooding issues, open space). Additional important considerations include (1) the types of nutrients, particularly phosphorus and nitrogen, involved in triggering HABs, (2) confounding factors including climate change, and (3) available funding sources (discussed in Section 13.2).

Phosphorus Forms

As described throughout this Action Plan, a primary factor contributing to HABs in the waterbody is excess nutrients, in particular, phosphorus. Total phosphorus (TP) is a common metric of water quality and is often the nutrient monitored for and targeted in watershed and lake management strategies to prevent or mitigate eutrophication (Cooke et al. 2005).

However, TP consists of different forms (Dodds 2003) that differ in their ability to support algal growth. There are two major categories of phosphorus: particulate and dissolved (or soluble). The dissolved forms of P are more readily bioavailable to phytoplankton than particulate forms (Auer et al. 1998, Effler et al. 2012, Auer et al. 2015, Prestigiacomo et al. 2016). Phosphorus bioavailability is a term that refers to the usability of specific forms of phosphorus by phytoplankton and algae for assimilation and growth (DePinto et al. 1981, Young et al. 1982).

Because of the importance of dissolved P forms affecting receiving waterbody quality, readers of the Action Plan should consider the source and form of P, in addition to project-specific stakeholder interest(s), when planning to select and implement the recommended actions, best management practices or management strategies in the Action Plan. Management of soluble P is an emerging research area; practices designed for conservation of soluble phosphorus are recommended in Sonzogni et al. 1982, Ritter and Shiromohammadi 2000, and Sharpley et al. 2006.

Nitrogen

Nitrogen is also an important factor that may be contributing to HABs. Nitrogen comes from natural and human sources, including wet and dry atmospheric deposition, sewage treatment

plants, stormwater runoff, and groundwater that becomes enriched as a result of excess fertilizer being applied to lawns, landscaping, and agricultural crops, as well from on-site waste water disposal systems (“septic systems”).

Climate Change

Climate change is also an important consideration when selecting implementation projects. There is still uncertainty in the understanding of BMP responses to climate change conditions that may influence best management practice efficiencies and effectiveness. More research is needed to understand which BMPs will retain their effectiveness at removing nutrient and sediment pollution under changing climate conditions, as well as which BMPs will be able to physically withstand changing conditions expected to occur because of climate change.

Where possible, selection of BMPs should be aligned with existing climate resiliency plans and strategies (e.g., floodplain management programs, fisheries/habitat restoration programs, or hazard mitigation programs). When selecting BMPs, it is also important to consider seasonal, inter-annual climate or weather conditions and how they may affect the performance of the BMPs. For example, restoration of wetlands and riparian forest buffers not only filter nutrient and sediment from overland surface flows, but also slow runoff and absorb excessive water during flood events, which are expected to increase in frequency due to climate change. These practices not only reduce disturbance of the riverine environment but also protect valuable agricultural lands from erosion and increase resiliency to droughts.

In New York State, ditches parallel nearly every mile of our roadways and in some watersheds, the length of these conduits is greater than the natural watercourses themselves. Although roadside ditches have long been used to enhance road drainage and safety, traditional management practices have been a significant, but unrecognized contributor to flooding and water pollution, with ditch management practices that often enhance rather than mitigate these problems. The primary objective has been to move water away from local road surfaces as quickly as possible, without evaluating local and downstream impacts. As a result, elevated discharges increase peak stream flows and exacerbate downstream flooding. The rapid, high volumes of flow also carry nutrient laden sediment, salt and other road contaminants, and even elevated bacteria counts, thus contributing significantly to regional water quantity and quality concerns that can impact biological communities. All of these impacts will be exacerbated by the increased frequency of high intensity storms associated with climate change. For more information about road ditches, see Appendix F.

For more information about climate change visit NYSDEC’s website (<https://www.dec.ny.gov/energy/44992.html>).

Water Quality Improvement Process

The water quality improvement process addressed in this action plan to combat HABs in Lake Agawam is a multi-faceted approach to improve overall water quality in the lake. Eradicating HABs is a long-term effort that will require active collaboration at all levels of government and citizen engagement moving forward.

This Action Plan is intended to be a 'living document' and interested members of the public are encouraged to submit comments and ideas to DOWInformation@dec.ny.gov to assist with HABs prevention and treatment moving forward. Local support and implementation of the plan's recommended actions are crucial to successfully preventing and combatting HABs.

Communities and watershed organizations are encouraged to review the plan for their lake, particularly the proposed actions, and work with state and local partners to implement those recommendations. Individuals can get involved with local groups and encourage their communities or organizations to act.

12.2 Priority Project Development and Funding Opportunities

The priority projects listed below have been developed by an interagency team and local steering committee that has worked cooperatively to identify, assess feasibility and costs, and prioritize both in-lake and watershed management strategies aimed at reducing HABs in Lake Agawam. The Village, the Lake Agawam Conservancy, consultants, residents and stakeholders continue to explore methods for improve water quality of Lake Agawam. The Village is seeking input on the feasibility of using clustered sanitary systems for treatment in the downtown area, on a temporary basis until a full sewage treatment plant can be installed. Other efforts are continually examined for lake improvements.

These projects have been assigned priority rankings based on the potential for each individual action to achieve one of two primary objectives of this HABs Action Plan:

1. In-lake management actions: Minimize the internal stressors (e.g., nutrient concentrations, dissolved oxygen levels, temperature) that contribute to HABs within Lake Agawam.
2. Watershed management actions: Address watershed inputs that influence in-lake conditions that support HABs.

As described throughout this HABs Action Plan, the primary factors that contribute to HABs in Lake Agawam include:

- Nitrogen inputs associated with septic system discharge.
- Internal loading of legacy nitrogen from in-lake sediments.
- Nonpoint source nutrient inputs from the contributing watershed.

The management actions identified below have been prioritized to address these sources. Projects were prioritized based on the following cost-benefit and project readiness criteria: local support or specific recommendation by steering committee members, eligibility under existing funding mechanisms, and expected water quality impacts as determined by the interagency team. Additionally, nutrient forms and the impacts of climate change were considered in this prioritization as described above.

The implementation of the actions outlined in this Plan is contingent on the submittal of applications (which may require, for example, landowner agreements, feasibility studies, match [financial or in-kind], permits, or engineering plans), award of funding, and timeframe to complete implementation. Due to these contingencies, recommended projects are organized into broad implementation schedules: short-term (0-3 years), mid-term (3-5 years), and long-term (5-10 years).

Funding Programs

The recommended actions outlined in this Section may be eligible for funding from the many state, federal and local/regional programs that help finance implementation of projects in New York State (see <https://on.ny.gov/HABsAction>). The New York State Water Quality Rapid Response Team stands ready to assist all partners in securing funding. Some of the funding opportunities available include:

The New York State Environmental Protection Fund (EPF) was created by the state legislation in 1993 and is financed primarily through a dedicated portion of real estate transfer taxes. The EPF is a source of funding for capital projects that protect the environment and enhance communities. Several NYS agencies administer the funds and award grants, including NYSDAM, NYSDEC, and Department of State. The following two grant programs are supported by the EPF to award funding to implement projects to address nonpoint source pollution:

The Agricultural Nonpoint Source Abatement and Control Program (ANSACP), administered by the NYSDAM and the Soil and Water Conservation Committee, is a competitive financial assistance program for projects led by the Soil and Water Conservation Districts that involves planning, designing, and implementing priority BMPs. It also provides cost-share funding to farmers to implement BMPs. For more information visit <https://www.nys-soilandwater.org/aem/nonpoint.html>.

The Water Quality Improvement Program (WQIP), administered by the NYSDEC Division of Water, is a competitive reimbursement program for projects that reduce impacted runoff, improve water quality, and restore habitat. Eligible applicants include municipalities, municipal corporations, and Soil and Water Conservation Districts. <https://www.dec.ny.gov/pubs/4774.html>

Non-Agricultural Nonpoint Source Planning Grant (NPG) administered by NYSDEC Division of Water, is a competitive, reimbursement grant program that funds planning reports for nonpoint source water quality improvement projects. Eligible applicants are municipalities and Soil and Water Conservation Districts. The goal of the program is to get projects ready for construction and future implementation funding through the Water Quality Improvement Project grant program or other funding opportunities. For more information visit <https://www.dec.ny.gov/pubs/116725.html>.

The Environmental Facilities Corporation (EFC) is a public benefit corporation which provides financial and technical assistance, primarily to municipalities through low-cost financing for water quality infrastructure projects. EFC's core funding programs are the Clean Water State Revolving Fund and the Drinking Water State Revolving Fund. EFC administers both loan and grant programs, including the Green Innovation Grant Program (GIGP), Engineering Planning Grant Program (EPG), Water Infrastructure Improvement Act (WIIA), and the Septic System Replacement Program. For more information about the programs and application process visit <https://www.efc.ny.gov/>.

Wastewater Infrastructure Engineering Planning Grant is available to municipalities with median household income equal to or less than \$65,000 according to the United States Census 2015 American Community Survey or equal to or less than \$85,000 for Long Island, NYC and Mid-Hudson Regional Economic Development Council (REDC) regions. Priority is usually given to smaller grants to support initial engineering reports and plans for wastewater treatment

repairs and upgrades that are necessary for municipalities to successfully submit a complete application for grants and low interest financing.

Clean Water Infrastructure Act (CWIA) Septic Program funds county-sponsored and administered household septic repair grants. This program entails repair and/or replacement of failing household septic systems in hot-spot areas of priority watersheds. Grants are channeled through participating counties. For more information visit <https://www.efc.ny.gov/SepticReplacement>.

CWIA Inter-Municipal Grant Program funds municipalities, municipal corporations, as well as soil and water conservation districts for wastewater treatment plant construction, retrofit of outdated stormwater management facilities, as well as installation of municipal sanitary sewer infrastructure.

CWIA Source Water Protection Land Acquisition Grant Program funds municipalities, municipal corporations, soil and water conservation districts, as well as not-for-profits (e.g., land trusts) for land acquisition projects providing source water protection. This program is administered as an important new part of the Water Quality Improvement Project program.

Consolidated Animal Feeding Operation Waste Storage and Transfer Program Grants fund soil and water conservation districts to implement comprehensive nutrient management plans through the completion of agricultural waste storage and transfer systems on larger livestock farms.

Water Infrastructure Improvement Act Grants funds municipalities to perform capital projects to upgrade or repair wastewater treatments plants and to abate combined sewer overflows, including projects to install heightened nutrient treatment systems.

Green Innovation Grant Program provides municipalities, state agencies, private entities, as well as soil and water conservation districts with funds to install transformative green stormwater infrastructure.

Peconic Bay Region Community Preservation Fund administered by the Town of Southampton, allows for utilization of a maximum of 20% of the annual Community Preservation Fund revenue to fund local water quality improvement projects.

Suffolk County Water Quality Protection and Restoration Program administered by the Suffolk County Department of Economic Development and Planning, supports eligible projects as defined in Article 12 Section 2(B) of the Suffolk County Charter.

Town of Southampton Community Preservation Fund water quality improvement projects.

Readers of this Action Plan interested in submitting funding applications are encouraged to reference this Action Plan and complementary planning documents (i.e., TMDLs or 9E Plans) as supporting evidence of the potential for their proposed projects to improve water quality. However, applicants must thoroughly review each funding program's eligibility, match, and documentation requirements before submitting applications to maximize their potential for securing funding.

There may be recommended actions that are not eligible for funding through existing programs, however, there may be opportunities to implement actions through watershed programs (<https://www.dec.ny.gov/chemical/110140.html>) or other mechanisms.

12.3 Lake Agawam Priority Projects

Priority Projects 1

Priority 1 projects are considered necessary to manage water quality and reduce HABs in Lake Agawam, and implementation should be evaluated and begin as soon as possible.

Short-term (0-3 years)

1. Continued water quality and HAB monitoring by Stony Brook University to document lake water quality and HABs.
2. Complete a full-scale groundwater study to assess the sources and levels of pollutants entering Lake Agawam via groundwater intrusion. This study would establish the flow to and from Lake Agawam to better define source nitrogen in groundwater that impacts the Lake. Hydraulic gradient and water quality monitoring wells would be placed in strategic locations at the head of and around the Lake, including multiple depth wells, to determine flow and water quality.
 - a. Coordinate with USGS, or other qualified private entity for implementation of study, including seasonality (i.e., 1 year of study).
 - b. Evaluate installation of permeable reactive barrier.
3. Complete sounding and sediment quantity sampling and engineering analysis of the balance of the lake to supplement the NP&V 2019 dredging documentation of the north end of the lake.
4. Develop village-wide water quality improvement plan to be adopted by the Village of Southampton.
5. Utilize emerging bloom reduction treatments, including hydrogen peroxide and ultrasonic technologies, as well as an algae harvester.
 - a. Contingent on any necessary permit application and approval.
6. Create bioswales, emergent marsh or other constructed wetland, including floating islands, in/around the lake for nutrient binding.
 - a. Install floating treatment wetlands
 - b. Implement current plans for bioswales (ie. Gin Lane, Pond Lane and Linden Lane).
 - i. Delay for bioswale creation should depend on completion of projects that may affect additional priority 1 projects (ex. Dredging or harvesting).
7. Continue with voluntary upgrades to septic systems within the Village, as well as the legislated new construction/addition upgrades to IA (Innovative Alternative) systems.
 - a. Incorporate Town of East Hampton's Law into legislation, which would require IA systems beyond solely transfer of property.
8. Complete dredging feasibility study.
 - a. Evaluate 2019 dredging report (NP&V. 2019) and address any missing elements.
 - i. Consider dewatering methods and locations, and dredged material disposition, consider using novel dewatering methods.

1. See Appendix G: Storage Rendering for potential dredged material de-watering (NP&V).
 - ii. Consider odor control measures as related to dredged material dewatering, either through geotextile bags or other dewatering methods.
- b. If needed: additional strategic sampling of the lake bottom sediments to identify nutrient rich areas for targeted removal of sediments, and characterization of southern end dredged material.
9. Harvest water lilies, manage phragmites and augment natural buffers.
10. Reduce applications of synthetic fertilizers and chemicals on landscapes throughout the watershed and encourage holistic, toxin-free landscape management practices. The Lake Agawam Conservancy is sponsoring an educational program directed at homeowners and professionals in the landscape industry that includes seminars and workshops that are free and open to the public throughout the year.
11. Encourage the planting of buffers on properties adjacent to Lake Agawam.
12. Establish point of sale septic system improvement to low N septic systems for any homes upon real estate transfer.
13. Install aeration devices, including nano-bubbling technology, in the center of the lake.
 - a. Request landowner donations for power.

Mid-term (3 to 5 years)

1. If feasible, install Permeable reactive barrier following groundwater study.
2. Establish point of sale improvement recommendations for any homes upon real estate transfer.
3. If feasible and established by Priority 1-3, Dredge areas indicated as priorities identified in Lake Agawam dredging assessment report 2019.
4. Encourage local municipalities to prepare water quality plans to prioritize implementation and to prepare for funding opportunities at the county and state level.
5. Continue to educate land owners on natural landscape and buffer options.
6. Coordinate set up of a council and sewer district for the Village.
7. Investigate uses and restriction of the Community Preservation Fund land owned by the village, potentially seek a vote or referendum change to allow installation of wetlands near the north end of the lake to treat and mitigate run-off and/or lake water.
 - a. Establish natural planting areas to intercept stormwater.

Long-term (5 to 10 years)

1. Dredge the remaining lake bottom.
2. Begin development of a Sewer District in the village of Southampton.
 - a. Begin “map and plan” aspect of sewer district creation, initiated by the Village.
 - b. Obtain necessary RFQ/RFP for incurred legal services.
 - c. Investigate potential for STP system(s) including location and funding.
 - Financing for P3 (Public Private Partnership) may be available.
 - STP treatment is superior to traditional microbial breakdown.
3. Connect hospital and schools to an alternative WWTP or the newly created SD from above.

4. Coordinate with local health department about the use of cluster systems.
5. Recommend septic inspection upon real estate transfer in high priority areas

Priority Projects 2

Priority 2 projects are considered necessary but may not have a similar immediate need as Priority 1 projects.

Short-term (0-3 years)

1. Evaluate efficacy of existing aeration systems and identify potential upgrades or system alterations to better address eliminating/minimizing anoxia.
2. Develop bioswale projects for the south and east ends of Lake Agawam.
3. If appropriate, complete a bench scale test and engineering study in preparation of nutrient inactivant application to sequester the legacy phosphorus within the bottom sediments.

Mid-term (3 to 5 years)

1. Target areas in the watershed not immediately adjacent to Lake Agawam for stormwater improvement projects.

Long-term (5 to 10 years)

1. If results from bench test and engineering study suggest that a nutrient inactivant (e.g., Phoslock) would be appropriate, then apply nutrient inactivant to targeted portions of the lake that are likely to be associated with internal phosphorus release based on the results of the bench scale test. This project would need to include the following prior to field implementation:
 - a. Preparation of an environmental impact statement (EIS) to comply with the State Environmental Quality Review Act (SEQRA).
 - b. Apply for and receive regulatory approvals from the NYSDEC, USACE, and other agencies.
 - c. Note that New York State is developing an approach for safely and legally using nutrient inactivants, and until that process is completed, the use of any inactivants in Lake Agawam is prohibited.

Priority Projects 3

Priority 3 projects are considered important but may not have a similar immediate need as Priority 1 and 2 projects.

Short-term (0-3 years)

1. Evaluate potential effectiveness and feasibility of hydromodification. This would include a pro vs. cons list and a literature review, as well as infrastructure cost estimates.
2. Initiate a carp removal program analogous to Mill Pond
 - a. Characterize site locations for box nets.
 - b. Contingent on DEC permitting where applicable.

Mid-term (3 to 5 years)

1. Land acquisition to purchase properties in the watershed.
2. Remove invasive vegetation, including phragmites, from the lake.

Long-term (5 to 10 years)

1. Create a waterfowl management plan.
2. Create a fish management plan.

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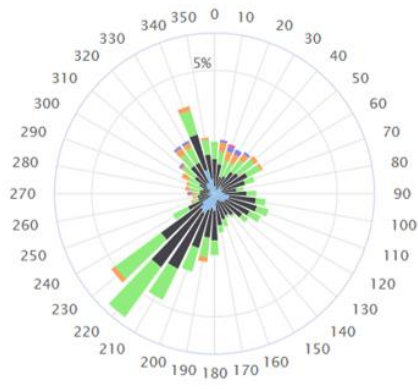
Zhou, H., Wang, J., Wan, J. and Jia, H. 2010. Resilience to natural hazards: A geographic perspective. *Natural Hazards*. 53. 21-41.

Appendix A. Wind and Wave Patterns



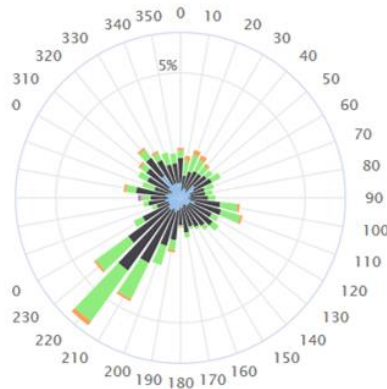
WESTHAMPTON GABRESKI AP, NY

Percent of winds blowing from the indicated direction
Date range: 2019-05-01 through 2019-10-31



EAST HAMPTON AP, NY

Percent of winds blowing from the indicated direction
Date range: 2019-05-01 through 2019-10-31



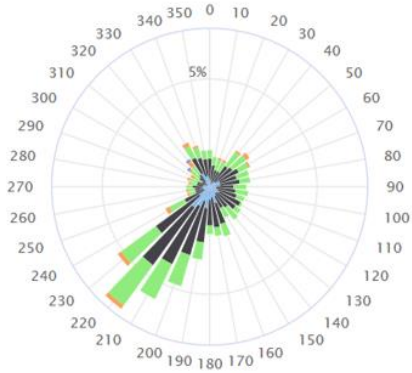
Wind speed (miles/hr)

- ≤5
- 5 to 10
- 10 to 15
- 15 to 20
- 20 to 25
- 25 to 30
- 30 to 35
- 35 to 40
- 40 to 45
- >45

<http://www.nrcc.cornell.edu/wxstation/windroses/windroses.html>

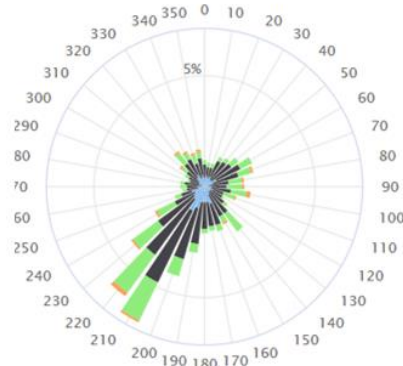
WESTHAMPTON GABRESKI AP, NY

Percent of winds blowing from the indicated direction
Date range: 2018-05-01 through 2018-10-31



EAST HAMPTON AP, NY

Percent of winds blowing from the indicated direction
Date range: 2018-05-01 through 2018-10-31

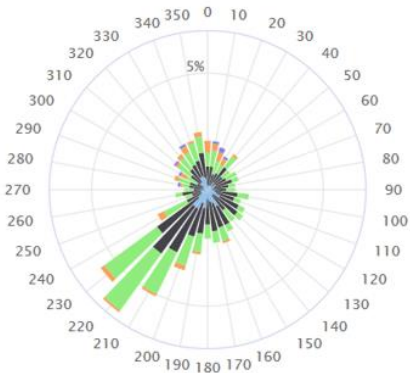


Wind speed (miles/hr)

- ≤5
- 5 to 10
- 10 to 15
- 15 to 20
- 20 to 25
- 25 to 30
- 30 to 35
- 35 to 40
- 40 to 45
- >45

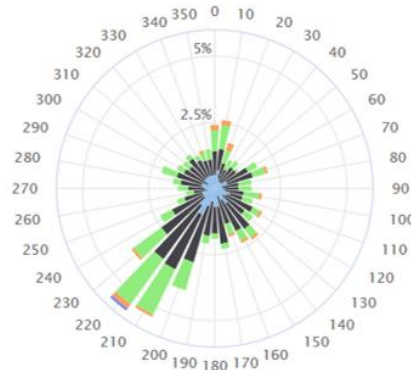
WESTHAMPTON GABRESKI AP, NY

Percent of winds blowing from the indicated direction
Date range: 2017-05-01 through 2017-10-31



EAST HAMPTON AP, NY

Percent of winds blowing from the indicated direction
Date range: 2017-05-01 through 2017-10-31



Wind speed (miles/hr)

- ≤5
- 5 to 10
- 10 to 15
- 15 to 20
- 20 to 25
- 25 to 30
- 30 to 35
- 35 to 40
- 40 to 45
- >45

Appendix B. Waterbody Classifications.

Class N: Enjoyment of water in its natural condition and where compatible, as source of water for drinking or culinary purposes, bathing, fishing and fish propagation, recreation and any other usages except for the discharge of sewage, industrial wastes or other wastes or any sewage or waste effluent not having filtration resulting from at least 200 feet of lateral travel through unconsolidated earth. These waters should contain no deleterious substances, hydrocarbons or substances that would contribute to eutrophication, nor shall they receive surface runoff containing any such substance.

Class AA_{special}: Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. These waters shall be suitable for fish propagation and survival, and shall contain no floating solids, settleable solids, oils, sludge deposits, toxic wastes, deleterious substances, colored or other wastes or heated liquids attributable to sewage, industrial wastes or other wastes. There shall be no discharge or disposal of sewage, industrial wastes or other wastes into these waters. These waters shall contain no phosphorus and nitrogen in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages.

Class A_{special}: Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. These waters shall be suitable for fish propagation and survival. These international boundary waters, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to remove naturally present impurities, will meet New York State Department of Health drinking water standards and will be considered safe and satisfactory for drinking water purposes

Class AA: Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. These waters shall be suitable for fish propagation and survival. These waters, if subjected to approved disinfection treatment, with additional treatment if necessary to remove naturally present impurities, will meet New York State Department of Health drinking water standards and will be considered safe and satisfactory for drinking water purposes

Class A: Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. These waters shall be suitable for fish propagation and survival. These waters, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to remove naturally present impurities, will meet New York State Department of Health drinking water standards and will be considered safe and satisfactory for drinking water purposes

Class B: The best usage is for primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival

Class C: The best usage is for fishing, and fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

Class D: The best usage is for fishing. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the

waters will not support fish propagation. These waters shall be suitable for fish survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

Class (T): Designated for trout survival, defined by the Environmental Conservation Law Article 11 (NYS, 1984b) as brook trout, brown trout, red throat trout, rainbow trout, and splake.

Class (TS): Designated for trout spawning waters. Any water quality standard, guidance value, or thermal criterion that specifically refers to trout, trout spawning, trout waters, or trout spawning waters applies.

Appendix C. Completed, partially implemented and proposed projects.

Lake Agawam 2009 Management Plan, Action Plan Updates - 8.1 Shoreline Improvements, Riparian (Buffer) Area			
Lake Management Recommendations	Actions	Priority	Target
Control waterfowl populations through management practices. 1a. - Discourage lawns fronting lake shore areas. 1b. - Discourage feeding of waterfowl populations.	Partially Implemented: Signage placed along Pond Lane to not feed waterfowl.		
2. Encourage homeowners to remove fertilizer dependent vegetation and establish native planting areas: Consider mandate for buffer zones with swale areas to eliminate direct run off, application of nitrogen and phosphorous-free fertilizers.	Partially Implemented	High Priority	
2a. - Naturalized meadow, woodland and shrub planting areas intercept and filter stormwater and reduce fertilizer/nutrient input: In 3/2019, Southampton Town Board authorized purchase of 2.9 acre property at 111 Pond Lane as a park using Community Preservation Funds. Water treatment use may require a state-level change.	Consider natural water treatment center.	High Priority	
2b. - Village laws encourage natural plantings within 125 feet of wetlands through Zoning Board of Appeals issued wetland permits.	Village Code 116-19 enacted.		Completed
2c. - Place shade trees near shore that will provide soil stability, biological uptake and shading of surface water to maintain lower water temperatures and allow higher dissolved oxygen levels: Weeping willow trees suggested to Zoning Board of Appeals/Village Board of Trustees for Gin Lane.	Partially Implemented		After dredging is completed.
3. Remove invasive vegetation in favor of natural habitat areas under controlled re-vegetation restoration programs.	Not Implemented	Low Priority	After dredging is completed.
4. Examine municipally owned lakefront areas for improvement opportunities (control direct stormwater overflow from paved surfaces in close proximity to the lake; establish lake front walking trails in areas where public access can be provided; provide public education and interpretive signage in appropriate lakefront areas).	Partially Implemented. Bioswale proposals under consideration.		Funding has been approved from State and County for thr Gin Lane corner Bioswale project
4a. - Consider installation of a drainage bioswale and subsurface detention along Pond Lane in connection with pedestrian walks, landscape improvements and sitting areas for lake enjoyment.	Bioswale installation under consideration		
4b. - Consider potential for invasive species removal, stormwater control and lake front walking trails for Gin Lane area at south and southeast part of the lake. Several planting proposals are under consideration.	Partially Implemented	Low Priority	After dredging is completed.
4c. Work cooperatively with the Town Trustees to improve the Gin Lane and Bathing Corporation parking area by reducing pavement, installing a "rain garden" along the shoreline, installing a low sill bulkhead along the southern shoreline (to retain parking capacity), installing subsurface drainage improvements, pedestrian circulation/traffic calming and providing aesthetic improvements through landscaping.	Bulkhead, Rain Garden: Havemeyer Park		Completed 12/2013
5. Provide educational opportunities in form of pamphlets, newsletters, web site information and other media tools through the Village of Southampton and the Lake Agawam Conservation Association.	"Owners Guide to Lake Agawam" pamphlet posted online.		Completed
6. Examine potential for removal of existing hardened shorelines; discourage expansion of new hardened shoreline structures.	Not Implemented		

Lake Agawam 2009 Management Plan, Action Plan Updates – 8.2 Stormwater and Watershed Improvements			
Lake Management Recommendations	Actions	Priority	Target
7. Intercept and recharge stormwater runoff in higher elevations of the watershed. Gin Lane Stormwater Drainage Improvements: Suffolk County Water Quality Protection and Restoration Program grant award & New York State Department of Environmental Conservation, Water Quality Improvement Program grant request. Suffolk County Grant: \$116,697 requested with matching funds to total \$233,394. DEC WQIP: \$186,714/\$46,679 matching funds to total \$233,393. Project utilizes rain garden & installation of 13 leaching basins at the south end of Lake Agawam. Outfall eliminated at Lake Agawam playground pipe; outflow reduced 50% at culvert on Pond Lane. The Gin Lane stormwater drainage improvement project at the south end of Lake Agawam will eliminate outflow at Gin Lane pipe. Suffolk County Grant - Culver/Ox Pasture/Pond Lane Drainage: \$111,224 with matching funds to total \$222,448. Suffolk County Grant - Bowden Square	Drainage installations on Hampton Road and Meetinghouse Lane corridors WQPRP award approved 7/11/19; WQIP request 7/26/19, award approved 12/19/2019. Playground outfall drainagae installed 2016 Award 2013 & 2011	High Priority	January 2020 Spring 2020 Completed Completed Completed
7a. - Install more street catch basins along Hill Street, and other streets where feasible.	CPF Application 7/11/2018		Completed
7b. - Examine Village/Town owned land opportunities for recharge facilities such as Windmill Lane and Nugent Street; the west side of Windmill Lane; and north of Bowden Square.	CPF Application 7/11/2018		Completed
7c. - Cordinate with CPF Stormwater for future grants.	Partially Implemented. West Main St. parking area targeted for future stormwater action.		
7d. - Consider maximum stormwater retention and on-site recharge for any site plans and subdivisions in the watershed area; ensure compliance with SPDES GP 0-08-01			
7e. - Review Village parking areas for potential subsurface stormwater detention installation in connection with parking lot improvement plans.	Partially Implemented.		
8. Maintain catch basins and leaching pools on a regular basis by removing accumulated sediment.	Vacuum truck cleans catch basins twice a week.		Ongoing
9. Maintain roads on a regular basis through street sweeping to reduce potential for sediments to accumulate and/or enter the lake: Cleaning of the business district sidewalk area and sweeping of the Village occur 7 days a week in summer and weather permitting 5 days a week in winter.	Implemented		Ongoing
10. Explore potential for sewerage in areas of the watershed with commercial downtown development and shallow depth to groundwater.	Partially Implemented	High Priority	
11. Encourage homeowners to regularly inspect and maintain sanitary systems in high groundwater areas and elsewhere in the watershed. 12. Encourage, and enforce when appropriate, upgrade of malfunctioning sanitary systems: Innovative & Alternative On-Site Wastewater Treatment System legislation for new residential construction & certain high priority areas, with rebate program.	Partially Implemented		Completed 9/2017
13. Ensure appropriate land use density within the Village and the watershed area for Lake Agawam through coordination with SCDHS on the implementation of Article 6 of the SCSC; sanitary credit transfers to the Lake Agawam watershed area should be reviewed and limited based on nitrogen load.	Partially Implemented		
14. Encourage and facilitate "pick up after your pet" practices. 14a. - Educational pamphlets, Village newsletter and public information media. 14b. - Install dispensers in Village parks and key areas for convenience.	Partially Implemented Mutt dispensers installed		

Lake Agawam 2009 Management Plan, Action Plan Updates - 8.3 Lake Aeration and Water Quality Improvements			
Lake Management Recommendations	Actions	Priority	Target
<p>15. Provide water circulation equipment to improve dissolved oxygen levels in the lake.</p> <p>15a. - Maintain and install forced air bubblers to improve dissolved oxygen levels and further the coverage already achieved by this cooperative Town/Village effort.</p> <p>15b. - Consider discontinuing fountains in favor of bubblers, particularly during algae blooms.</p>	<p>Village installed 6 air stations 2014- 2019 (Town installed one air station). Lake fountain removed in 2010. Find two private homeowners to provide power for install two bubbler systems for the center of the lake.</p>		<p>Partially completed</p>
<p>15c. - Algae Harvester 10-day pilot program to reduce Harmful Algal Blooms.</p>	<p>DEC Pilot completed October 2019</p>	<p>High Priority</p>	<p>Completed 10/19/2019</p>
<p>16. Improve fish populations in the lake favoring native fish assemblages.</p>	<p>Not Implemented</p>		
<p>16a. - Stock bass, perch and bluegill fish assemblages, if necessary.</p>	<p>Not implemented.</p>		
<p>16b. - Remove or reduce carp populations in the lake, if necessary, ensuring that harvested fish are managed in a manner that considers public health and safety.</p>	<p>Under consideration: Carp traps for Lake Agawam.</p>		
<p>17. Maintain, but do not expand areas of aquatic vegetation on the west side of the lake; such vegetation provides fish habitat, food source and shading.</p>	<p>Not Implemented</p>		
<p>18. Examine wetland biological treatment options for north end of lake near stormwater outfall.</p>	<p>Village has installed Fabco canisters in catch basins for Railroad Plaza drainage project.</p>		
<p>19. Evaluate potential for removal of organically enriched surface sediments from the lake bottom in order to reduce the release of nutrients into the water column:</p> <p>Dredging of Sediments: New York State Department of Environmental Conservation, Non-agricultural Nonpoint Source Planning Grant Program request, Lake Agawam Dredging Feasibility Study. Nelson & Pope conducted survey of Lake Agawam sediment in Summer 2019. Sediment has large sand content, will consider options for sediment removal. Suffolk County WQPRP Survey: \$30,000/\$3,000 Total Cost: \$33,000.</p>	<p>Lake Agawam sediment testing overview presented to Trustees 9/24/2019. NYS DEC request 7/26/19, NPG Award Notification 12/19/2019; Overview presented to Trustees 9/24/2019.</p>	<p>High Priority</p>	<p>In process.</p>

Lake Agawam 2009 Management Plan, Action Plan Updates - 8.4 Water Quality Monitoring and Research			
Lake Management Recommendations	Actions	Priority	Target
20. Continue water quality and cyanobacteria monitoring to determine effectiveness of implemented management recommendations and to track trends in water quality: Village Board of Trustees agreed to share the costs of in-water monitoring buoys with the Southampton Town Trustees; installation July 2019.	Partially Implemented		
21. Continue associated ecological-based studies and research (e.g. chemical, physical and biological factors) to further elucidate the factors which promote the presence of cyanotoxins.	Partially Implemented		
22. Implement an adaptive management approach for Lake Agawam as the understanding of cyanotoxins is expanded, and strive to improve water quality while minimizing health risks to humans and animals.	Partially Implemented		

Lake Agawam 2009 Management Plan, Action Plan Updates - Community Preservation Funds			
Water Quality Improvement Project Plan, Lake Agawam Stormwater Improvements. Lake Agawam is included in NYS Section 303(d) List of Impaired Waters. These improvements could result in a potential reduction of 28.2 pounds-per-year of nitrogen (42% reduction), and a reduction of 4.8 pounds-per year of phosphorous (44% reduction going into Lake Agawam.	Actions	Priority	Target
Remove dated catch basins at Meeting House Lane/Oak Street and replace with curb inlet catch basins.	Village Matching Funds: \$54,555		Completed May 2019
Install two new catch basins at Meeting House Lane/either side of SH Village volunteer Ambulance driveway.	Village Matching Funds: \$34,836		Completed May 2019
Install 19 leaching pools along Jobs Lane	Town CPF Recommended Funds: \$292,040		Completed May 2019
O'Connell Drive Parking Lot, install replacement pipe, with catch basins and 14 10' leaching pools along the pipe.	Village Matching Funds: \$166,495		Completed 1/2018
Total Project Cost	\$547,926		
Southampton Town CPF Recommended Funds		\$292,040	
Village Matching Funds Committed		\$255,886	
Railroad Plaza drainage, WQIP proposal 3/15/19 for capture and treatment of stormwater runoff to reduce contaminants entering Lake Agawam. Construction of drainage improvements began 8/05/2019. Board of Trustees Village of Southampton accepted Southampton CPF award 8/8/2019.	Town CPF request: \$211,600 Village match: \$21,160	High Priority	Completed August 2019
Total Project Cost	\$232,760		
Southampton Town CPF Recommended Funds		\$211,600	
Village Matching Funds Committed		\$21,160	

Appendix D. WI/PWL Summary

Agawam Lake (1701-0117)

Impaired

Waterbody Location Information

Revised: 05/17/2016

Water Index No:	(MW7.1b) AO-P815	Water Class:	C
Hydro Unit Code:	Shinnecock Bay-Atlantic Ocean (0203020206)	Drainage Basin:	Atlantic-Long Island Sound
Water Type/Size:	Lake/Reservoir 64.0 Acres	Reg/County:	1/Suffolk (52)
Description:	entire lake		

Water Quality Problem/Issue Information

(CAPS indicate MAJOR Pollutants/Sources)

Uses Evaluated	Severity	Confidence
Water Supply	N/A	-
Public Bathing	N/A	-
Recreation	Impaired	Known
Aquatic Life	Stressed	Suspected
Fish Consumption	Unassessed	-

Conditions Evaluated

Habitat/Hydrology	Unassessed
Aesthetics	Unassessed

Type of Pollutant(s)

Known:	HARMFUL ALGAL BLOOMS,
Suspected:	Nutrients (phosphorus, nitrogen), LOW D.O./OXYGEN DEMAND
Unconfirmed:	- - -

Source(s) of Pollutant(s)

Known:	- - -
Suspected:	URBAN/STORM RUNOFF, Onsite/Septic Systems
Unconfirmed:	- - -

Management Information

Management Status:	Verification of Sources Needed
Lead Agency/Office:	DOW/Reg 1
IR/305(b) Code:	Impaired Water Requiring a TMDL (IR Category 5)

Further Details

Overview

Agawam Lake is assessed as an impaired waterbody due to recreational uses that are known to be impaired by phosphorus and low dissolved oxygen. These conditions result in frequent and severe harmful algal blooms in the lake. No specific pollutant or sources have been identified, but land use suggests failing onsite wastewater treatment systems and urban non-point source runoff contribute to the impacts.

Use Assessment

Agawam Lake is a Class C waterbody, suitable for general recreation use and support of aquatic life, but not as a water supply or for public bathing.

Recreation uses are considered to be impaired due to elevated nutrients (phosphorus), excessive algae, poor water clarity and shoreline harmful algal blooms. Algae (chlorophyll-a) levels in the open water were well above the threshold of 10 µg/l associated with impaired recreational conditions during 2014, consistent with phosphorus levels that at all times exceed the DEC threshold of 20 µg/l. Aesthetic conditions of the lake are considered to be poor because of lake wide algal blooms. (DEC/DOW, BWAM/LMAS, December 2015)

Aquatic life is considered to be supported but stressed by shoreline toxic algae blooms and low dissolved oxygen. Periodic fish kills (including a large event in 1981 that was reported on national news) have been reported in the past. There are no health advisories in place limiting the consumption of fish from this waterbody (beyond the general advice for all waters). There are no records of tissue analysis on fish collected from Lake Agawam. However, due to the presence of shoreline algae toxins, fish consumption use may be threatened, despite the lack of information about contaminants in fish flesh. (NYS DOH Health Advisories and DEC/DOW, BWAM/LMAS, December 2015)

Water Quality Information

Regular water quality sampling of Agawam Lake was conducted by researchers at SUNY Stony Brook from 2011 to 2015. Phosphorus levels in the lake frequently exceed the state guidance values of 20 µg/l, and chlorophyll a levels most always exceed the 10 µg/l threshold associated with elevated risk for algae blooms, unsafe water clarity, algae toxins, and poor aesthetic conditions. Water clarity was severely restricted because of cyanobacteria blooms. Water transparency measurements often failed to meet the minimum recommended criteria for swimming beaches and water clarity was determined to be severely restricted as a result of high algae levels. Harmful algae bloom samples collected over this period revealed algal toxin levels that frequently exceeded the World Health Organization (WHO) threshold for safe swimming; however, these toxin samples were limited to shoreline locations. (DEC/DOW, BWAM/LMAS, SUNY Stony Brook unpublished data, December 2015 WHO, 2009)

Source Assessment

Based on surrounding land use and other knowledge of the waterbody, the most likely source(s) of phosphorus/nutrients to the waterbody are urban/storm water runoff and/or failing onsite septic systems.

Management Actions

Agawam Lake is included on the Section 303(d) List for eventual development of a TMDL or other restoration strategy (see below).

The NYS Legislature authorized \$5 million to DEC and the Long Island Regional Planning Council (LIRPC) for a Long Island nitrogen management and mitigation plan. Plan development – with active input from local stakeholders and public – is underway. Chief among the expectations for the plan is a focus on wastewater issues, including sewerage of unsewered communities in Suffolk County and the evaluation and use of advanced alternative onsite wastewater treatment systems to reduce nitrogen loads from individual septic systems where sewerage is not viable. (DEC/DOW, BRWM, November 2015)

This waterbody is also included within the South Shore Estuary Reserve (SSER). The SSER encompasses the tidal waters and watershed between the Nassau–Queens County line and the eastern boundary of Shinnecock Bay. The goals of the SSER Program outlined in the 2001 Comprehensive Management Plan (CMP) include improvement and maintenance of water quality, protection and restoration of living resources, expansion of public use and enjoyment, sustaining and of the estuary–related economy, and increasing education, outreach and stewardship. Program activities focus on point and nonpoint source pollution reduction, protection and restoration of water quality and coastal habitat, increasing shellfish harvesting, open space preservation and enhancing other public uses of the estuary. A vessel waste no discharge zone was established for the entire South Shore Estuary in 2009 to address impacts from boat pollution. (DEC/DOW, Region 1, March 2010)

Section 303(d) Listing

Agawam Lake is included on the current (2016) NYS Section 303(d) List of Impaired/TMDL Waters. The waterbody is included on Part 1 of the List as an impaired waterbody requiring TMDL development for phosphorus and related low dissolved oxygen. This waterbody was first listed on the 2008 List in Appendix B – Waters Not Meeting Dissolved Oxygen Standards. (DEC/DOW, BWAM/WQAS, January 2016)

Segment Description

This segment includes the total area of the Agawam Lake.

Appendix E. Road Ditches

In New York State, ditches parallel nearly every mile of our roadways and in some watersheds, the length of these conduits is greater than the natural watercourses themselves. Although roadside ditches have long been used to enhance road drainage and safety, traditional management practices have been a significant, but unrecognized contributor to flooding and water pollution, with ditch management practices that often enhance rather than mitigate these problems. The primary objective has been to move water away from local road surfaces as quickly as possible, without evaluating local and downstream impacts. As a result, elevated discharges increase peak stream flows and exacerbate downstream flooding. The rapid, high volumes of flow also carry nutrient laden sediment, salt and other road contaminants, and even elevated bacteria counts, thus contributing significantly to regional water quantity and quality concerns that can impact biological communities. All of these impacts will be exacerbated by the increased frequency of high intensity storms associated with climate change. Continued widespread use of outdated road maintenance practices reflects a break-down in communications among scientists, highway managers, and other relevant stakeholders, as well as tightening budgets and local pressures to maintain traditional road management services. Although road ditches can have a significant impact on water quality, discharges of nutrients and sediment from roadways can be mitigated with sound management practices.

Road Ditch Impacts

Roadside ditch management represents a critical but overlooked opportunity to help meet watershed and clean water goals in the Honeoye Lake watershed by properly addressing the nonpoint sources of nutrients and sediment entering the New York waters from roadside ditches. The three main impacts of roadside ditch networks are: (1) hydrological modification, (2) water quality degradation, and (3) biological impairment.

Mitigation Strategies to Reduce Impacts

Traditional stormwater management focused on scraping or armoring ditches to collect and rapidly transport water downstream. The recommended mitigation strategies described below focus on diffusing runoff to enhance sheet flow, slowing velocities, and increasing infiltration and groundwater recharge. This approach reduces the rapid transfer of rainwater out of catchments and helps to restore natural hydrologic conditions and to reduce pollution while accommodating road safety concerns.

These strategies can be divided into three broad, but overlapping categories:

1. Practices designed to hold or redirect stormwater runoff to minimize downstream flooding.
 - a. Redirect the discharges to infiltration or detention ponds.
 - b. Restore or establish an intervening wetland between the ditch and the stream.
 - c. Divert concentrated flow into manmade depressions oriented perpendicular to flow using level lip spreader systems.
 - d. Modify the road design to distribute runoff along a ditch, rather than a concentrated direct outflow.
2. Practices designed to slow down outflow and filter out contaminants.
 - a. Reshape ditches to shallow, trapezoidal, or rounded profiles to reduce concentrated, incisive flow and the potential for erosion.

- b. Optimize vegetative cover, including hydroseeding and a regular mowing program, instead of mechanical scraping. Where scraping is necessary, managers should schedule roadside ditch maintenance during late spring or early summer when hydroseeding will be more successful.
 - c. Build check dams, or a series of riprap bars oriented across the channel perpendicular to flow, to reduce channel flow rates and induce sediment deposition while enhancing ground water recharge.
 - d. Reestablish natural filters, such as bio-swales, compound or “two-stage” channels, and level lip spreaders.
3. Practices to improve habitat.
- a. Construct wetlands for the greatest potential to expand habitat.
 - b. Reduce runoff volumes to promote stable aquatic habitat.

The Upper Susquehanna Coalition (USC) is developing a technical guidance document in the form of a Ditch Maintenance Program Guide that can be used by any local highway department. The guide will include an assessment program to determine if the ditch needs maintenance and what is necessary to stabilize the ditch. It will also contain a group of acceptable and proven management guidelines and practices for ditch stabilization. In addition, the USC is developing a broad-based education and outreach program to increase awareness and provide guidance to stakeholder groups. This program will take advantage of existing education programs, such as the NY’s Emergency Stream Intervention (ESI) Training program, USC, Cornell University and the Cornell Local Roads program. This new program will be adaptable in all watersheds.

Appendix F: Parcels abutting Lake Agawam.



Appendix G: Storage Rendering for potential dredged material dewatering (NP&V)

Potential Geotube® Dewatering Cell Area



Exhibit E



PHOTO DATA SHEETS

PROJECT NAME: COUNTY ROAD 19 RECONSTRUCTION

CLIENT REFERENCE: WILLIAM HILLMAN, P.E., CHIEF ENGINEER
 SUFFOLK COUNTY DEPARTMENT OF PUBLIC WORKS
 631-852-4002



Preliminary and final design, survey and mapping, for the reconstruction of Suffolk County Road 19 between Waverly Avenue and Main Street in Patchogue. The roadway was narrowed and shifted away from the Patchogue River to calm traffic and create a landscaped park area adjacent to the river. A roundabout was designed at the Lake Street intersection. The project included extensive traffic capacity analysis, as well as reconstruction of the traffic signals at Main Street and the access to the new Blue Point Brewery and YMCA facilities. The project implemented bio-swales and grass swales to capture and treat stormwater runoff from the reconstructed roadway. Project was completed in 2020 at a cost of approximately \$5.3 million.



INTERSECTION IMPROVEMENTS TO CR19

CHALLENGES

- Heavily traveled corridor connecting Main Street in Patchogue up to Sunrise Highway
- Vibrant Main Street generates a significant amount of pedestrian and motorist traffic
- Dangerous interchange with high speeds
- No safe crossings for pedestrian and bikes
- Outfall discharging untreated runoff
- High Ground Water
- Underutilized lake front



DANGEROUS INTERSECTION GEOMETRY



NEW SHARED USE PATH & GREENSPACE



ENVIRONMENTALLY FRIENDLY BIOSWALE



PROJECT NAME: NYS ROUTE 110 RECONSTRUCTION DRAINAGE IMPROVEMENTS, HUNTINGTON



CLIENT REFERENCE: GLENN MURRELL, PE
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
631-952-6018



This project evaluated the development of feasible alternatives for roadway and significant drainage improvements on a 0.9 mile section of NYS Route 110 (New York Avenue) in the vicinity of Huntington Harbor, and developed plans for construction. The project area suffers from several contributing factors that create a complex flooding situation, including low and nearly flat elevations of the roadway; steep grade of the surrounding area; a 3,500 acre watershed area; high groundwater table; influence of tidal action due to proximity of the Huntington Bay; and significant development of the area and the stream parallel to Rte. 110.

Hydraulic and hydrologic modeling of the large urban watershed was performed using the USEPA SWMM program and an evaluation of stormwater treatment Best Management Practices was conducted. An innovative drainage solution, including upgrading the capacity of a parallel creek to accommodate stormwater flows, was developed. The project was awarded an "Evergreen" rating—the highest possible rating under NYSDOT's (Green Leadership In Transportation Environmental Sustainability)," a transportation environmental sustainability rating program.

WET POND—STORMWATER TREATMENT

- HYDRAULIC/HYRDOLOGIC MODELING
- USEPA SWMM PROGRAM
- AWARDED "EVERGREEN" RATING
- 2014 COMPLETION
- \$21,000,000



ENVIRONMENTALLY FRIENDLY TIDE GATES



PRE-CONSTRUCTION FLOODING





PROJECT NAME: 'PATH TO THE PARK' SHORELINE IMPROVEMENTS IN SOUTH VALLEY STREAM

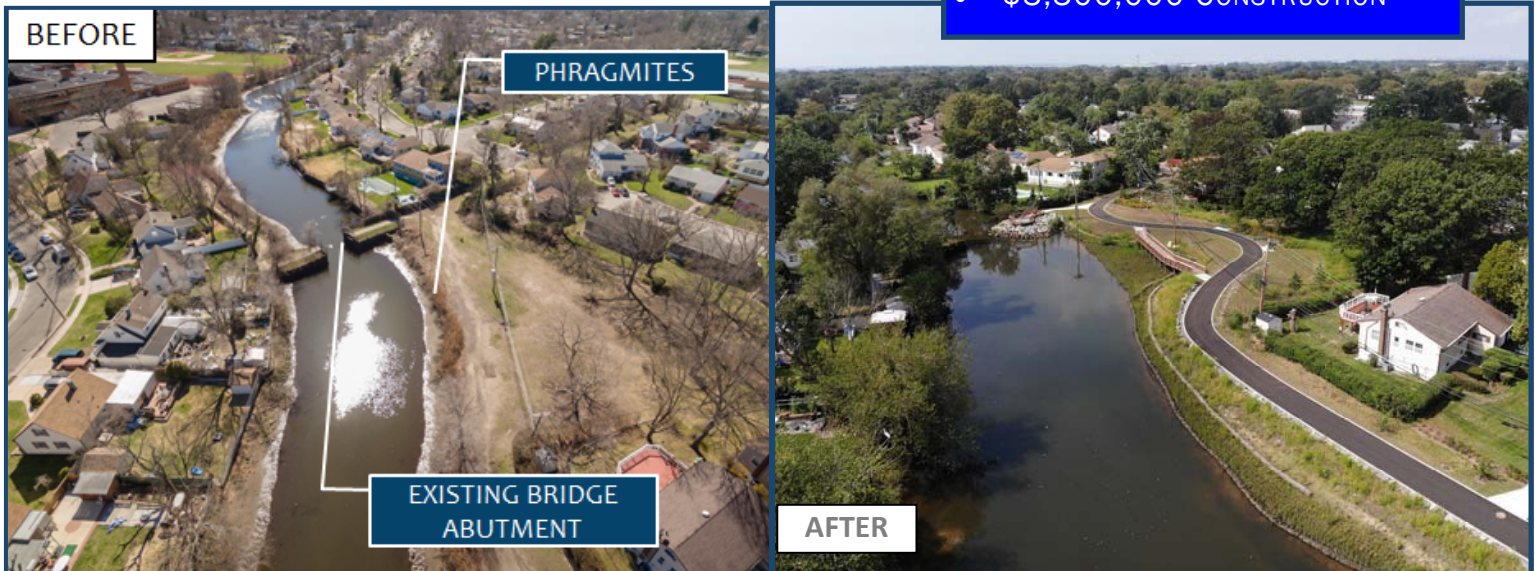
CLIENT REFERENCE: JEFFREY TIERNEY
DEPUTY COMMISSIONER / DEPARTMENT OF ENGINEERING
TOWN OF HEMPSTEAD
516-812-3483



LKMA was the Lead Consultant for this Governor's Office of Storm Recovery (GOSR)-funded project to restore the natural shoreline along Hook Creek from Cloverfield Road north to Mill Road and the adjacent 2,000 foot Path to the Park. A second component of this project was the replacement of the existing deteriorated timber bulkhead at Brook Road Park with a vinyl bulkhead anchored with helical earth anchors. The overall concept of the project was to remove invasive plant species and plant native wetland species that would create a living shoreline that utilized a combination of both green and hardened features to re-establish the park's shorelines at a higher and more flood resilient elevation.

All proposed upland and wetland plantings were native plant species. Other improvements at the park includes the design of a scenic overlook, pedestrian boardwalk, pollinator garden, kayak launch, osprey's nest and pocket-park.

- ACEC DIAMOND AWARD
- NYSGOSR
- TIMBER BULKHEAD REPLACEMENT
- WETLAND SPECIES
- SCENIC OVERLOOK
- 2019 COMPLETION
- \$3,300,000 CONSTRUCTION



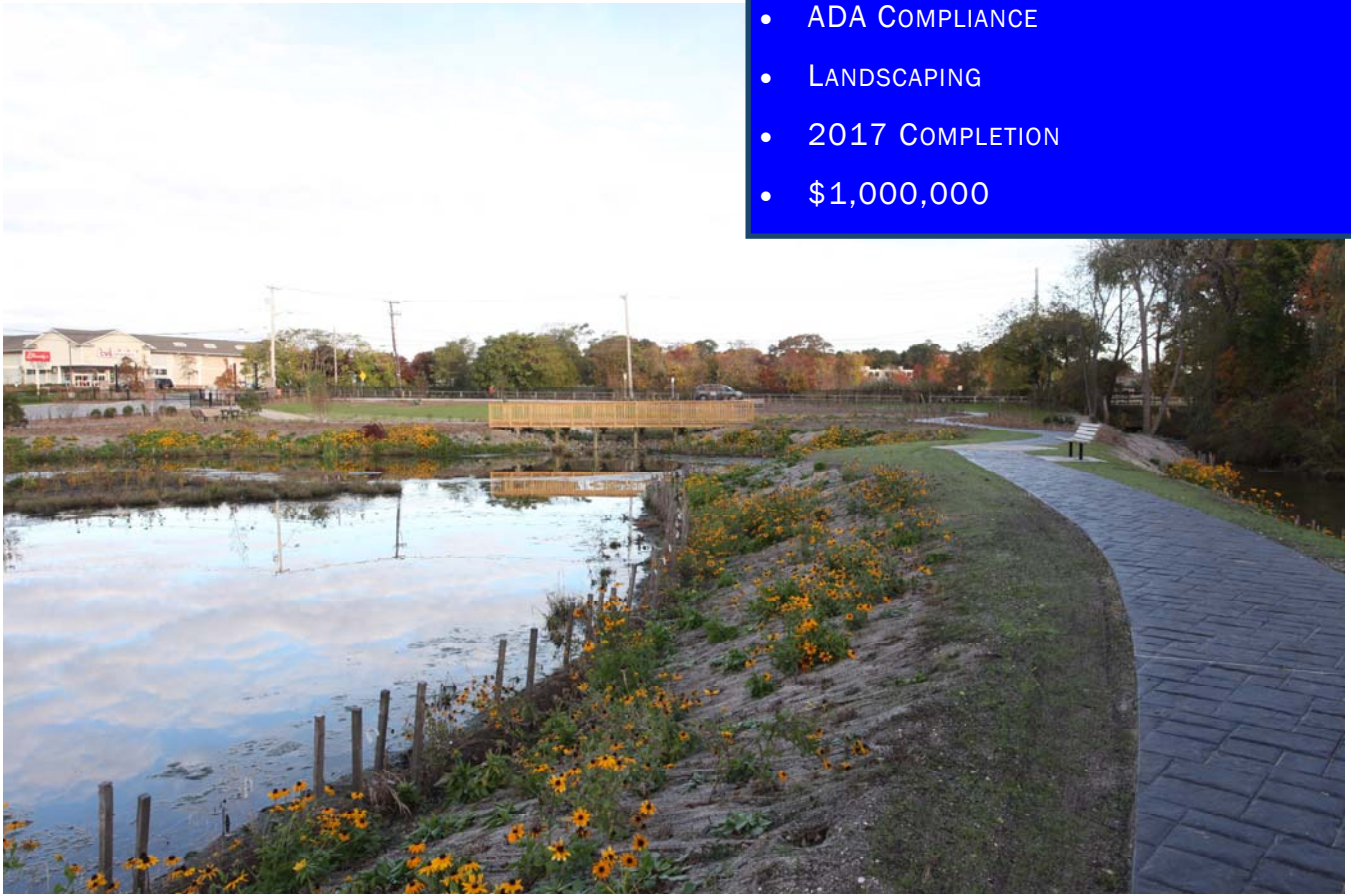
PROJECT NAME: STORMWATER QUALITY IMPROVEMENTS NESSENGER CHEVROLET SITE

CLIENT REFERENCE: EDWARD MORRIS
COMMISSIONER OF PARKS & RECREATION
TOWN OF BROOKHAVEN
631-451-6140



Under a NY State Environmental Facilities Corporation Grant, LKMA developed plans and procured environmental permits for stormwater quality improvements at the site of a former Chevrolet dealer in Patchogue. In addition to establishing a wet meadow for stormwater treatment prior to its entering the adjacent Swan River, a passive-use park was created which showcases a variety of green infrastructure technics with educational signing that explains the features and benefits of the project. Other green infrastructure practices installed include a parking lot and maintenance road constructed of permeable pavers and a bio-retention basin. As part of this project, the original streambed of the Swan River was re-shaped to form a more natural cross sectional geometry and invasive plant species were removed and replaced with native wetland species. Other amenities include an ADA-accessible walking path and significant landscaping.

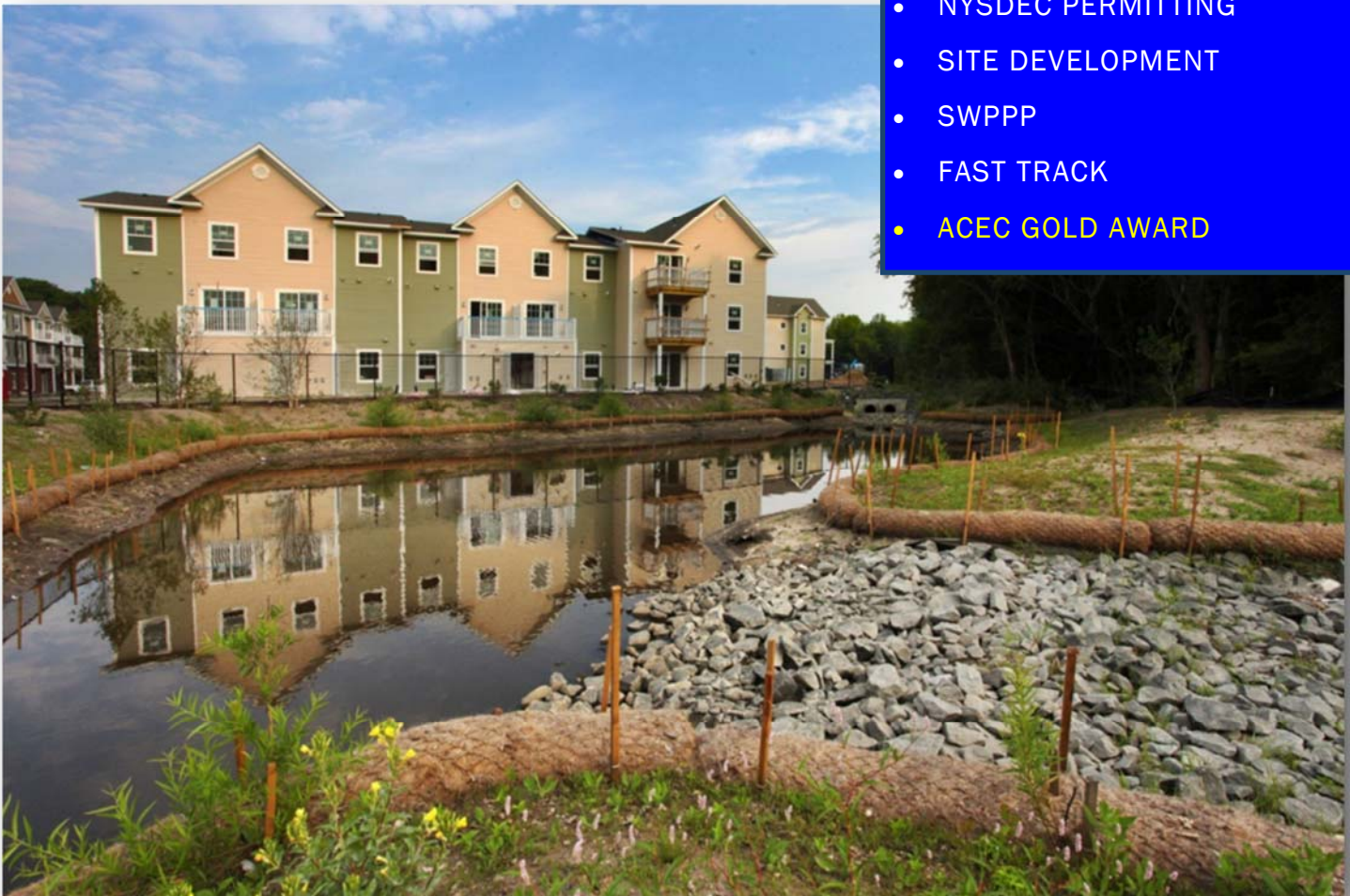
- STORMWATER TREATMENT
- GREEN INFRASTRUCTURE
- ENVIRONMENTAL PERMITTING
- ADA COMPLIANCE
- LANDSCAPING
- 2017 COMPLETION
- \$1,000,000



PROJECT NAME: WINCORAM COMMONS (BROOKHAVEN BLIGHT TO LIGHT) APARTMENT COMPLEX—SITE/CIVIL PERMITTING DESIGN

LKMA was hired by Conifer Realty LLC in 2011 to prepare wetland mitigation plans, sanitary pump station & connection plans as well as all site civil aspects of the 184-unit apartment complex in Coram (Route 112 & Route 25). The Town of Brookhaven has granted preliminary site plan approval and the NYSDEC has approved the wetland mitigation plans prepared by LKMA. The project design team consists of LKMA (engineering) and Kitchen Associates (architectural). Site civil design elements include grading, drainage, interior road design, traffic impact study, NYSDOT road & signal design, utility layout/coordination, preparation of a storm-water pollution prevention plan, landscaping, site lighting, site access, parking and other site elements. LKMA's in-house surveying capabilities have enabled the fast-track project to quickly advance into final site plan design.

- WETLAND MITIGATION
- SANITARY PUMP STATIONS
- NYSDEC PERMITTING
- SITE DEVELOPMENT
- SWPPP
- FAST TRACK
- ACEC GOLD AWARD



The site plan above depicts the new 184 unit apartment complex and site infrastructure situated at the intersection of Route 112 and Route 25 in Coram known as WinCoram Commons.

PROJECT NAME: VINEYARD VIEW APARTMENT COMPLEX

CLIENT REFERENCE: ALLEN HANDELMAN
 CONIFER
 (585) 943-3906



LKMA performed all site/civil design for the Vineyard View Apartment Complex, a 50-unit workforce housing (affordable) rental community located in Greenport, Long Island. Located at the headwaters to Moore’s Drain and Pipe’s Cove of the Peconic Estuary, the environmental restrictions, eco-system protection concerns and site features shaped engineering decisions leading to innovative solutions to stormwater and wastewater management. The site had been previously undeveloped due to these complex issues; however, through engineering, the site was able to be developed in a sensitive way which brought much needed workforce housing back to a region where seasonal accommodations had taken affordable housing. Unique features include:

- ◆ 50-feet of impermeable clay layer—typical subsurface leaching systems used to manage stormwater would not work.
- ◆ Developed a surface level “hold, clean & move” stormwater filtration system to manage the stormwater while maintaining and supplying clean water back to neighboring wetland ecosystems.
- ◆ Designed and obtained regulatory permits for a non-standard consolidated wet well/valve chamber unit for the pump station that fit within the limited site footprint.



Pre-Development—Critical Environmental Protection Concerns



Post Development—Implemented Green Infrastructure Stormwater Best Management Practices



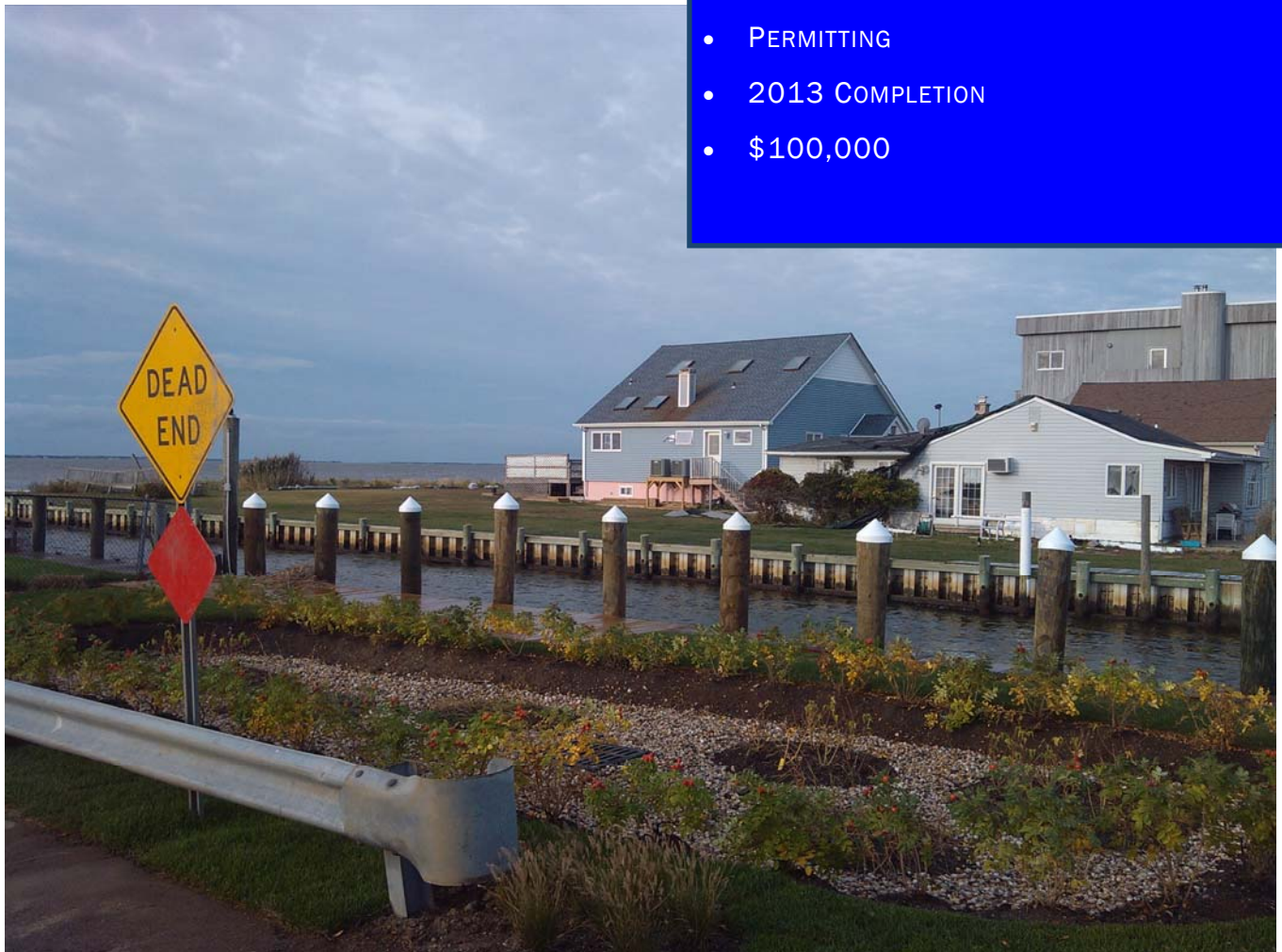
PROJECT NAME: DONALD COURT, BLUE POINT

CLIENT REFERENCE: STEVE TRICARICO, DEPUTY SUPERINTENDENT
TOWN OF BROOKHAVEN DEPARTMENT OF HIGHWAY
631-451-9242



LKMA prepared design plans and procured environmental permitting for the replacement of a deteriorated timber bulkhead at the end of Donald Court. Project also included the design of a vegetated swale meant to treat stormwater runoff from the roadway prior to entering the adjacent canal. Pollutant loading calculations were also provided to the Town that identified the pollutant removal capability of the system.

- ROAD ENDING
- VINYL BULKHEAD
- STORMWATER QUALITY / BIOSWALE
- PERMITTING
- 2013 COMPLETION
- \$100,000



PROJECT NAME: BARNUM ISLAND / HARBOR ISLE DRAINAGE IMPROVEMENTS PROJECT

CLIENT REFERENCE: JEFF TIERNEY, DEPUTY COMMISSIONER
 TOWN OF HEMPSTEAD DIVISION OF ENGINEERING
 516-812-3483



LKMA was the Lead Consultant for this Governor's Office of Storm Recovery (GOSR)-funded project to investigate existing stormwater deficiencies within the Hamlets of Barnum Island and Harbor Isle, located in the Town of Hempstead; and identify flood reduction projects that, when implemented, will address the existing stormwater deficiencies. After completing the study phase of this project for Nassau County DPW, LKMA was hired by the Town of Hempstead to prepare final contract documents for the proposed roadway and drainage improvements. Proposed solutions include road raisings, check valves, and drainage system capacity improvements. Robust utility coordination was required for the new drainage system capacity improvements. Additionally, temporary easements for grading work on the adjacent private properties were prepared. LKMA assisted the Town with obtaining signatures from the local residents.

BARNUM ISLAND / HARBOR ISLE STUDY AREA MAP



- GOSR FUNDED
- STORMWATER MODELING
- HIGHWAY DRAINAGE
- 2021 DEISIGN COMPLETION
- \$10.5 MILLION (EST CONSTRUCTION)





PROJECT NAME: SILVER LAKE DRAINAGE IMPROVEMENTS STUDY

CLIENT REFERENCE: SEAN SALLIE
NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS
516-571-9342



In 2018, LKMA completed the Technical Design Report and the 30% Design Plans for the Silver Lake Drainage Improvements Project. This project required an extensive drainage inventory of the upland 2,675 acre watershed as well as creation of a drainage model that would analyze the existing drainage conditions and provide flood mitigation solutions that would fit into the County's limited funds for the project (\$1.7 million). As a result of both the drainage study and heavy community participation, LKMA developed four high priority projects that will significantly reduce the occurrence of flooding, improve water quality and improve the overall aesthetics of the park.



- GOSR FUNDED
- STORMWATER MODELING
- HIGHWAY DRAINAGE
- 2018 COMPLETION
- \$1.7 MILLION (EST CONSTRUCTION)



PROJECT NAME: BAY AVENUE BULKHEAD & STORMWATER TREATMENT, PATCHOGUE



CLIENT REFERENCE: STEVE TRICARICO, DEPUTY SUPERINTENDENT
TOWN OF BROOKHAVEN DEPARTMENT OF HIGHWAY
631-451-9242

This project entailed the replacement of the highway road ending bulkhead and drainage improvements at Bay Avenue in Patchogue. The existing deteriorated timber bulkhead at Bay Avenue was replaced with a navy style vinyl sheet bulkhead. The existing drainage system, which discharged through the road ending bulkhead, drained a portion of Bay Avenue untreated. The project installed a new stormwater treatment system to remove sediment, oil and floatables in the stormwater prior to discharging into the bay. A hydrologic and hydraulic study was performed used AutoDesk Storm and Sanitary Analysis Software. LKMA provided construction administration and inspection services.



BEFORE

- ROAD ENDING
- VINYL BULKHEAD
- STORMWATER TREATMENT
- PERMITTING
- 2013 COMPLETION
- \$160,000



AFTER

PROJECT NAME: PENATAQUIT VILLAGE HOUSING RESILIENCY IMPROVEMENTS (GOSR)

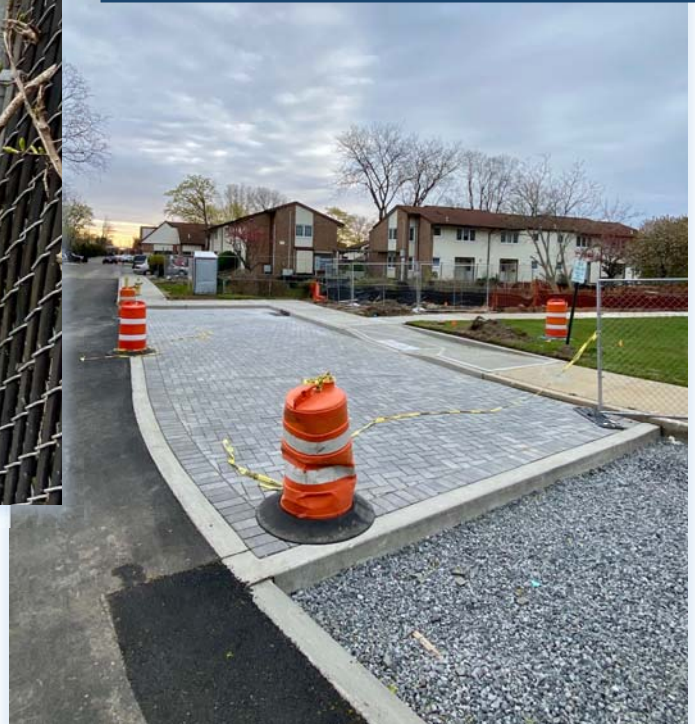


CLIENT REFERENCE: MARY KEIVINS, CONTRACT MANAGER
 TOWN OF ISLIP HOUSING AUTHORITY
 631-589-7100

LKMA provided Design and Construction Inspection Services to install a series of “Green” drainage improvements on a Town of Islip Housing Authority owned parcel with existing multi-family residential housing. The project included the installation of porous pavers within the parking lot area, installation of catch basin filter inserts within existing catch basins and the replacement of the existing lawn adjacent to Penataquit Creek with vegetated infiltration basins. Overflow structures were installed within the infiltration basins to direct storm drainage into the creek.



- “GREEN” DRAINAGE
- INFILTRATION BASINS
- OVERHEAD STRUCTURES
- 2020 COMPLETION
- \$481,000



A decorative graphic at the top of the page consisting of several overlapping, wavy bands of blue. The colors range from a very dark navy blue to a bright, vibrant cyan. The waves flow from left to right across the top of the page.

RESUMES



MATTHEW C. JEDLICKA, LEED AP Project Manager/Associate

Education

BS, Ceramic Engineering, New York State College of Ceramics, Alfred University, 1992

Studied Architecture at New York Institute of Technology School of Architecture and Design (1999-2001)

Registrations

Leadership in Energy and Environmental Design Accredited Professional (LEED AP)

Professional Training

OSHA Lead in Construction Training
OSHA Asbestos Awareness Training
OSHA HAZWOPER
Construction Safety Training, 2005

Mr. Jedlicka has over 20 years of experience in the design and construction of civil and architectural projects. Mr. Jedlicka's role at LKMA includes working on a wide range of municipal projects including parks and recreational facilities, buildings, marine work and all types of civil projects. His involvement includes project management, design, construction administration and monitoring. He also lends support with quality control management. Matt is proficient in AutoCAD and produces construction plans, specifications and accurate construction estimates. He has successfully obtained a wide range of permits, monitored various construction projects and designed several well used facilities.

Representative project experience includes:

Town of East Hampton Professional Engineering Services – Provided a point of contact for the Town and project management on over 60 projects since 2015. Projects range from I/A OWTS sanitary system design to roof replacements to new baseball fields to the Montauk skatepark expansion. (2015 – current; Project Manager).

Town of Southampton, CPF Historic Projects Coordinator – Providing project management and construction support services for the Town's historic restoration projects. On a daily basis, Matt provides support to the contractors, design professionals and property stewards. Matt has represented the Town on this annual contract since 2018. (Management; 2018 – current).

Town of Southampton, Ponquogue Redevelopment of Beach Pavilion – Provided Construction Administration and limited inspections services on the renovation of a 1966 wood framed beach pavilion. In addition to the Administration and daily coordination, Matt also coordinated the NYSDEC permit application process and obtained the final DEC permit close out. (\$3.35M; complete; Construction Administrator; 2018-2019).

Town of Southampton, Hot Dog Beach Ocean Facility – Provided planning, design, permit and bid documents, and construction support services for this project which involved restoration and reconstruction of two dune crossovers, ADA compliant parking and ramp to access the beach, new electric service and security lighting. Responsible for obtaining the NYSDEC permit and the final close out. Also obtained new electric service approvals from PSEG LI. (\$412,000; complete; Design and Construction; 2018-2019).

Village of Ocean Beach, Ocean Beach Ferry Terminal – Provided design for the new pile foundation for a new ferry terminal built to replace the existing facility destroyed by Super Storm Sandy. The multi-phase redevelopment of the entire ferry basin and the ferry terminal that included site survey, marine engineering, site and civil engineering, architectural development, preparation of construction documents and support through all phases of construction. Also provided Construction Administration and Project Management in cooperation with FEMA. (\$7.3M all phases; complete; Design and Construction; 2018).

Town of Islip, Islip Beach Comfort Station: This project was in response to the destruction of the existing comfort station at Islip Beach caused by Superstorm Sandy,

Mr. Jedlicka prepared expedited contract plans for a modular, pre-cast concrete comfort station and concessions building on a pile foundation so that the beach could be re-opened for the summer season. The new facility includes handicapped bathrooms, showers and ramps and is equipped with an energy efficient lighting system. Ramps, railings, and boardwalks are made from a dense tropical hardwood. The cost of the project was \$1.76 million, with the majority of funding to come from FEMA. LKMA also provided construction oversight and assisted the Town with their efforts to received reimbursement for the project from FEMA. (\$1.76; complete 2013; Drafting & permitting).

Town of Babylon, Animal Shelter, Amityville, NY: This project entailed LKMA working with a national design team to prepare the civil and structural design / construction documents for the proposed 13,000 SF facility and site. LKMA also prepared the Storm Water Pollution Prevention Plan (SWPPP) in accordance with NYSDEC regulations. The building design was prepared in strict accordance with the Humane Society of the United States, United States Green Building Council (LEED Certification), local municipal guidelines and the Building Codes of New Your State. The proposed shelter was designed with the capacity to house approximately 145 animals. (Bid total \$9.05 M; Construction start summer 2016)

Town of Brookhaven, Sandspit Ferry Terminal: This project consisted of preparing complete construction drawings and technical specifications to construct a 1,600 SF building structure at the Sandspit Marina Facility in Patchogue. The two-tier building was designed for office use by the ferry company, baggage inspections and a ticket booth/waiting area. The building includes two public bathrooms for the passengers going to and from Fire Island. A separate 20' x 20' storage facility was part of the project for the storage of bulk goods heading to the island. (\$1.1M; Designer; 2008)

Town of East Hampton - Springs Youth Building: This \$2.5 million dollar project included survey, permitting, design and construction monitoring to construct a 4,100 square foot Structural Insulated Panel (SIP) building. It was constructed adjacent to the existing elementary school in the community. The building utilizes a state-of-the-art HVAC system to minimize operating expenses. The great room can function as a homework area as well a space to conduct Town Board/Community meetings. It is used by students before and after school hours and also used by the Town of East Hampton Parks Dept. for athletic programs. (2009; Lead Designer)

Tiana Bayside Beach – Phase I – Hampton Bays: This project entailed a reconstruction of the Town of Southampton's Tiana Beach (Bayside) located on Shinnecock Bay on Dune Road. Site developments include a bathing beach, swimming area, transient small boat access, small boat launching/storage area, picnic area, playground, piers, boardwalks, and sitting areas. The project includes the design, permitting, NYSDEC, ACOE, Town Trustees, NYSDOS Coastal Consistency, SCDHS) and construction monitoring for removal of 900 feet of deteriorated bulkhead system, replacement of 500 feet of bulkhead, dredging, installation of a Gabion Revetment system, new breakwater, piers/pilings, moorings, site grading, vegetation removal/relocation, replacement of asphalt parking area, new stormwater drainage, boardwalks, buildings/structures, and utilities (\$2.45M; 2006).



ROBERT STEELE, P.E. Project Officer

Education

BE, Civil Engineering, Villanova University, 1994

Registrations

Professional Engineer, NY

Professional Societies

American Society of Civil Engineers

National Society of Professional Engineers

Professional Training

Certified Preparer of Stormwater Pollution Prevention Plans, 2008

OSHA HAZWOPER
Construction Safety Training,
2005

Mr. Steele has a well-diversified background in the field of civil engineering. He has experience in the design of: highways; bridges; storm water drainage systems; shoreline erosion prevention systems; and, sanitary sewer system restorations. He has also coordinated the surveying efforts required to support his design projects, and has provided construction inspection services for a number of those projects. In the course of developing the projects assigned to him, Mr. Steele has demonstrated his ability to deal with a variety of different clients on the state, county, local municipality and private levels. Representative project experience includes the following:

Silver Lake Drainage Improvement Study & 30% Design (Nassau County DPW / GOSR) Project Manager working with Nassau County DPW on this GOSR funded study to improve the flooding conditions of Silver Lake Park located in Baldwin, NY. In 2018, LKMA completed the Technical Design Report and the 30% Design Plans for the Silver Lake Drainage Improvements Project. This project required an extensive drainage inventory of the upland 2,675 acre watershed as well as creation of a drainage model that would analyze the existing drainage conditions and provide flood mitigation solutions that would fit into the County's limited funds for the project (\$1.7 million). As a result of both the drainage study and heavy community participation, LKMA developed four high priority projects that will significantly reduce the occurrence of flooding, improve water quality and improve the overall aesthetics of the park. As Project Manager, Bob took part in every design aspect of the project including stormwater modeling, development of design alternatives, community outreach meetings, preparation of the Technical Design Report and development of the 30% design plans and estimates.

Barnum Island / Harbor Isle Drainage Improvements, Hempstead, NY (Nassau County DPW / GOSR): Project Manager working with Nassau County Department of Public Works on this GOSR funded project to study flooding issues in the Hamlets of Barnum Island and Harbor Isle located in the Town of Hempstead. Coordinated efforts with sub-consultants to perform a complete GIS based drainage inventory inside the project study area. The project included the evaluation of approximately 11 drainage systems located in Harbor Isle and 30 drainage systems located in Barnum Island. Oversaw the design team's modeling efforts using USEPA SWMM methodology and led the effort in the developing proposed drainage solutions that will eliminate existing flooding conditions and meet the County's design criteria for the project. Project will include the development of 30% Design Plans for proposed construction projects estimated to be approximately \$10.5 million. Proposed project will involve drainage improvements including raising roads, check valves, pipe capacity improvements and bulkhead replacements at existing outfalls. (2017, Project Manager)

The Path to the Park – Shoreline Improvements in South Valley Stream (Town of Hempstead): Project Manager working with the Town of Hempstead on this GOSR funded project to restore the natural shoreline along Valley Stream from Cloverfield Road north to Mill Road and the adjacent 2,000 foot Path to the Park. Led design team's efforts on this project which involves removal of invasive phragmites, construction of berms for flood protection, expansion of wetland marsh areas, creation of scenic overlooks and stormwater quality improvements. Project also includes replacement of the existing deteriorated timber bulkhead at Brook

Road Park with a vinyl bulkhead or gabion wall. (Active, Project Manager)

NYS Route 110 Reconstruction, Drainage Improvements, Town of Huntington (NYSDOT): This project involved evaluating feasible alternatives for roadway and significant drainage improvements on a 0.9 mile section of NYS Route 110 (New York Avenue) in the vicinity of Huntington Harbor. The project included pavement repairs, resurfacing, curb improvements, and sidewalk and safety improvements. A major element of the project was the reconstruction of the drainage system. The project area suffered from several contributing factors that create a complex flooding situation, including low and nearly flat elevations of the roadway; steep grade of the surrounding area; large watershed area; numerous side streets with a long downhill component; high groundwater table; influence of tidal action due to proximity of the Huntington Bay; and significant development of the area and the stream parallel to Rte. 110. As the Drainage Project Engineer, Mr. Steele utilized the USEPA SWMM program to develop a conceptual drainage alternative which mitigated the chronic flooding of Route 110 and adjacent properties. (\$15M; 2013; Drainage Project Engineer)

Bay Avenue, Town of Brookhaven: Project Manager for this project which entailed the replacement of the highway road ending bulkhead and drainage improvements at Bay Avenue, which is located on the west side of this project. The existing deteriorated timber bulkhead at Bay Avenue was replaced with a navy style vinyl sheet bulkhead. The existing drainage system, which discharged through the road ending bulkhead, drained a portion of Bay Avenue untreated. The project installed a new stormwater treatment system to remove sediment, oil and floatables in the stormwater prior to discharging into the bay. This project was completed in 2013 at a cost of \$160K. LKMA also provided construction administration and inspection services.

Donald Court, Blue Point, Town of Brookhaven: Project Manager for the preparation and design plans and procured environmental permits for the replacement of a deteriorated bulkhead timber bulkhead at the end of Donald Court. Project also included the design of a vegetated swale meant to treat stormwater runoff from the roadway prior to entering the adjacent canal. Pollutant loading calculations were also provided to the Town that identified the pollutant removal capability of the system. Project completed in 2013 for a cost of \$100,000.

Roadway and Drainage Improvements in Carle Place (Town of North Hempstead): Developed design report and construction plans for 16 residential roadways located in Carle Place. Project was initiated by the Town of North Hempstead to address roadway flooding conditions and pavement deficiencies. Drainage analysis was performed and indicated that additional inlet capacity was required as well as reconstruction of the existing asphalt full depth pavement section. The use of mixed-in-place pavement restoration was evaluated and recommended for the reconstruction of the roadways. Existing positive drainage system was expanded to satisfy the drainage needs. (\$3.6M; 2012; Project Manager)



JAMES PETERMAN, P.E.

Senior Engineer QA/QC

Education

BS, SUNY Buffalo

Registrations

PE, New York, 1989

Professional Societies

American Society of Civil Engineers

Professional Awards

ASCE Engineer of the Year, 2011

Mr. Peterman had over 36 years of experience in the field of highway, bridge, canal, and bulkheading planning, budgeting, design, procurement, construction oversight and inspection. Mr. Peterman worked his way up the engineering ladder at the Suffolk County Department of Public Works (SCDPW) starting as a Junior Civil Engineer Trainee out of college and eventually appointed to the Chief Deputy Commissioner and retiring in January 2017. As Chief Deputy Commissioner, he oversaw the daily activities of over 700 employees with a capital program averaging \$250,000,000 per annum with an operating budget of nearly \$80,000,000 per annum.

Representative experience includes the following:

Senior Engineer, LKMA (2017 to present): As QA/QC officer, Mr. Peterman reviews designs, design calculations, plans, specifications, and estimates at various stages before submissions to insure consistency, clarity, accuracy, and to insure that best design principals and construction practices are incorporated. Reviews consist of practicality of design insuring the best value is achieved while meeting the desired goals of the project, safe constructability and construction phasing with least possible impact to the public and surrounding community. His analytical thinking looks for innovative ways to best solve situational design problems in the most cost effective and time constrained manner. All plans requiring a Professional Engineer Seal/Stamp are thoroughly reviewed and analyzed for structural integrity and that proper factors of safety are incorporated.

Director of Engineering & Construction, NV5 Inc. (formerly RBA) (2017): After retirement from Suffolk County in January 2017, Mr. Peterman managed the Engineering and Construction inspection/support group for the Melville office of NV5, Inc.. Notable projects advanced in his tenure were the Parking expansion and internal roundabout at the Suffolk Community College Ammerman Campus, Parking lot reconstruction of the Nassau Community College, Reconstruction of Austin Blvd., NCDPW, and coordination of design and construction staff.

Suffolk County Department of Public Works (1984-2017):

Chief Deputy Commissioner: Supervised and directed the planning, design, construction, maintenance and repair of all projects and appurtenances under the jurisdiction of the Suffolk County Department of Public Works which included: 425 miles of roadway, 82 bridges, 26 sanitary sewer districts, 370 County owned and leased buildings and facilities, Suffolk County Transportation, Fleet Services, Vector Control, Space Management, Procurement Services, Maintenance Activities, along with Accounting, Personnel and Administrative Services.

Assistant to the Chief Engineer of Highways Structure Waterways: Directed all aspects of highway and bridge construction; Prepared and coordinated Capital and Operating budgets for the division; Represented the Department at Civic and Chamber of Commerce meetings; Coordinated the activities of the Highway, Traffic, and Bridges/Waterways sections. Coordinated with County Attorney's office on legal actions, NYSDEC, NYSDOT, FHWA, Towns, Village and Elected officials. Some notable projects include:

- PIN 0756.14 Reconstruction of CR 67, Motor Parkway Bridge over I-495, Long Island Expressway: Bridge widening, bearing replacement, deck milling

and strengthening, traffic signals, reconstruction of approaches.

- PIN 0756.69 Reconstruction of CR 57, Bay Shore Road from SR 231 to SR 27
- PIN 0759.71 Reconstruction of CR 11, Pulaski Road from Oakwood to Depot: Full reconstruction, full depth widening, positive drainage, signage, new signals, ADA compliant sidewalks, recharge basins, NYSDEC/DOT permits
- FAA AIP 3-36-0122-13 Pavement Management: Rehabilitation of Runway 6-24 at Francis S. Gabreski Airport
- PIN 0759.44/45 ARRA: Pavement resurfacing of Long Island Expressway North and South Service Roads

Director of Highway/Bridge Design and Construction: Coordinated, oversaw and managed the activities and assignments of all highway and bridge design staff, CAD operators, surveyors, construction inspectors, water quality staff, and computer support personnel; Field inspection and managed complaints and correspondence with all complainants attributed to construction projects; Prepared Design Reports, Environmental Assessment Forms, Project Proposals, Interface and coordinated with all necessary utility companies, Towns, Villages, Suffolk County Departments, contractors, consultants, and the general public as required. Prepared detailed specifications and standards for the division as required. Notable projects include:

- Reconstruction of CR 39, North Service Road from SR 27 to CR 83, North Sea: Full reconstruction, widening, drainage, sidewalk, signals, striping, signage. Project alleviated long time backups at the end of Sunrise Highway to the South fork, completed under budget and on time, with incentives.
- Reconstruction of the St. Andrews Bridge over CR 39, North Road: Developed methodology to replace the existing deficient 2 lane bridge over Saint Andrews Road with Precast Concrete Arches that were slid under the existing structure while in use. Saved \$14,000,000 and was able to widen the bridge to facilitate the CR39 widening. Project on budget and on time.
- Reconstruction of CR 58, Old Country Road from I-495, LIE to CR 43, Northville Turnpike: Full reconstruction, widening, drainage, sidewalk, signals, striping, signage. Project alleviated long time backups through Riverhead traveling to the North fork, completed under budget and on time.
- Rehabilitation of the Shinnecock Canal Locks, Tide Gates, Jetties and Bulkheads: Removal and refurbish lock and tide gate doors, coin bearings, switches, hydraulics, bulk heading, electronics, wiring and monitoring equipment.
- Bridge Rehabilitation of CR 21 over LIRR, CR 97 over LIRR, CR 101 over Sunrise Highway, Smith Point Bridge: Replace/refurbish bridge bearing, remove and replace armor joints, steel preparation and paint, bridge and approach rail replacement.
- Installation of Bulkhead and Boardwalk along CR42 Shore Road, Timber Point Marina, Shinnecock Commercial Fishing Dock, Smith Point County Park, and Quogue Canal : Removal and replacement of deteriorated bulkheads and boardwalk, deadmen, anchors, and railings with associated electrical components for shore power and lighting.
- Rehabilitation of Landing Avenue Bridge: Underpinning of existing abutments, installation of new bulkheading, spall and crack repair, sediment and debris removal, installation of pedestrian bridge adjacent to existing structure.



KEITH MASSERIA, P.E. Project Engineer

Education

BS, Civil Engineering, Vermont University, 2008

Registrations

PE, New York, 2013

Professional Societies

American Society of Civil Engineers

ASCE Young Engineer of the Year 2016

Mr. Masseria has diversified engineering experience in the areas of construction inspection, highway design, water resources, and marine projects. Mr. Masseria is one of the emerging users of ArcGIS desktop products at LKMA and his knowledge of AutoCAD Civil 3D and advanced hydrologic analysis position him to be lead GIS projects requiring data development under an experienced engineering professional's guidance. His experience includes the following:

Barnum Island / Harbor Isle Drainage Improvements, Hempstead, NY (Nassau County DPW / GOSR) Project Engineer working with Nassau County Department of Public Works on this GOSR funded project to study flooding issues in the Hamlets of Barnum Island and Harbor Isle located in the Town of Hempstead. The project included the evaluation of approximately 11 drainage systems located in Harbor Isle and 30 drainage systems located in Barnum Island. Led drainage modeling efforts using USEPA SWMM methodology and aided in the development of proposed drainage solutions that will eliminate existing flooding conditions and meet the County's design criteria for the project. Coordinated collection of drainage data using ArcGIS Collector and the transfer of ArcGIS Online data into the drainage model. Project will include the development of 30% Design Plans for proposed construction projects estimated to be approximately \$10.5 million. Proposed project will involve drainage improvements including raising roads, check valves, pipe capacity improvements and bulkhead replacements at existing outfalls. (2017, Project Engineer)

Silver Lake Drainage Improvement Study & 30% Design (Nassau County DPW / GOSR) Project Engineer working with Nassau County DPW on this GOSR funded study to improve the flooding conditions of Silver Lake Park located in Baldwin, NY. In 2018, LKMA completed the Technical Design Report and the 30% Design Plans for the Silver Lake Drainage Improvements Project. This project required an extensive drainage inventory of the upland 2,675 acre watershed as well as creation of a drainage model that would analyze the existing drainage conditions and provide flood mitigation solutions that would fit into the County's limited funds for the project (\$1.7 million). As a result of both the drainage study and heavy community participation, LKMA developed four high priority projects that will significantly reduce the occurrence of flooding, improve water quality and improve the overall aesthetics of the park. As Project Engineer, Keith took part in every design aspect of the project including stormwater modeling, development of design alternatives, community outreach meetings, preparation of the Technical Design Report and development of the 30% design plans and estimates.

Flushing Meadows – Corona Park Watershed Study, Flushing (NYSDOT): Project Engineer, responsible for hydrologic and hydraulic analysis of the Corona Park Watershed located in Flushing, New York. Purpose of project was to identify drainage deficiencies on the Van Wyck Expressway and Grand Central Parkway as well as the adjacent hydraulic system of Corona Park, which consists of a series of interconnected lakes, channels and culverts. A key aspect of the analysis was to determine if the existing tidal gates located below Porpoise Bridge are effective at regulating surface water elevations in park's lakes (Willow Lake and Meadow Lake). Project required the development of a drainage model using AutoDesk Storm and Sanitary Analysis Software™ for a 714 acres watershed. Challenging aspect of the project was the gathering of drainage system data from record plans dating back to

the 1950's, converting the elevation data into NAVD88 and organizing the data in CAD with coordinates so that the drainage model could be created. (2016; Project Engineer)

Allen Street and Brian Street Drainage Investigations (Town of North Hempstead): Performed hydrologic and hydraulic analysis using EPA SWMM methodology for a 1,130 acre watershed in order to determine the cause of severe flooding that was occurring at the low points of Allen Street and Brian Street located in Herricks, NY. LKMA drainage analysis revealed the cause of the severe flooding and final design plans were developed to correct the flooding condition. (\$0.2M; 2014; Project Engineer)

Roadway and Drainage Improvements in Carle Place (Town of North Hempstead): This project involved the design of roadway and drainage improvements for sixteen residential roadways located in Carle Place. Drainage improvements included expansion of the existing positive drainage system to increase inlet capacity and alleviate existing flooding conditions. Roadway improvements incorporated the use of recycled mixed-in-place pavement as well as full depth pavement reconstruction. Mr. Masseria's responsibilities included modeling of the existing and proposed stormwater drainage system using EPA SWMM methodology, development of roadway plans and curb profiles using AutoCAD Civil 3D software and preparation of the Engineer's Estimate. (\$4M; 2011; Project Engineer)

Stormwater Remediation to the Yaphank Lakes and Carman's River at CR21 (SCDPW): This project involved the remediation of three direct stormwater discharges to the Yaphank Lakes and Carman's River. Proposed stormwater quality improvements included the design of pervious paving (Grasscrete) for roadside parking; design of a stormwater treatment system (Vortech); and design of a system of leaching basins to capture the stormwater quality runoff volume. Mr. Masseria's responsibilities included stormwater hydrologic and hydraulic calculations using StormNET EPA SWMM software; development of construction plans and details and preparation of the Engineer's Cost Estimate. (\$600,000; 2011; Project Engineer)

Dogwood Lane Water Quality Improvements, Locust Valley (Town of Oyster Bay): This project was funded under the Nassau County Environmental Bond Act and involved the watershed analysis of the upland area discharging runoff to the Dogwood Lane Drainage system and the adjacent creek that outfalls to Shu Swamp Preserve and preparation of a report to outline potential water quality improvements inside the watershed. Mr. Masseria's responsibilities included delineation of the watershed boundary discharging to Dogwood Lane, development of the computer drainage model using StormNET EPA SWMM, preparation of proposed alternative conceptual drawings and development of preliminary Engineer's Estimates. (\$100,000; 2010; Project Engineer)



KEVIN J. PETERMAN, E.I.T. Engineer

Education

BS, Clarkson University
Deans Scholar, May 2013

Registrations

Engineer-in-Training, NY,
2016

Professional Societies

NYSDEC Erosion & Sediment
Control Training, 2014

ASCE (American Society of Civil
Engineers)

LIREG (Long Island Real Estate
Group)

Awards

2021 Long Island Business News
"Who's Who in Engineering"

2020 Long Island Business News
"30 Under 30"

2019 New York Real Estate
Journal "One's to Watch"

Charitable Affiliations

Kairos Coffee for a Cause –
Founder and Operator (2017 –
2019)

Various Young Adult and High
School Programs (2013 – 2019)

Mr. Peterman is a result oriented, hands-on professional with a successful record of accomplishments in civil engineering, land development, and site planning. His diverse portfolio includes both municipal and private sector projects, including site development and planning, permitting, stormwater design, sanitary design, highway design, traffic signal design, marina/bulk head design, construction management, and environmental analysis (asbestos and lead based paint). Peterman's outstanding leadership skills and problem solving engineering ability are complimented by his astute analytical sense and technical acumen. He takes ownership of each of his projects and holds himself to an exceptionally high standard, which has generated quality work, satisfied clients, and a history of professional success and dependability for more than eight years. Representative project experience includes the following:

Sanitary System Design (Various Locations throughout Suffolk County, NY): Mr. Peterman has designed a vast array of residential and commercial sanitary systems throughout Suffolk County, consisting of traditional on-site sanitary systems (septic tanks and leaching pools), modified on-site sanitary systems (septic tanks with leaching galleys, clustered leaching systems, or gravelless absorption trenches for properties with high groundwater), and I/A Onsite Wastewater Treatment Systems in accordance with the current SCDHS code. Mr. Peterman has obtained a multitude of permit approvals from SCDHS Office of Wastewater Management, SCDHS Office of Pollution Control, and SCDPW for sewered areas and has performed various sanitary structure certifications and as-built sanitary inspections. Mr. Peterman has coordinated various underground injection control samples for sanitary structure abandonment in accordance with SCDHS Office of Pollution Control and NYSDEC requirements and has been involved with the remediation of same under the direction of SCDHS Office of Pollution Control. Mr. Peterman also has experience in preparing SPDES Site Plans and applications for commercial/industrial projects with on-site leaching systems injecting greater than 1,000 gallons per day into the ground. (2013 – 2021; Project Engineer and Assistant Project Manager)

Contractor Express Stormwater Design (Oceanside, Town of Hempstead, Nassau County, NY): The subject property is located along a tidal creek with minimal clearance to groundwater. Under existing conditions, the property was poorly graded, lacked on-site stormwater retention structures, experienced frequent flooding from stormwater runoff, and discharged untreated stormwater runoff directly into the creek. This project entailed improved grading and drainage design to provide drainage inlets with sumps, drainage conveyance piping, sub-surface stormwater leaching galleys, reduction in run-off volume to the creek, and improved water quality for all stormwater prior to discharging to the creek by means of a hydrodynamic vortech separator capable of removing 80% of total suspended solids and oil contaminants. Mr. Peterman lead the design and received approval from NYSDEC. (2017; Assistant Project Manager)

Stormwater Management/Water Quality Services Term Agreement, Downstate Regions 8, 10 & 11 (D031093): The Term Agreement was established to address such tasks as stormwater management, surface/groundwater quality services, watershed or drainage system mapping, erosion & sediment control and training Department personnel. Five separate assignments were progressed and included: (1) Inspection of approximately 3000 stormwater outfalls in Region 8 for evidence of

illicit discharges and updating the Department's GIS information database, (2) Water quality sampling and evaluation of coliform bacteria levels at multiple points within 2 different Route 25A (Region 10) culvert drainage systems terminating in Northport Harbor to address EPA mandates, (3) Flushing Meadows-Corona Park Watershed Study (Region 11) to evaluate flooding conditions impacting the park, Van Wyck Expressway and the Grand Central Parkway. Includes installation of groundwater monitoring wells; lake surface, tidal and groundwater level recordings; topographic surveying; evaluation of area flooding conditions; stormwater system drainage modeling using StormNET; coordination with NYC Parks Dept., (4) Evaluation and remedial action recommendations for illicit discharge of sewage into the Route 25A drainage collection system at Northport Harbor, (5) Inspection of stormwater outfalls in Region 11 for evidence of illicit discharges. (Project Engineer, 2013 – 2015; \$450 K).

Wincoram Planned Unit Development – Coram (Town of Brookhaven): This was a "Blight to Light" project with State funding to renovate the existing parcel on the southwest corner of NYS Route 25 and NYS Route 112. This former UA Movie site will include condos, apartments and a small retail component. Assisted in the development of drainage improvements, erosion and sediments control plans, site details and planting details. (2012-2013; Project Engineer)

Brentwood School District Sanitary Study (Brentwood, Town of Islip, Suffolk County, NY): This project entailed the review and inspection of the existing sanitary systems at four schools within the Brentwood School District. Review of existing sanitary systems (and sizing of same) was performed using the current Suffolk County Department of Health Services Commercial Standards for sanitary system components and hydraulic loading rates. The Brentwood School district was interested in understanding the capacity and condition of the existing sanitary systems as they relate to proposed building additions and/or changes in use. The results of the sanitary inspections were reviewed against proposed build-out scenarios and recommendations were documented in a sanitary due diligence report issued to the Brentwood School District. (2020; Assistant Project Manager)

Sanitary Improvements at National Grid (Melville, Town of Huntington, Suffolk County, NY): National Grid reported consistent sanitary system failures at their existing office and warehouse facility in Melville, NY. Mr. Peterman was retained to investigate the existing sanitary systems for capacity and structural integrity. Each of the sanitary systems was pumped for proper inspection, and dye-testing was performed to identify building tributary areas. As a result of Mr. Peterman's sanitary investigation, he was able to recommend major improvements to the existing sanitary systems to ensure proper function and received SCDHS approval for same. This project also entailed the development of sanitary as-built plans. Permitting included: SCDHS Office of Wastewater Management, SCDHS Office of Pollution Control. (2019; Assistant Project Manager)



ANDREW SPEISER

Senior Environmental Scientist

Education

BS, Aeronautics-Meteorology,
Parks College of Aeronautical
Technology, St. Louis University,
1975

MS, Atmosphere Science, SUNY
at Stony Brook, 1979

Professional Training

OSHA HAZWOPER Training
(since 1987)

OSHA Confined Space Training
(since 1996)

OSHA 10-Hr. Construction Safety
Training (2005)

OSHA Lead in Construction
Training (2007)

NYSDOL Asbestos Inspector and
Project Designer

USEPA Lead-Based Paint
Inspector

NITON X-ray Diffraction meter
training for detection of lead in
paint (1995)

MTA: LIRR & MNRR – Roadway
Worker Protection Training

NYSDEC Erosion & Sediment
Control Training

Mr. Speiser has over 45 years of diversified experience in the preparation, conduct and analyses of a wide variety of environmental studies. During that time, he has participated in numerous air quality, noise and hazardous waste site investigations, with a particular emphasis in the fields of transportation and of landfill construction/closure. His background includes experience in the design, implementation and coordination of sampling programs; data assessments; health and safety issues; permitting; wetlands; and, report development (including Environmental Impact Statements/Assessments, Phase I site assessments, Phase II site contamination investigations, and asbestos assessments). He has conducted both indoor and outdoor ambient air quality investigations, as well as associated dispersion modeling for residential, commercial, industrial and municipal clients.

Mr. Speiser is currently certified by NYSDOL as an Asbestos Inspector and Project Designer, and has participated in the past as an Asbestos Supervisor, Project Monitor and Air Sampling Technician. He has been responsible for numerous asbestos projects for NYSDOT, the New York City Department of Sanitation, and local municipalities.

He has been designated as the site safety officer on a number of hazardous waste site investigations, with responsibility for the training and oversight of both site workers and investigation activities. Mr. Speiser has specialized training in the conduct of hazardous waste site investigations and in confined space entry procedures. Finally, he has been responsible for the planning and conduct of ambient air and subsurface vapor sampling studies; supervision of groundwater monitoring well installations; collection of surface and subsurface water and soil samples; and, overall project health and safety monitoring.

Representative project experience includes:

Stormwater Management/Water Quality Services Term Agreement, Statewide (D031473): A Statewide Term Agreement to address tasks such as stormwater management, outfall inspections, surface/groundwater quality services, watershed or drainage system mapping, and erosion & sediment control. To date, 23 assignments progressed included: Review of as-built record plans for geo-locating possible stormwater outfalls in various Counties; Conducting inspection of stormwater outfalls for evidence of illicit discharges; Supplemental water quality sampling at the Route 25A drainage collection system at Northport Harbor for coliform bacteria contamination; Water quality sampling at the Route 25A drainage collection system in Centerport for coliform bacteria; and water quality sampling study at stormwater BMP's to evaluate Phosphorus concentration reduction. (2017 – Current; \$1.0 M; Role: Contract/Project Manager and Lead Staff Person).

Stormwater Management/Water Quality Services Term Agreement, Downstate Regions 8, 10 & 11 (D031330): This Term Agreement was established to address such tasks as stormwater management, surface/groundwater quality services, watershed or drainage system mapping, erosion & sediment control and training Department personnel. Six (6) separate assignments were progressed and included: (1) Inspection of over 2700 stormwater outfalls in Westchester County for evidence of illicit discharges and updating the Department's GIS information database, (2) Round 4 of water quality sampling and evaluation of coliform bacteria levels at

multiple points on Route 25A (Region 10) culvert drainage systems terminating in Northport Harbor to address EPA mandates, (3) Inspection of over 1700 stormwater outfalls in Orange & Rockland Counties for evidence of illicit discharges and updating the Department's GIS information database, (4) Round 5 of water quality sampling and evaluation for illicit discharge of sewage into the Route 25A East section of the drainage collection system at Northport Harbor, (5) Wet weather sampling of surface water runoff entering Georgica Pond, East Hampton for evaluation of various water quality parameters, (6) Inspection of approximately 600 stormwater outfalls in Putnam County for evidence of illicit discharges. (2015 – 2018; \$450 K; Role: Contract/Project Manager and Lead Staff Person).

Stormwater Management/Water Quality Services Term Agreement, Downstate Regions 8, 10 & 11 (D031093): The Term Agreement was established to address such tasks as stormwater management, surface/groundwater quality services, watershed or drainage system mapping, erosion & sediment control and training Department personnel. Five separate assignments were progressed and included: (1) Inspection of approximately 3000 stormwater outfalls in Region 8 for evidence of illicit discharges and updating the Department's GIS information database, (2) Water quality sampling and evaluation of coliform bacteria levels at multiple points within 2 different Route 25A (Region 10) culvert drainage systems terminating in Northport Harbor to address EPA mandates, (3) Flushing Meadows-Corona Park Watershed Study (Region 11) to evaluate flooding conditions impacting the park, Van Wyck Expressway and the Grand Central Parkway. Includes installation of groundwater monitoring wells; lake surface, tidal and groundwater level recordings; topographic surveying; evaluation of area flooding conditions; stormwater system drainage modeling using StormNET; coordination with NYC Parks Dept., (4) Evaluation and remedial action recommendations for illicit discharge of sewage into the Route 25A drainage collection system at Northport Harbor, (5) Inspection of stormwater outfalls in Region 11 for evidence of illicit discharges. (2013 – 2016; \$450 K; Role: Contract/Project Manager and Lead Staff Person).

Bridge Lane over Sagaponack Pond, Southampton, Suffolk County (Town of Southampton): Performed an initial visual screening assessment and subsequent detailed site inspection and sampling for the presence of asbestos containing materials associated with the design for renovation of this 90 foot long, 6 span structure.

Intersection Improvements to County Route 100 (Suffolk Ave.) at Brentwood Rd./ Washington Ave., Brentwood (SCDPW, CP 5065.111) – Phase II Site Assessment: Responsible for conducting a Phase II subsurface soil investigation for possible contamination by gasoline and automobile service stations. The investigation entailed progressing a total of 17 boreholes on 3 parcels at the intersection, along with collection, evaluation and reporting of soil/water samples.

Route 27 (Sunrise Highway), Section 7A (Pond Rd. to East of Lakeland Ave.), Suffolk County (NYSDOT): Reconstruction of 2.4 miles of highway. Conducted Haz. Waste/Contaminated Materials and Asbestos screening studies and detailed site investigations including installation of groundwater monitoring wells, collection and analysis of soil and water samples, and asbestos sampling. (1993; Env. Specialist)



GARY GENTILE , R.L.A., CPSWPPP

Senior Landscape Architect

Education

AS, Ornamental Horticulture, NYS University at Farmingdale, 1966

BLA , Landscape Architecture, University of Georgia, 1969

Registrations

Licensed Landscape Architect, New York, 1974

US Soil Conservation, Soil & Erosion Control Certification

US Army Corp. of Engineers Wetland Delineation Certification

NYS Native Plant Species Expert Certification

Bioengineering Training & Implementation Certification

International Erosion Control Association Certification

Certified Preparer of Stormwater Pollution Prevention Plans, 2016

Professional Societies

Association of State Wetland Managers (ASWM)

Professional Awards

NY Historical Preservation Award (NYSOPRHP – 2001)

Member of Design Team awarded Federal Highway Administration 2005 Environmental Excellence Award

NYS DOT "Wayne McCready" Environmental Innovation and Stewardship Award (2006)

Statewide Engineer of the Year, NYS Association of Transportation Engineers (2007)

Mr. Gentile was a Senior Landscape Architect with NYS Department of Transportation for 39 years. Gary supervised up to six people charged with the review of Region 10 and Region 11 landscape programs. He was also responsible for wetland mitigation, planting plans, historic and cultural resource programs and review, topsoil analysis, highway work permit review, nursery inspection of landscape plant materials, the evaluation of noise wall installation, invasive species, bikeway design and construction, historic parkway design issues, sediment and erosion control, ADA requirements, native plant species, permitting (NYS Department of Environmental Conservation Permits and Mitigation and US Army Corp. of Engineers Wetland Permits and Mitigation Plans), and coordination with the Long Island Pine Barrens Commission.

His experience over the past 39 years included tidal wetland evaluations, design, installation, monitoring, and restoration efforts. During his career he has supported and conducted wetland seminars in New York and New Jersey. His work with innovative materials include geotextiles, GRES system (Geotextile reinforced earth system), gabions, erosion control blankets, bio-logs, pyramats, and new nursery planting techniques (planting pallets, bare root, planting cells, plant rescue, etc.)

In addition to his 39 years' experience with the New York State Department of Transportation, Mr. Gentile has work 10 years at L. K. McLean Associates, performing similar work on State, County, Town, Village and private projects. These projects included wetland restorations, Long Island Railroad landscape management restoration projects, airport improvements, drainage projects, horticulturist for Nassau County DPW, and hurricane Irene and Sandy recovery work for Nassau County.

Mr. Gentile's expertise enable him to be qualified by New York City Park's Department as the Restoration Specialist for the NYC Blue Belt program at Oakland Lake Park restoration project.

Gary's professional training in the wetlands field includes Wetland Policies in Transportation Projects, Managing and Protecting Long Island Wetlands, FHWA WET-II training, U.S. Army Corp of Engineers Wetland Delineation Course with Ralph Tiner, Ecological Construction for Wetlands, Designing Stormwater Wetlands, New York State Erosion and Sediment Control Training for Designers,

Representative project experience includes the following:

Path to the Park-Shoreline Improvements Project, Town of Hempstead: This project was funded through a U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant-Disaster Recovery (CDBG-DR) for disaster recovery projects. The funding was administrated through the NY Rising Community Reconstruction (NYRCR), within the New York Governor's Office of Storm Recovery (GOSR) for the Town of Hempstead.

LKMA developed plans and procured environmental permits to restore the natural tidal shoreline along Valley Stream's 2,000 foot linear Path to the Park, from Forest Road School to Edward W. Cahill Memorial Park.

The design created a living shoreline utilizing a combination of both green and hardened features to re-establish the park's shorelines at a higher and more flood resilient elevation.

Stormwater Quality Improvements, Nessenger Chevrolet Site: Under a NY State Environmental Facilities Corporation Grant for the Town of Brookhaven, LKMA developed plans and procured environmental permits for stormwater quality improvements at the site of a former Chevrolet dealer in Patchogue. In addition to establishing a wet meadow for stormwater treatment prior to its entering the adjacent Swan River, a passive-use park was created. A maintenance road was constructed of permeable pavement. A bio-retention basin was constructed to accommodate drainage from the proposed access road and parking area, and included the restoration of native wetlands vegetation. The original streambed of the Swan River was re-established. Gary served as lead landscape architect and was responsible for the development of proposed wetland planting plans, details and specifications.

NYS Route 110 Reconstruction – Drainage Improvements, Huntington (NYSDOT): This project evaluated the development of feasible alternatives for roadway and significant drainage improvements on a 0.9 mile section of NYS Route 110 (New York Avenue) in the vicinity of Huntington Harbor, and developed plans for construction. The project area suffers from several contributing factors that create a complex flooding situation, including low and nearly flat elevations of the roadway; steep grade of the surrounding area; a 3,500 acre watershed area; high groundwater table; influence of tidal action due to proximity of the Huntington Bay; and significant development of the area and the stream parallel to Rte. 110. Gary's responsibilities including landscape plans, wetland plantings and development of details for a vegetated filter and proposed stormwater wetland designed to treat runoff from Route 110.

Loop Parkway/Meadowbrook State Parkway Interchange Tidal Wetland Design and Installation: Design and installation of the tidal wetland mitigation for impacts of the redesign of the eastbound ramp from Loop Parkway to northbound Meadowbrook State Parkway. Design included tidal ditches for mosquito controls and the installation of nesting structures for the local Osprey, and the use of gabions in the tidal wetlands to support the GRES wall system. Native species were installed into the GRES wall to make the wall compatible with the tidal wetland, mitigate the visual impacts, and create wildlife habitat.

Highway Runoff Mitigation Project (PIN 0807.54.301): The Long Island Region of NYSDOT was required to look at direct discharge and the impacts of highway drainage system retrofits. Sensitive environmental areas needing mitigation were identified in coordination with the NYSDEC. Wetlands were identified, highway runoff mitigation solutions were identified, and design plans were prepared. In addition invasive species were identified, horticultural controls evaluated, construction concerns addressed and landscape mitigation implemented.



TAMARA STILLMAN, P.L.S.

Associate/Director of Survey & Mapping

Education

AAS, Civil Engineering
Technology, SUNY College of
Technology at Farmingdale,
1990

Registrations

Professional Land Surveyor, NY,
2003

Professional Societies

National Society of Professional
Surveyors (NSPS)

New York State Association of
Professional Land Surveyors
(NYSAPLS)

Nassau Suffolk Civil Engineers
(NSCE)

Genesee Valley Land Surveyors
Association

Professional Training

OSHA HAZWOPER
Construction Safety Training,
2005

Ms. Stillman has over 33 years of comprehensive experience in both office and field survey. She has worked on a number of New York State Department of Transportation, Term Agreement for Survey Services (TASS) projects, and as an Assistant Project Manager has interacted with clients on various types of survey and mapping projects.

She is experienced in performing topographic, boundary, hydraulic and GPS surveys and has completed many transportation and site development projects. Her office experience includes preparing research, downloading and manipulating field data, mapping, profiles, site plans, grading and preparation of Right-of-Way (ROW) taking plans and acquisition maps. Her field experience includes crew chief, instrument person and rodman duties. She is experienced in MicroStation V8i, AutoCAD Civil 3D computer drafting, and design computer programs such as InRoads, Eagle Point, TDS and Cogo PC. Representative project experience includes:

NYSDOT ADA Compliance - Various Locations on Long Island: The project scope of work was a study that resulted in identifying the existing non-compliant sidewalks ramps in Nassau County and Suffolk County. Survey services included providing topographic base mapping, DTM, control information and boundary determination at these locations so that new ADA compliant ramp designs could be developed by AECOM. This work presented the need for LKMA to prepare numerous Permanent Easement and Temporary Easement Acquisition Maps for NYSDOT.

East Hampton Airport Lease Parcel Survey: Project involved providing boundary survey and mapping of the various lease parcels created throughout the years by agreements between the Town of East Hampton legal department and private entities at the East Hampton Airport at Daniels Hole Rd. in East Hampton. LKMA was also involved in producing the topographic mapping necessary for the design of a new fuel facility on-site.

Middle Island Solar Farm, SYBAC Solar: Project involved providing an ALTA/NSPS Land Title Survey and topographic mapping of a 100-acre parcel in Middle Island in which a 60-acre lease parcel was created to be used for the development of a solar farm. LKMA survey department then prepared a stakeout plan and provided field stakeout services of the site design features; clearing limits, driveways, recharge basins, drainage and utility structures, and the 4,752 posts that were needed to support the solar panels.

NYSDOT Emergency Standby and Pavement Design: Under this "on-call" design agreement, LKMA prepared plans for fast-track construction assignments for NYSDOT. Projects included design of bridge parapet wall replacement for all of the bridges at the Southern State Parkway/Wantagh State Parkway Interchange, a safety study at the Loop Parkway/Southern State Parkway interchange, safety crossings for hikers using the Greenbelt Trail on NY 108, drainage improvements on NY Route 107, left turn lane designs for Route 27, safety improvements for NY 111 and CR 17, and design of ADA-compliant crosswalks and accessible sidewalk ramps at multiple locations in Nassau and Suffolk Counties. Services included project scoping, survey and mapping, preliminary design (Phase I-IV), final design (Phase V & VI) and construction support services.



TAMARA STILLMAN, P.L.S.
Associate/Director of Survey & Mapping

Mill Pond, Bay Shore: LKMA developed plans for the creation of a new pond adjacent to Penataquit Creek in downtown Bay Shore. The pond will be offline from the creek, receiving inflow via a diverter structure at the creek and outflow will be controlled with a weir. The pond is designed so that it freezes during the cold winter months, thus, creating a link to the historic "Ice Pond" which was filled in during the early 1900s. In addition to developing bid documents, a NYSDEC permit was obtained and survey and mapping services were provided.

Drainage Improvements at Linden Place, Glen Head, Town of Oyster Bay: Project involved evaluating feasible alternatives for drainage improvements on Linden Place in the vicinity of Glen Cove Avenue to eliminate a chronic flooding condition which often made the road impassable. The project included a topographic survey of Linden Place, Willow Place, Elm Place and the segment of Glen Cove Avenue between University Place and Elm Place. Hydraulic and hydrologic modeling of the urban watershed area was performed using the USEPA SWMM program for a variety of storm frequencies. A drainage report was prepared showing a variety of improvement options. The alternative selected by the Town involves the installation of diffusion wells on Willow Place and possibly connecting the drainage system on Linden Place to Willow Place by installing a positive connection along Glen Cove Avenue. The project involved coordination and permitting with the NCDPW.

Five Term Agreements for Survey Services (PIN S115.13) (NYS DOT Region 10): Open-end survey agreement involving topographic, hydrographic, utility, drainage and property survey (2002-2009).

NYS DOT Region 10, Route 25, Smithtown, NY: Responsible for deed research, correlation, computation and mapping of the existing highway boundaries and adjacent properties for three miles of state highway necessary for a reconstruction and widening project. Work also included the development of Highway Boundary plan.

NYS DOT Region 10, Route 105, North Bellmore, NY: Responsible for the computation and mapping of all ROW taking maps required for the widening of this section of state highway.

NYS DOT Region 10, Route 24, Hempstead, NY: Responsible for the development of a Digital Terrain Model (DTM) for a two mile section of a four lane divided highway. Work included coordinating field crews and correlation of DTM in conjunction with planimetric aerial mapping.

NYS DOT Region 10, Route 25, Aquebogue, NY: Responsible for necessary field work and topographic mapping of one mile of state highway. Work included the deed research, correlation, computation and mapping of the existing highway boundaries and adjacent properties, as well as the development of a DTM.



GLENN BREWSTER, P.L.S. Senior Surveyor

Education

BS, Finance, CW Post

Registrations

Professional Land Surveyor, NY

Professional Societies

New York State Association of Professional Land Surveyors (NYSAPLS)

Board of Director member Nassau Suffolk Civil Engineers (NSCE)

National Society Professional Surveyors (NSPS)

Mr. Brewster has 34 years of comprehensive experience in both office and field survey and has interacted with various clients on survey and mapping projects.

He is experienced in performing route and site topographic surveys as well as boundary, ALTA and GPS surveys.

His field experience includes party chief, instrument person and rod person. His office experience includes deed research and property line determination, downloading of field data, development of mapping, DTMs, site plans and acquisition maps. He is experienced in AutoCAD Civil 3D and Microstation.

Representative project experience includes:

Peconic Crossing LLC Provided comprehensive ALTA/NSPS, easement and shoreline survey and mapping services for construction of workforce housing along the Peconic River in Riverhead.

Munsell Road Town of Brookhaven: Complete boundary survey, road abandonments and radius maps Established remainder parcels and wrote legal descriptions for all parcels involved.

County of Suffolk DPW: Provided survey and mapping services for reconstruction and replenishment of the Fire Island Pines ocean front properties.

Reconstruction of CR 57 (Bay Shore Rd.), Suffolk County (SCDPW): Reconstruction of 3.1 miles of roadway to increase capacity, upgrade the existing pavement and drainage system, and increase safety through use of traffic control devices and safety appurtenances. Responsible for the development of scoping alternatives, drainage analysis incorporating stormwater treatment Best Management Practices, pavement evaluation report and interchange modifications at Southern State Parkway and CR 57 (Exit 43), Expanded Project Proposal, Design Report, and cost analysis of feasible alternatives.

Town of Oyster Bay "On Call" Civil Engineering Services: Evaluations including computer modeling of stormwater flows and development of drainage solutions including survey & mapping, preparation of reports, preliminary plans and final plans, specifications and estimates for numerous locations. Also includes roadway rehabilitation projects for several roadways including locations in Farmingdale and East Norwich.

NYS Route 27 Control Survey: Provided survey & mapping services relative to aerial photogrammetric survey control. Developed survey report from control network of 24 checkpoints and 92 targets.

NYS Thruway Harriman: Development of abstract request map, right-of-way taking maps, and easement maps for construction of interchange plaza.



GLENN BREWSTER, P.L.S.
Senior Surveyor

NYSDEC Orient Point – Truman Beach: Topographic and right-of-way survey for improvements related to redesign and reconstruction of Truman Beach boat ramp and parking area.

NYC Roosevelt Island: Comprehensive topographic mapping and survey services to establish boundaries and planning for future development.

Suffolk County Farmland Preservation Surveys: Research survey and development of acquisition maps for various properties throughout Suffolk County for purchase as part of the Suffolk County Drinking Water Protection Programs. Surveys included Delea Sod Farm, Zuhowski, Zeh, Hulse, Tooker, Lewin, Crowder, Reeves, and Miller Family Trust parcels.

Town of Brookhaven Sewer District (Patchogue Sewer District): Complete boundary mapping of all parcels involved and adjacent to sewer easement placement.

Town of Riverhead Grumman Site: Provided boundary survey and topographic mapping for entire parcel, with subsequent subdivision for sale of parcels.

NY Air National Guard – Gabreski Airport: Control and topographic mapping for drainage and tarmac reconstruction.

NY Air National Guard Stewart Air Force Base: Provided update boundary survey and topographic map for entire site.

Conoco Phillips, Northville Terminal: Topographic and boundary survey of complete facility including piping, storage tanks, piers and offshore terminal.

S.C. Road 21, Yaphank: Coordinated complete topographic and boundary surveys for total drainage study. Generated centerline stationing for future construction.

Town of North Hempstead, Carle Place: Detailed topographic and boundary survey for reconstruction of roads sidewalks curbs and drainage. Established centerline stationing for rigorous design plan.

City of Long Beach: Provided comprehensive topographic survey of highway right of ways for complete reconstruction of drainage, sewer, roads, curbs and sidewalk infrastructure.



KEVIN QUINN Senior Inspector

Education

BS, Biology, Southampton
College of Long Island University,
2006

Professional Training

OSHA Construction Safety
Training, 2005

NYS DOL Asbestos
Inspector/Project Monitor/Air
Sampling Technician

ACI Concrete Field Testing
Technician - Grade 1

NYS DEC Erosion & Sediment
Control Training, 2013

Mr. Quinn has over 10 years of diversified construction experience in a variety of construction projects including roadway reconstruction, parks development, new building construction, marine construction and rehabilitation of existing building structures. Other construction monitoring assignments have included, landfill cell construction, demolition/asbestos abatement and bluff rehabilitation projects. Representative project experience includes:

Village-Wide Pavement and Drainage Study, Village of Shoreham: Preparation of a comprehensive evaluation of the existing roadway and drainage facilities. The study included a complete inventory of drainage facilities and an assessment of the existing pavement conditions for more than five miles of roadways. The US EPA's Storm Water Management Model (SWMM), created for the Village's stormwater system, was utilized to identify deficiencies and develop proposed drainage recommendations. Prioritized recommendations to improve pavement and drainage, accompanied by phased construction costs, were prepared. The recommendations included "Green Infrastructure Practices" where appropriate, as well as shore stabilization improvements for the terminus of the main outfall pipe.

Atlantique Beach and Marina, Fire Island (Town of Islip) In response to the destruction caused by Hurricane Sandy, LKMA developed final contract bid documents and cost estimate for the extensive repairs that were necessary to re-open the Town of Islip facility to the public before Memorial Day 2013. Repairs included 550 feet of bulkhead replacement, complete replacement of docks electrical system, boardwalk reconstruction and repairs to existing comfort stations. (\$2M; 2013 ; Sr. Inspector)

East Islip Marina (Town of Islip) Project that provided survey & engineering services relative to the replacement of 1,300 linear feet of timber bulkhead with vinyl bulkhead. In addition to a new bulkhead, the project included the replacement of the existing boardwalks with IPE (ironwood) decking, new electrical power posts, new water service, new park benches and decorative pedestrian lighting. Permits obtained by LKMA included NYS DEC, US Army Corps, and NYS Department of State. Soil investigations, site survey, and bulkhead structural analyses were all performed by LKMA staff. (\$2M; 2013; Sr. Inspector)

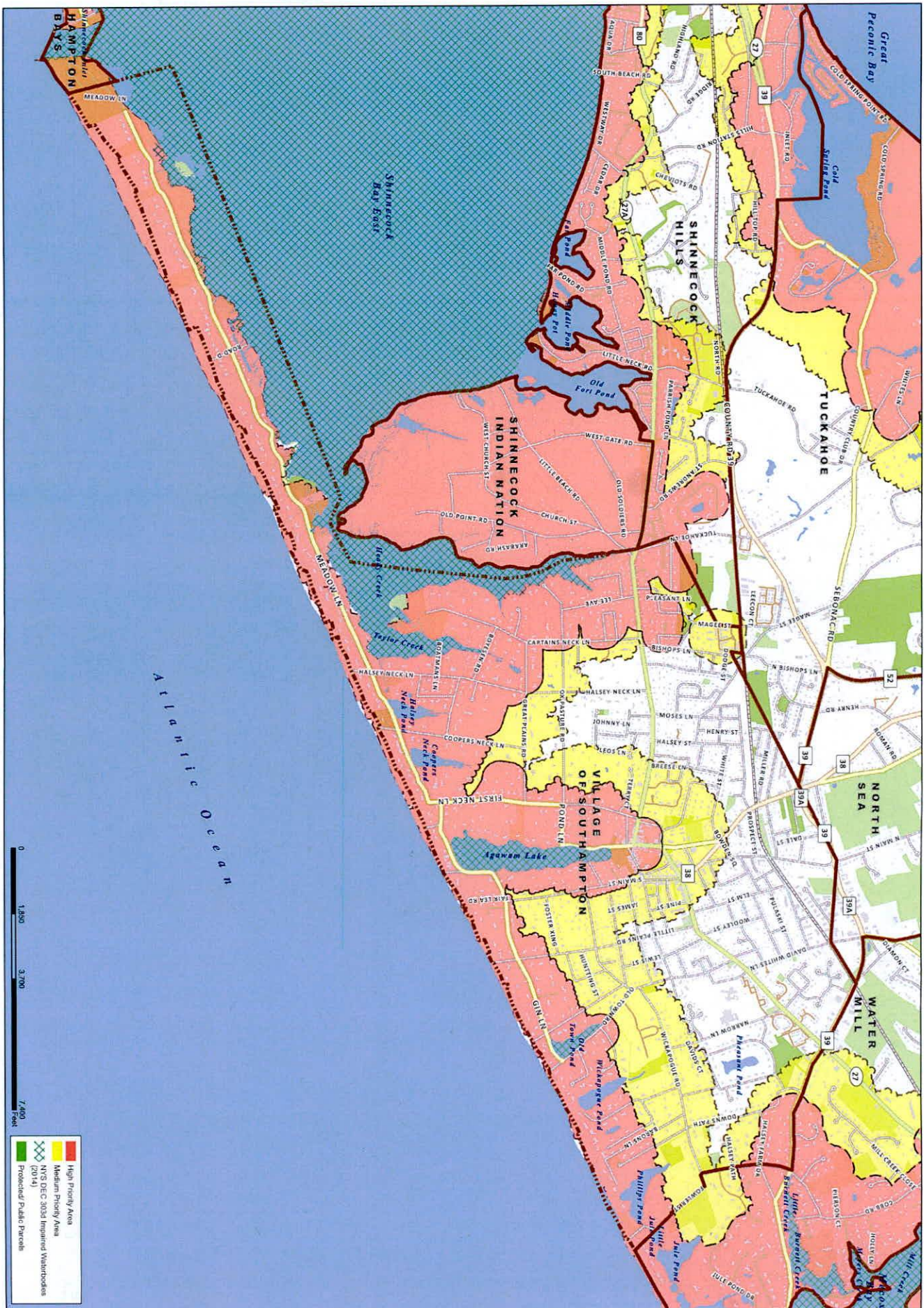
Windswept, Inc. Village of Ocean Beach, N.Y.: As a result of Super Storm Sandy the Village owned building and property was seriously damaged by water intrusion, wind and debris. The rehabilitation and restoration of the facility needed to be coordinated with FEMA and the Village of Ocean Beach planning and zoning codes governed by high seasonal occupancy. Construction is defined within two (2) separate phases within a multi-year construction cycle scheduled for out of season occupancy. The initial scope of work includes selective demolition, lifting and moving the existing three story wood frame structure, installation of new wood pile foundation and resetting the structure onto the new foundation. Upon completing this scope exterior decking, stairs and handicapped ramps will be installed. The scope of work included within the second phase includes the finishing of the interior and exterior of the structure, including new full service emergency generator, mechanical, electrical and plumbing, all conforming to the current Building Code of New York State.

Town of Brookhaven FEMA Reimbursement: LKMA was responsible to sufficiently detail what change to the Project Worksheet's Scope of Work (SOW), including the Hazard Mitigation Proposal (HMP). The detail included, as applicable, changes in dimensions, materials, footprint (provide map/drawing of new foot print with respect to existing); location; whether digging, structural removal, site work (i.e. tree removal), access roads was anticipated; whether work to be done was by Contract or force account (annual contract). The project also required LKMA to identify the cost attributable to the SOW change(s) including any costs that would be avoided when implemented. We include any documentation supporting the cost estimate. Our resources were required to provide justification for the change(s) including, as applicable, cost effectiveness/reasonableness; whether related to newly observed additional damages at the time (provided short explanation why the damage was not observed during the initial inspection and why the damage was related to the disaster) or not; related to code/standards or regulatory requirements (provided reference & a copy of the referenced requirement); best engineering/construction practices (provided explanation); recommendations by engineering consultant (included documentation of the recommendation); proposed HMP (with explanation what damages were mitigated by the change); or related to a substantial increase in cost (provide documentation i.e. contract bid proposals/quotes). The project also included discussions of eligibility under the Stafford Act. Lastly, our staff was responsible to identify any regulatory timeframes and whether the work was covered by existing permits or required a new permit; amendments to any existing permits; or if application for regulatory approval was needed. Included in this assignment was any regulatory documentation received related to the change. If a change in the foot print involved a historic structure, we were expected to indicate whether State Historical Preservation Office (SHPO) had been contacted.

Town of Southampton: Serving as Deputy Superintendent, oversee reconstruction of 450 miles of roadway and highway drainage systems on Town roadways, including the milling and paving of Dune Road. Work includes overseeing various drainage improvements throughout the town and preparing estimates and final payment review.

Village of Ocean Beach Ferry Terminal (Village of Ocean Beach:) Project Involved survey and engineering services relative to the replacement of 550 linear feet of timber bulkhead and 8,200 square feet of freight and passenger dock. New bulkhead is an epoxy coated steel bulkhead. Unique aspect of project was the design of a precast concrete decking system for the freight dock area. Since the project was federally funded under the ferry boat discretionary program, the contract documents were developed in accordance with the latest NYSDOT standards. Cost of project is approximately \$3 million.

Exhibit F



Town of Southampton CPF Water Quality Improvement Project Plan

VILLAGE OF SOUTHAMPTON

Small text at the bottom left corner, likely a disclaimer or metadata regarding the map's data sources and permissions.

