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## PROPOSAL ESS Proposal 17835

### Response to Request for Proposal Silver Lake Water Quality Monitoring Halifax, Plympton, Pembroke and Kingston, Massachusetts



## PREPARED FOR

**Central Plymouth County Water District Commission**  
c/o Frank Basler, County Administrator  
44 Obery Street  
Plymouth, MA 02360

June 3, 2021

**Non-Price Proposal**





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environmental consulting & engineering services

June 3, 2021

Plymouth County Commissioner's Administration Office  
c/o Frank Basler, County Administrator  
44 Obery Street  
Plymouth, Massachusetts 02360

**Re: Non-Price Proposal – Response to RFP for Silver Lake Water Quality Monitoring  
Halifax, Plympton, Pembroke and Kingston, Massachusetts  
ESS Proposal No. 17835**

Dear Mr. Basler:

ESS Group, Inc. (ESS) is pleased to provide this non-price proposal to the Central Plymouth County Water District Commission (CPCWDC) in response to the *Request for Proposal – Silver Lake Water Quality Monitoring* (the Project). ESS has reviewed the Request for Proposal (RFP) and examined the prior study documentation to develop a better understanding of the lake and the CPCWDC's needs for this Project. In reviewing our proposal, you will find the following advantages that set us apart from the competition:

**Prior Experience at Silver Lake.** ESS completed the 2004 study of water and sediment quality of Silver Lake for the Jones River Watershed Association for the purposes of understanding the nutrient loading dynamics of this critical freshwater resource. This study was authored by Mr. Carl Nielsen, who will advise our Project Team and provide a unique perspective on changes that the lake since the time of that study. This will allow ESS to hit the ground running and provide useful insights from the beginning of the Project.

**The Right Mix of In-House Expertise for this Specific Project.** ESS's core project team consists of two Certified Lake Managers with skill in watershed assessments and lake management plan development, a PhD lake modeler, a highly experienced hydrogeologist, and a GIS programmer who specializes in the presentation and sharing of environmental data. Each of these core staff have successfully executed projects with other Massachusetts municipalities, large public water supply companies, NGOs, and state agencies that are very similar to that described in the RFP.

**Proven Ability to Generate Public Support for Lake and Watershed Management Programs.** ESS understands the need to build our approach for each project with the community in mind. Ultimately, public involvement and consensus-building are what turn studies and plans into successful programs that achieve real sustainable management goals. Our project portfolio demonstrates our success in building this broad support for projects with municipal and NGO clients through public outreach and integration of public input into final deliverables.

ESS confirms that we are submitting this proposal in accordance with the requirements of the RFP and that we understand all sections and provisions. Thank you for the opportunity to submit this response. Please do not hesitate to contact me at (401) 330-1204 or [mladewig@essgroup.com](mailto:mladewig@essgroup.com) with any questions.

Sincerely,

**ESS GROUP, INC.**

Matt Ladewig, CLM  
Senior Scientist  
Attachments





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- Attachment A - Required Forms
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- Attachment C - Key Personnel Resumes
- Attachment D - Organizational Chart





## INTRODUCTION

ESS Group, Inc. (ESS) has developed this proposal to provide the Central Plymouth County Water District Commission (CPCWDC) with a detailed description of our capabilities, experience, and technical approach to executing the requested Scope of Services for the Silver Lake Water Quality Monitoring (the Project).

### Contents of the Proposal

Our proposal is organized to clearly address each item in the CPCWDC’s Request For Proposal (RFP), dated May 7, 2021. In accordance with the RFP, we have included the following elements in our proposal to cover the Statement of Qualifications:

Required Element	Proposal Location or Section Title
Previous Experience with Water Quality Monitoring Projects	<ul style="list-style-type: none"> <li>• <i>About ESS Group, Inc</i></li> <li>• <i>Relevant Experience</i></li> <li>• <i>Project Team</i></li> <li>• <i>Technical Qualifications</i></li> <li>• <i>Resumes of Key Personnel (Attachment C)</i></li> </ul>
Adherence to Standardized Procedures & QA/QC	<ul style="list-style-type: none"> <li>• <i>About ESS Group, Inc.</i></li> <li>• <i>Relevant Experience</i></li> <li>• <i>Scope of Services</i></li> <li>• <i>Resumes of Key Personnel (Attachment C)</i></li> </ul>
Previous Experience with Provision of Data	<ul style="list-style-type: none"> <li>• <i>Relevant Experience</i></li> <li>• <i>Scope of Services</i></li> <li>• <i>Resumes of Key Personnel (Attachment C)</i></li> </ul>
Resumes of Key Employees	<ul style="list-style-type: none"> <li>• <i>Resumes of Key Personnel (Attachment C)</i></li> </ul>
Five (5) References	<ul style="list-style-type: none"> <li>• <i>References</i></li> </ul>
Narrative of Bidder’s Qualifications	<ul style="list-style-type: none"> <li>• <i>About ESS Group, Inc</i></li> <li>• <i>Relevant Experience</i></li> <li>• <i>Project Team</i></li> <li>• <i>Technical Qualifications</i></li> <li>• <i>Resumes of Key Personnel (Attachment C)</i></li> </ul>
Company Profile or Organizational Chart	<ul style="list-style-type: none"> <li>• <i>About ESS Group, Inc.</i></li> <li>• <i>Organizational Chart (Attachment D)</i></li> </ul>
Proposed Subcontractors	<ul style="list-style-type: none"> <li>• <i>Project Team</i></li> </ul>
Conflict Check	<ul style="list-style-type: none"> <li>• <i>Conflict Check</i></li> </ul>

The Required Forms and ESS Certificate of Insurance are provided in Appendices A and B, respectively. The Project Cost is provided under separate cover.







## ABOUT ESS GROUP, INC.

ESS is a full-service environmental consulting and engineering firm operating from two locations in southern New England, including our **Waltham, Massachusetts** and **East Providence, Rhode Island** offices. Our team of more than 30 staff, including lake managers, ecologists, biologists, geologists, regulatory specialists, and engineers excels at conducting accurate analyses and developing solutions to water quality issues that will provide both immediate results and holistic, long-term success. We have successfully designed and implemented hundreds of water quality monitoring and lake management programs for municipalities, non-governmental organizations, water suppliers, state agencies, and private clients over the course of our more than 20 years in business.

For this project, ESS envisions the need for a range of scientific expertise. The team assembled for this project has been involved with all aspects of lake and watershed management, from lake and pond diagnostic and feasibility studies to stormwater and septic impact assessments, groundwater investigations, lake and watershed modeling, and public education and outreach. ESS specializes in lake and watershed assessment and management and routinely designs, permits, and oversees lake restoration projects of all kinds. As such, our firm is fully prepared to assist you in addressing each of the key elements included in the RFP.

We believe the following advantages stand out as key reasons to select ESS to ensure the ultimate success of this project.

### **1. Prior Experience at Silver Lake**

ESS completed the 2004 study of water and sediment quality of Silver Lake for the Jones River Watershed Association for the purposes of understanding the nutrient loading dynamics of this critical freshwater resource. This study of Silver Lake consisted of five key components: (1) reviewing existing data, maps, and reports; (2) attempting to identify likely sources of pollution to the lake from its watershed; (3) sampling water from in lake, tributaries and its outlet to determine water quality characteristics; (4) sampling bottom sediment to determine its nutrient content and potential to impact water quality; and (5) assessing the hydrologic (water flow) and nutrient (phosphorus and nitrogen) loading to the lake. This study was authored by Mr. Carl Nielsen, who will advise our Project Team and can provide a unique perspective on changes that the lake has experienced since the time of that study. This will allow ESS to hit the ground running and provide useful insights from the beginning of the Project.

### **2. The Right Mix of In-house Expertise for this Specific Project**

ESS's core project team consists of two Certified Lake Managers (CLM's) with skill in watershed assessments and lake management plan development, a PhD lake modeler, a hydrogeologist, and a GIS programmer who specializes in the presentation and sharing of environmental data. Each of these core staff have successfully executed projects with other Massachusetts water suppliers, municipalities, NGOs, and state agencies that are very similar to that described in the RFP.

### **3. Proven Ability to Generate Public Support for Lake and Watershed Management Programs**

ESS understands the need to build our approach for each project with the community in mind. Ultimately, public interest and buy-in is what turns studies and plans into successful programs that achieve real management goals. Our project portfolio demonstrates our success in building this broad support for projects with municipal and non-government organizations (NGO) clients through public outreach and integration of public input into final deliverables.



A summary of our response to the evaluation criteria identified in this RFP is presented in the table below. Additional details on how we meet or exceed each of the evaluation criteria are provided in the sections cross-referenced by this table.

### Response to Comparative Evaluation Criteria

Criteria	Response	Cross Reference Section
1. Prior Similar Contract Experience	<p><i>Responder has successfully completed, within the past five years (5), more than three (3) service contracts that are similar in size and scope to this Project.</i></p> <ul style="list-style-type: none"> <li>• Seven project examples are provided.</li> <li>• Lake/reservoir and watershed assessments and management plans are a primary focus of the work we do at ESS.</li> <li>• Our firm can demonstrate a wealth of experience in Massachusetts, including far more than five projects of similar size and scope.</li> <li>• Most of our projects are completed for water suppliers, municipalities, state and federal agencies and NGOs.</li> </ul>	Relevant Experience
2. Past Performance on Public and Private Contracts	<p><i>Responder has not received a judgment against it by a court of competent jurisdiction regarding any public or private contract in the last five (5) years.</i></p> <ul style="list-style-type: none"> <li>• ESS has extensive experience and successful performance of projects contracted with multiple municipalities, public water supply companies, state and federal agencies and NGOs.</li> <li>• Performance with similar projects in Massachusetts (or New England) on similar size and scope. ESS demonstrates a wealth of experience including far more than five (5) projects of similar size and scope.</li> <li>• Lake/reservoir and watershed assessments and management plans are a primary focus of the work we do at ESS.</li> <li>• ESS expects that positive comments will be received by CPCWDC from the references provided herein for similar projects.</li> </ul>	Relevant Experience
3. Interview	<p><i>Responder has provided an outstanding interview, clearly articulate, and clearly has sufficient resources to complete the project.</i></p> <ul style="list-style-type: none"> <li>• ESS will be prepared for the Interview and has significant experience interviewing for these types of projects.</li> </ul>	N/A

Criteria	Response	Cross Reference Section
<p>4. Qualifications of Responder and Assigned Personnel</p>	<p><i>Responder has identified adequate staffing and consultants to support the proposed work plan, has documented extensive experience with similar projects by all key staff, and has documented that most key staff (in-house and consultants) have worked together as a team on previous projects.</i></p> <ul style="list-style-type: none"> <li>• The ESS Team has extensive experience preparing SAPs and QAPPs for projects of similar size and performing field work in accordance with ESS-developed SOPs.</li> <li>• The assigned Project Personnel have extensive experience with QA/QC procedures for all aspects for this Project.</li> <li>• ESS has provided detailed descriptions of more than five (5) successful comparable projects. Select examples of our deliverable quality for municipal clients are publicly available at the following links. We can provide additional examples upon request:</li> <li>• Plymouth (multiple deliverables) <ul style="list-style-type: none"> <li><a href="https://www.plymouth-ma.gov/sites/g/files/vyhlf3691f/uploads/draft_bartlett_pond_diagnostic_report_and_management_plan_rev022620.pdf">https://www.plymouth-ma.gov/sites/g/files/vyhlf3691f/uploads/draft_bartlett_pond_diagnostic_report_and_management_plan_rev022620.pdf</a></li> </ul> </li> <li>• Concord <ul style="list-style-type: none"> <li><a href="https://concordma.gov/740/White-Pond-Watershed-Management-Plan">https://concordma.gov/740/White-Pond-Watershed-Management-Plan</a></li> </ul> </li> <li>• Westford <ul style="list-style-type: none"> <li><a href="https://westfordma.gov/DocumentCenter/View/554/New-Lake-and-Ponds-Study-PDF?bidId=">https://westfordma.gov/DocumentCenter/View/554/New-Lake-and-Ponds-Study-PDF?bidId=</a></li> </ul> </li> <li>• Norton <ul style="list-style-type: none"> <li><a href="https://www.nortonma.org/sites/g/files/vyhlf3606f/uploads/2020_lakes_and_ponds_annual_report.pdf">https://www.nortonma.org/sites/g/files/vyhlf3606f/uploads/2020_lakes_and_ponds_annual_report.pdf</a></li> </ul> </li> <li>• ESS is also approved by University of Maine System to provide SAPs and QAPPs through the Technical Assistance for Southeast New England Program Network (SNEP): Watershed Management, Stormwater Management and Restoration Efforts</li> </ul>	<p><i>Relevant Experience</i></p> <p><i>Also see links at left</i></p>

<p>5. Ability to Complete the Project on Time</p>	<p><i>Responder has submitted extremely detailed work plan and timelines and has provided three (3) references that confirm a successful track record for completing similar projects both on time and within budget.</i></p> <ul style="list-style-type: none"> <li>• ESS is of the opinion that we have provided an extremely detailed scope and timeline.</li> <li>• ESS has provided six (6) references that should confirm a successful track record for completing similar projects both on time and within budget.</li> <li>• ESS is able to begin this Project immediately upon execution of a contract.</li> <li>• Our Project schedule indicates completion of tasks within the timelines established in the RFP.</li> <li>• ESS has established timelines and work plans that demonstrate how the Project can be completed in the timeframe requested.</li> </ul>	<p><i>References</i></p> <p><i>Schedule</i></p>
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## RELEVANT EXPERIENCE

ESS has extensive experience in working on water quality and eutrophication issues in Massachusetts and throughout southern New England and has completed several watershed assessment, modeling and management plans for over the last two decades. Clients view our collective integration of a wide array of technical disciplines as a convenient and cost-effective solution for their environmental assessment and restoration needs. In this section, we highlight selected recent or current projects that are relevant to the requested Scope of Services.

### Featured Projects

#### Bartlett Pond Watershed Assessment and Management Plan – Plymouth, MA

After suffering a cyanobacteria bloom and high bacteria indicator counts in 2018, the Town of Plymouth commissioned a comprehensive study of 30-acre Bartlett Pond and its much larger watershed to assess and address the many management issues facing the pond. Although existing data were limited, the presence of various risk factors implied a high likelihood of multiple important sources of nutrients and bacteria. Additionally, the geographic setting of the pond suggested the potential for complex interactions between fresh and saltwater influence, surface, and groundwater inputs, aquatic macrophytes and algae, and external and internal loading, each combination of which could yield different environmental consequences for the pond, beach, and community. ESS addressed these issues by providing the Town with a custom-tailored program of detailed data collection and analysis, including physical, biological, water quality, and sediment quality components. Additionally, at the request of the Town, ESS sampled for emerging contaminants, including PFAS.



The data from these study components were used to develop a customized one-dimensional model of in-pond water quality and biological response over time. In turn, this model and the watershed source tracking results were used to develop a management and implementation plan that included prioritized mechanical, chemical, biological, and policy-based lake, and watershed management recommendations. ESS introduced the project to the public at an initial kick-off presentation and solicited input from the community. A mid-point and final project presentation were also delivered to the public to keep the community informed of progress and the ultimate results of the study.

<p>Date: 2019 - 2020          Cost: \$175K          ESS Group Personnel on the Project:          Matt Ladewig, Jeff Hershberger, Anna Chase,          Scott DeHainaut, BEC (Dr. Keith Pilgrim)</p>	<p>Client Contact Info:          David Gould, Director          Department of Marine and Environmental Affairs          Town of Plymouth          (508) 747-1620 x10134          dgould@townhall.plymouth.ma.us</p>
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### Providence Water Supply Board – Limnological Study of Scituate Reservoir – Scituate, RI

ESS is supporting Providence Water, a nationally top-rated water supplier, in assessing its water supply and developing plans to maintain its excellent water quality. This includes undertaking the first comprehensive study to assess the limnological characteristics of the Scituate Reservoir, the primary water supply for Providence Water, in its 100-year history. Since 2007, ESS has supported Providence Water in its efforts to conserve its primary water supply, the Scituate Reservoir, which is the largest fresh waterbody in Rhode Island.



For this multi-year study, ESS monitored how the system responds to daily and seasonal changes in weather, storm inputs, and algal community production by using a real-time data collection buoy—the first application of its kind in Rhode Island inland waters. ESS also monitored the water quality in numerous ungagged tributaries that flow to the reservoir using water level data loggers to assess each location’s stream stage and flow. To create a customized, accurate model of the hydrologic and nutrient budget for the reservoir, ESS also



measured the quantity and quality of groundwater movement into the reservoir. This information, in tandem with Providence Water’s management goals, was used to develop the reservoir’s Long-term Management Plan. This plan is being used to help prioritize management actions and guide Providence Water in maintaining or improving water quality.

The baseline conditions that ESS collected and analyzed serve as a valuable contextual tool for Providence Water to evaluate future water quality monitoring data and assess trends in water quality from watershed development pressure, climate change, and other long-term factors. In addition to conserving this important resource, protecting the water quality within this critical water supply saves ratepayer money by reducing treatment costs.

<p>Date: Scituate Reservoir Assessment Completed 2019          Other Reservoir Projects On-going          Cost: ~\$300K for Scituate Reservoir          ESS Group Personnel on the Project:          Matt Ladewig, Carl Nielsen, Jeff Hershberger,          Anna Chase, Scott DeHainaut</p>	<p>Client Contact Info:          Rich Blodgett, Environmental Resources Manager          Providence Water          (401) 521-6300 x7316          rblodgett@provwater.com</p>
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**White Pond Watershed Management Plan – Concord, MA**

ESS developed a comprehensive biological, groundwater, surface water and sediment sampling program at White Pond, a sensitive kettlehole pond and community resource with recurring algae blooms and declining long-term water quality trends. This included development of a MassDEP and EPA-approved Quality Assurance Project Plan (QAPP) to ensure collection of high-quality data. The results from these efforts were used to develop nutrient and hydrologic budgets and complete a watershed management plan with prioritized short- and long-term recommendations. Recommendations included integrated in-pond, shoreline, and watershed management actions and also addressed recreational usage of Town-owned lands to minimize inputs of sediment and nutrients. Additionally, ESS developed and provided public outreach and education materials specific to White Pond. The watershed management plan was presented at two public meetings and public comments were incorporated into the final project report. Recommendations from the watershed management plan, including nature-based stormwater and erosion controls, have been successfully implemented.



<p>Date: 2016</p> <p>Cost: ~\$100K</p> <p>ESS Group Personnel on the Project:          Matt Ladewig, Carl Nielsen, Jeff Hershberger,          Anna Chase, Scott DeHainaut</p>	<p>Client Contact Info:          Delia Kaye, Natural Resources Director          Concord Division of Natural Resources          978.318.3285          dkaye@concordma.gov</p>
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**Massachusetts Water Resources Authority – Monitoring of Ten Source and Emergency Reservoirs – Statewide, MA**

Since 2010, ESS has provided monitoring and management support for ten MWRA/DCR Source and Emergency Reservoirs. These reservoirs serve communities in Metropolitan Boston, MetroWest, and the Chicopee Valley, and are monitored for exotic aquatic plants (macrophytes) that could grow to nuisance levels in these water supplies.



The reservoir monitoring program managed by ESS Certified Lake Managers includes field surveys, plant mapping, bathymetric measurement, water quality data collection, and risk assessment. Our lake and water resources scientists coordinate with MWRA and DCR to conduct safe, efficient surveys at each reservoir during periods of maximum plant development. ESS scientists then evaluate annual changes in water quality and aquatic macrophyte beds and provide specific management recommendations for each reservoir. ESS also provides MWRA and DCR with a forward-looking assessment of new exotic species and the potential influence of climate change on aquatic macrophyte growth patterns and distributions in the reservoir system.

With support from ESS, the continued implementation of this expanded monitoring program is helping to manage, control, and/or prevent the threat of aquatic invasive species over this wide geographic area. Through our ongoing experience with each reservoir’s specific conditions, ESS provides project continuity and assurance that recommendations are based on environmental changes, rather than sampling or personnel inconsistencies.

<p>Date: On-going on annual basis          Cost: ~\$80K/year          ESS Group Personnel on the Project:          Matt Ladewig, Carl Nielsen, Anna Chase, Scott DeHainaut</p>	<p>Client Contact Info:          Massachusetts Water Resources Authority          John Gregoire          Program Manager, Reservoir Operations          (508) 424-3608  <a href="mailto:john.gregoire@mwra.com">john.gregoire@mwra.com</a></p>
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### Lost Lake Watershed Management Plan – Groton, MA

ESS assisted the Town of Groton and Groton Lakes Association in evaluating Lost Lake/Knops Pond and developing a long-term management plan for its preservation. ESS first developed a Sampling and Analysis Plan (SAP) to guide the collection of high-quality field data and provide the client with protocols for conducting monitoring work on an ongoing basis. To support this work, ESS also provided a QAPP. ESS then conducted field investigations of the lake and its watershed, including aquatic plant mapping, groundwater sampling, and surface water monitoring. At the conclusion of the project, ESS provided the project partners with final recommendations as part of the long-term management plan report. Additionally, ESS developed and provided public outreach and education materials.

<p><b>Overview</b></p> <p>Lost Lake and Knops Pond provide a home for wildlife and recreational opportunities for residents and visitors. Unfortunately, living near a lake can negatively impact the waterbody. Runoff from roads, use of fertilizers on lawns and gardens, and poor animal waste management can increase nutrients (phosphorus and nitrogen) and other pollutants in stormwater runoff that flows to the pond. Excessive nutrient levels can lead to nuisance plant and algae growth, and decrease the quality of wildlife habitat and recreational use. In addition, boats brought in from other waterbodies can introduce exotic and invasive species to Lost Lake and Knops Pond. Invasive species can overtake native plants and grow to nuisance levels that are detrimental to both recreation and wildlife.</p> <p><b>Watershed Preservation</b></p> <p>If you live within or visit the Lost Lake watershed, your actions can affect its water quality. A watershed is all the land that drains into a waterbody or into the streams that feed the waterbody. Anything within the watershed that can be transported by the water will eventually find its way into the pond. Even if you don't live near the shore, your daily actions (e.g., lawn care, pet walking, yard waste disposal, car washing, etc.) may contribute to the degradation of the water quality in Lost Lake and Knops Pond.</p> <p>Not sure if you live within the Lost Lake watershed? Check out the map on the back of this brochure.</p>	<p><b>Problematic Plants: Identifying Invasives</b></p> <table border="0"> <tr> <td> <p><b>Variable-leaf Milfoil (<i>Myriophyllum heterophyllum</i>)</b></p> <ul style="list-style-type: none"> <li>• Finely dissected, feathery leaves</li> <li>• Leaves are in whorls of four to six around the stem</li> <li>• Stems are pale pink to reddish-brown</li> <li>• Flowers appear above water on spikes that are several inches long</li> </ul> </td> <td> <p><b>Curly-leaf Pondweed (<i>Potamogeton crispus</i>)</b></p> <ul style="list-style-type: none"> <li>• Leaves are oblong, rounded at apex</li> <li>• Leaves are both wavy and serrated along the edges</li> <li>• Fine cone-shaped tubercles may be present at the leaf axils</li> <li>• Leaves do not clasp stem</li> </ul> </td> </tr> <tr> <td> <p><b>Eurasian milfoil (<i>Myriophyllum spicatum</i>)</b></p> <ul style="list-style-type: none"> <li>• Feather-like leaves; blunt-ended as if cut by scissors</li> <li>• Leaves are in whorls of four around the stem</li> <li>• Stems are pale pink to reddish-brown</li> <li>• Tiny, reddish flowers appear above water on spikes that are several inches long</li> </ul> </td> <td> <p><b>Water Chestnut (<i>Trapa natans</i>)</b></p> <ul style="list-style-type: none"> <li>• Floating leaves characterized by rosettes of shiny toothed leaves with swollen, air-filled petioles</li> <li>• Submerged leaves are finely divided and whorled around the stem</li> <li>• Floating seeds are four-barbed and large</li> </ul> </td> </tr> <tr> <td> <p><b>Fanwort (<i>Cabomba caroliniana</i>)</b></p> <ul style="list-style-type: none"> <li>• Finely dissected, fanlike leaves</li> <li>• Leaves arranged oppositely on submerged stems</li> <li>• Small, white flowers with small floating leaves emerge in late summer</li> </ul> </td> <td> <p><b>Brittle Naiad (<i>Najas minor</i>)</b></p> <ul style="list-style-type: none"> <li>• Narrow, opposite leaves with prominent spines along each edge</li> <li>• Spines are small but clearly visible with the naked eye</li> <li>• Stems are extensively branched and fragment easily</li> </ul> </td> </tr> </table> <p><small>Photos credit: Jeremy Ripman, D.A., Daniel C. Simon, and Ryan Robinson, 2017. <i>Myriophyllum spicatum</i>; U.S. Geological Survey, <i>Nonindigenous Aquatic Species Database</i>, <a href="https://nas.erdc.gov/species/nasweb/SpeciesDetails.asp?SpeciesID=1199">https://nas.erdc.gov/species/nasweb/SpeciesDetails.asp?SpeciesID=1199</a>, accessed June 03/2021. All other drawings: USDA-NRCS/NARS Database / USDA NRCS, accessed June 03/2021. <i>Illustrated guide to plant species</i>.</small></p>	<p><b>Variable-leaf Milfoil (<i>Myriophyllum heterophyllum</i>)</b></p> <ul style="list-style-type: none"> <li>• Finely dissected, feathery leaves</li> <li>• Leaves are in whorls of four to six around the stem</li> <li>• Stems are pale pink to reddish-brown</li> <li>• Flowers appear above water on spikes that are several inches long</li> </ul>	<p><b>Curly-leaf Pondweed (<i>Potamogeton crispus</i>)</b></p> <ul style="list-style-type: none"> <li>• Leaves are oblong, rounded at apex</li> <li>• Leaves are both wavy and serrated along the edges</li> <li>• Fine cone-shaped tubercles may be present at the leaf axils</li> <li>• Leaves do not clasp stem</li> </ul>	<p><b>Eurasian milfoil (<i>Myriophyllum spicatum</i>)</b></p> <ul style="list-style-type: none"> <li>• Feather-like leaves; blunt-ended as if cut by scissors</li> <li>• Leaves are in whorls of four around the stem</li> <li>• Stems are pale pink to reddish-brown</li> <li>• Tiny, reddish flowers appear above water on spikes that are several inches long</li> </ul>	<p><b>Water Chestnut (<i>Trapa natans</i>)</b></p> <ul style="list-style-type: none"> <li>• Floating leaves characterized by rosettes of shiny toothed leaves with swollen, air-filled petioles</li> <li>• Submerged leaves are finely divided and whorled around the stem</li> <li>• Floating seeds are four-barbed and large</li> </ul>	<p><b>Fanwort (<i>Cabomba caroliniana</i>)</b></p> <ul style="list-style-type: none"> <li>• Finely dissected, fanlike leaves</li> <li>• Leaves arranged oppositely on submerged stems</li> <li>• Small, white flowers with small floating leaves emerge in late summer</li> </ul>	<p><b>Brittle Naiad (<i>Najas minor</i>)</b></p> <ul style="list-style-type: none"> <li>• Narrow, opposite leaves with prominent spines along each edge</li> <li>• Spines are small but clearly visible with the naked eye</li> <li>• Stems are extensively branched and fragment easily</li> </ul>
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<p>Date: 2017</p> <p>Cost: ~\$35,000</p> <p>ESS Group Personnel on the Project: Carl Nielsen, Anna Chase, Scott DeHainaut</p>	<p>Client Contact Info: Art Prest 8 Weymisset Road Groton, MA 01450 Telephone: 978-448-2384 Mobile: 240-401-5240 Email: <a href="mailto:aprest@verizon.net">aprest@verizon.net</a>; <a href="mailto:prest@prest.biz">prest@prest.biz</a></p>
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### **Pawtuxet River Authority – Fish Passage Feasibility Study for Blackamore and Cranberry Ponds – Cranston and Warwick, RI**

ESS assisted the Pawtuxet River Authority with a SNEP grant-funded assessment of Blackamore and Cranberry Ponds and their outlet streams, with a focus on their ability to support anadromous fish passage and spawning habitat. ESS first developed a QAPP to ensure that all primary and secondary environmental data collected or used to support the project were sufficient to meet data quality objectives. The QAPP was submitted to EPA and approved quickly after addressing one comment. ESS then completed a desktop- and field-based program to identify existing fish passage barriers and habitat conditions in each system. Finally, ESS developed restoration and management options, with cost estimates, for improvements to each of the two systems. This study and subsequent restoration efforts will support the larger goal of improving habitat connectivity and fish passage within the greater Pawtuxet River system.



<p>Date: 2017</p> <p>Cost: \$10K</p> <p>ESS Group Personnel on the Project: Matt Ladewig, Carl Nielsen</p>	<p>Client Contact Info: Robert Nero, Chairman Pawtuxet River Authority 401.615.7039 pra@pawtuxet.org</p>
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**Town of Weymouth – Whitman’s Pond Vegetation Management Action Plan – Weymouth, MA**

ESS developed a comprehensive Vegetation Management Action Plan for the Whitman’s Pond Working Group. This town-appointed committee was charged with identifying a restoration strategy for the 190-acre pond to address the pond’s problems while being protective of the multiple resources it provides to a diverse group of stakeholders.



In addition to serving as a backup water supply for the town, this coastal pond is a major herring spawning resource and vegetation management activities needed to be compatible with protection of the spawning habitat throughout the pond. Thus, ESS conducted an extensive fishery habitat impact and improvement analysis for the pond. ESS also coordinated with the MA Division of Marine Fisheries and attended multiple meetings with town officials and committee members. The final five-year action plan was presented at a public meeting.

ESS later worked with the Town to update and refine the Whitman’s Pond Management Strategy for the next five year period. All data were collected under a US EPA-approved QAPP.

<p>Date: 2013 (Original Plan) and On-going (Strategy)          Cost: ~\$50K          ESS Group Personnel on the Project:          Matt Ladewig, Carl Nielsen, Scott DeHainaut</p>	<p>Client Contact Info:          Mary Ellen Schloss - Conservation Administrator          Town of Weymouth -Conservation Commission          781.682.3658  <a href="mailto:mschloss@weymouth.ma.us">mschloss@weymouth.ma.us</a></p>
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### Other Recent/Relevant Projects

The matrix below provides a summary of some additional recent and representative water resources project examples from southern New England.

Project Name	Client	GIS Mapping & Database	Diagnostic/Feasibility Study	Invasive Species Surveys & Management	Hydrologic Analysis & Modeling	Sediment Surveys & Management	Stormwater Management & Design	Ecosystem Restoration Planning & Design	Design & Permitting	Stakeholder Outreach & Education
<b>Barden Reservoir Diagnostic / Feasibility Assessment</b> Foster, RI	Providence Water Supply Board	●	●	●	●	●	●			●
<b>Bartlett Pond Watershed Assessment and Management Plan</b> Plymouth, MA	Town of Plymouth	●	●					●	●	●
<b>Cornell Pond Dam Feasibility Study</b> Dartmouth, MA	Town of Dartmouth	●	●	●	●	●		●	●	●
<b>Flowering Pond Restoration Plan</b> Newburyport, MA	MassDCR Lakes & Ponds	●	●		●	●	●	●	●	
<b>Lake Wickaboag Diagnostic / Feasibility Stormwater Management Design</b> West Brookfield, MA	Town of West Brookfield Storm Water Authority	●	●	●	●	●	●	●	●	●
<b>Lake Wyola Beach Replacement</b> Shutesbury, MA	MassDCR Lakes & Ponds					●	●		●	
<b>Lily Pond Diagnostic / Feasibility Assessment</b> Newport, RI	Friends of Lily Pond	●	●	●	●	●	●	●	●	
<b>Memorial Pond Restoration Project</b> Walpole, MA	Town of Walpole	●				●	●	●	●	●
<b>Mill Pond and Brook Watershed Assessments</b> West Tisbury, MA	Town of West Tisbury	●	●	●	●	●		●		●
<b>Moswansicut Reservoir Diagnostic/Feasibility Assessment and Alum Treatment</b> Scituate, RI	Providence Water Supply Board	●	●	●	●	●	●	●	●	●
<b>Norton Lakes and Ponds Vegetation Management Plan and Program Implementation</b>	Town of Norton	●	●	●	●			●	●	●





Project Name	Client	GIS Mapping & Database	Diagnostic/Feasibility Study	Invasive Species Surveys & Management	Hydrologic Analysis & Modeling	Sediment Surveys & Management	Stormwater Management & Design	Ecosystem Restoration Planning & Design	Design & Permitting	Stakeholder Outreach & Education
<b>Ponaganset Reservoir Diagnostic / Feasibility Assessment</b> Glocester, RI	Providence Water Supply Board	●	●	●	●	●	●			●
<b>Warner’s Pond Dredge Design &amp; Permitting</b> Concord, MA	Town of Concord	●		●		●		●	●	●
<b>Westford Ponds Nutrient Budgets, Management Plans, and Monitoring</b> Westford, MA	Town of Westford	●	●	●	●			●	●	●
<b>White Pond Watershed Management Plan</b> Concord, MA	Town of Concord	●	●			●	●	●		●
<b>Whitehall Reservoir Restoration Project</b> Hopkinton, MA	DCR Lakes & Ponds	●	●	●				●	●	
<b>Whitman’s Pond Vegetation Management Action Plan and Final Management Strategy</b> Weymouth, MA	Town of Weymouth	●	●	●	●	●		●		●



## PROJECT TEAM

ESS's proposed project team consists of highly qualified personnel with significant local experience in lake management and watershed science. The key personnel identified to provide these services for the CPCWDC are listed below. Detailed resumes for each are provided in Attachment C. Please note that ESS also has multiple additional qualified technical and support staff to help complete this project in a timely and cost-effective manner. Their resumes are available upon request. An Organizational Chart of the ESS Team and subcontractors is provided in Attachment D.

**Matt Ladewig, CLM – Project Manager and Senior Scientist:** Mr. Ladewig is a Certified Lake Manager and ecologist with more than 18 years of experience in the monitoring, modeling, and management of aquatic ecosystems. He has completed studies on over 80 lakes and ponds for a variety of clients, including water suppliers, state and municipal governments, lake associations, and private landowners. Mr. Ladewig has also developed and implemented numerous surface water sampling, sediment testing, and biomonitoring programs for a wide variety of water resource projects. He has developed public education and outreach materials related to lake and watershed management for multiple municipalities and state agencies. Additionally, Mr. Ladewig regularly trains others in the collection and interpretation of high quality water resources data.

On this project, Mr. Ladewig will serve as the Project Manager and primary point of contact. He will also develop prioritized recommendations for management actions and oversee creation of project deliverables.

**Carl Nielsen, CLM –Principal Limnologist:** Mr. Nielsen has over 30 years of experience in the assessment and evaluation of lake and pond ecosystems. He is a Certified Lake Manager and has worked extensively in identifying and understanding the ecology of most aquatic organisms including aquatic plants, algae, zooplankton, aquatic invertebrates, fish, reptiles, and amphibians. By understanding the ecological needs of an aquatic system, Mr. Nielsen is able to tailor management recommendations and mitigation strategies that are appropriate and help to develop community consensus. Mr. Nielsen is actively involved in the restoration of aquatic systems and has worked to improve water quality and aquatic habitat conditions in numerous lake and river systems throughout New England. As part of these efforts, Mr. Nielsen regularly uses water quality data collected to develop customized scientific watershed models to assist in locating sources of pollution and to evaluate the potential effectiveness of a variety of watershed management strategies including storm water improvements, sewerage, dredging, sediment management, or other alternative approaches.

On this project, Mr. Nielsen will serve as Principal Limnologist, providing expert technical guidance on project design and senior technical review of project deliverables. Mr. Nielsen led the 2004 assessment of Silver Lake and will be able to provide unique insights and perspectives into how the lake has changed over more than two decades.

**Jeff Hershberger, PG – Senior Hydrogeologist:** Mr. Hershberger is a Senior Hydrogeologist with over 30 years of environmental consulting experience focusing on the assessment of impacts to soil, sediment, and groundwater resources, hydrogeologic investigations, and water supply feasibility evaluations, permitting and development. His experience emphasizes evaluation and quantification of hydrogeologic processes as related to groundwater flow and contaminant transport, aquifer remediation, aquifer yield, capture zone modeling for remedial design and wellhead protection, analysis of the fate and transport of contaminants in the subsurface and within freshwater and marine environments, assessment of natural degradation of contaminants and development of conceptual site models of hydrogeology and

contaminant fate and distribution. Mr. Hershberger has significant experience at CERCLA NPL sites as the technical lead or project manager for the Remedial Investigation/Feasibility Study (RI/FS), Pre-Design and Remedial Design/Remedial Action Implementation (RD/RA) work phases at sites throughout New England. Project management experience also includes site investigations and feasibility evaluations under various state regulations, complex field investigation and sampling programs, and water supply development and groundwater resource assessments.

On this project, Mr. Hershberger will serve as Senior Hydrogeologist and will be the technical lead for assessment of groundwater resources and contaminant pathways at Silver Lake.

**Scott DeHainaut – Senior Data Manager:** Scott DeHainaut is a recognized expert in GIS with more than 30 years of diverse training and experience in geospatial data management, analysis, and system design. This includes more than a decade developing GIS and data management systems at the municipal and county levels, and almost two decades supporting the use of GIS for environmental restoration and management. Mr. DeHainaut's expertise has an emphasis on ESRI applications and includes advanced spatial analysis, database management, GIS/CAD integration, visual impact assessments and simulations, and multimedia graphics presentations. Additionally, he brings experience in the development of client web portals and data collection using mobile platforms, as well as fluency in several programming languages which he leverages for data automation, integration, and analyses.

On this project, Mr. DeHainaut will serve as Senior Data Manager, setting up a robust data management system and he will also oversee overseeing GIS analysis and figure production.

**Anna Chase – Field Program Lead and Trainer:** Anna Chase holds an MS in Zoology and a BA in Biology and Environmental Studies with more than ten years of professional experience. Ms. Chase performs and oversees field work, assists with experimental design, conducts data analysis, visualization, and research, prepares technical reports, and assists with permitting actions. She is also an experience freshwater and marine taxonomist. In addition to developing and presenting training sessions to lake associations and homeowners, Ms. Chase also provides internal training of field crews at ESS. She has supported a variety of projects, including numerous lake and pond restoration projects, hydrologic and water quality monitoring, and marine surveys.

On this project, Ms. Chase will serve as Field Program Lead and Trainer, developing the SAP and coordinating the preparation of the QAPP. She will provide data analysis services and work with Mr. Ladewig and Dr. Pilgrim to develop the final project report.

**Keith Pilgrim, PhD – Senior Water Resources Modeler (BEC):** Given the specific needs of this project, ESS has elected to add Dr. Keith Pilgrim to complement our in-house team. Dr. Pilgrim is an experienced limnologist and modeler and has previously worked with ESS on municipal and water supplier projects in both Massachusetts and Rhode Island. His more than 20 years of experience have involved water quality modeling, development of innovative BMPs, nutrient management, hydrology, aquatic chemistry, and toxicology. Dr. Pilgrim is a member of the National Academies of Sciences National Cooperative Highway Research Program and also designs and implements surface-water-quality monitoring programs for urban environments.

On this project, Dr. Pilgrim will serve as Senior Modeler, coordinating the sediment phosphorus fractionation analytical effort, if this optional task is pursued, as well as developing and calibrating the models that will integrate hydrologic, physical, chemical, and biological components for Silver Lake.



## **Subcontractors**

ESS will also include subcontractors on our team for specialty services, as follows.

### **BEC – Modeling and Specialty Laboratory Services**

Dr. Keith Pilgrim of BEC Engineering and Geology, PC (BEC) will provide specialty modeling services to support the project. BEC will also provide specialty laboratory services on this Project, should the CPCWDC elect to have our team conduct phosphorus fractionation of sediment cores.

ESS has successfully worked with BEC to complete phosphorus fractionation analysis and/or modeling on multiple other projects in southern New England. In the past, Dr. Pilgrim has collaborated with ESS on site visits, collection of sediment cores, and presentations. This working relationship allows our team to work seamlessly in meeting client goals and timelines.

### **Analytical Laboratories – Laboratory Services**

ESS intends to use the following certified laboratories for the Project: Phoenix Environmental Laboratories (Phoenix) of Manchester, Connecticut and Alpha Analytical of Westborough, Massachusetts for water quality testing; Aquatic Analysts of Friday Harbor, Washington, and GreenWater Laboratories of Palatka, Florida.





## TECHNICAL QUALIFICATIONS

ESS has the in-house ability to manage and deliver a range of watershed science and engineering services to support the CPCWDC on this Project, including the following key services:



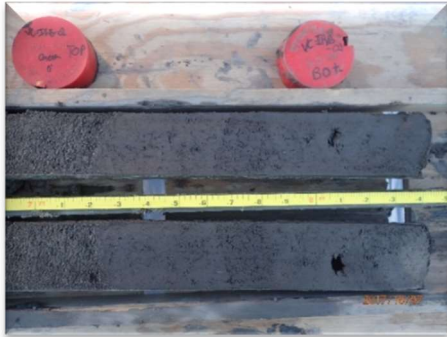
### Groundwater Input Collection & Analysis

The health of a waterbody is greatly influenced by the nutrient and chemical inputs that enter the waterbody through groundwater sources. These nutrients and chemicals commonly occur from sub-surface waste disposal (e.g., septic systems) as well as from fertilizers, yard and agriculture maintenance chemicals and fertilizers, and animal waste which can all be carried through the groundwater and enter lake/pond systems. These added inputs may lead to algae blooms and degraded water quality. Excess nutrient inputs often lead to high algal and plant growth which greatly diminishes the health of a waterbody. ESS can conduct a seepage survey and sampling of shallow interstitial porewater to measure the quantity and quality of groundwater entering Silver Lake along the immediate shorelines where groundwater infiltration is typically the highest and also most influenced by anthropogenic behaviors and activities. Additionally, ESS regularly oversees installation of and monitors water quality at groundwater wells for characterization and remediation purposes.



### Surface Water Input Collection & Analysis

Surface water can affect a waterbody's health through the nutrients and chemicals it carries during high stormwater runoff periods. During the first hour of a rain event the rainwater collects the highest concentration of nutrients and pollutants as it flows down the watershed and into the connected waterbodies. These nutrients and chemicals are found in the same sources and also include high concentrations of petrochemicals, nutrients from pet waste, soaps, and other anthropogenic contaminants. ESS routinely assesses stormwater during rain events to measure and quantify the inputs from streams and stormwater discharge pipes. ESS has also utilized specifically designed "first flush" samplers to identify the highly concentrated nutrients and chemicals being deposited into a pond from direct runoff during storm events. These can be installed in almost any location to characterize sheet or channelized surface flow from the watershed.



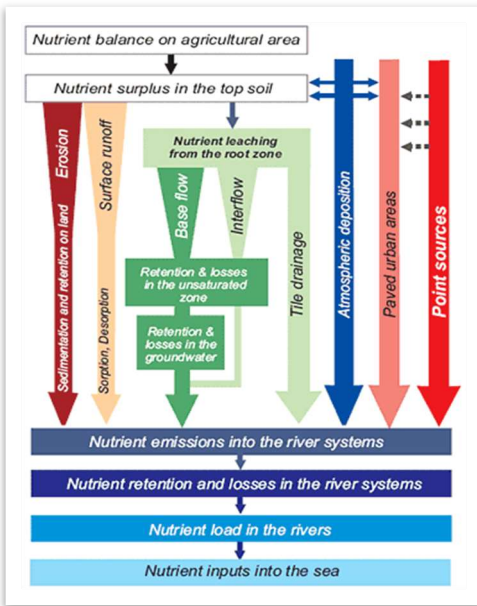
### Sediment Collection & Analysis

Collection and analysis of sediment samples are required to determine the likely impact of accumulated fine sediments on the quality of water within a pond. Each year, algal cells, bacteria, macrophytes, leaf fall, watershed inputs, and associated nutrients and contaminants sink to the lake/pond bottom where they accumulate. In many cases, nutrients and other pollutants may ultimately be released to the water column, a process known as internal recycling. ESS can commonly collect sediment samples from the lake/pond bottoms (depending on depth) to be analyzed for nutrient concentration and availability, as well as other contaminants of potential concern. This analysis will help us offer possible alternatives toward reducing pollutants in the lake/pond through sediment management approaches such as chemically binding nutrients (e.g., with alum), direct removal (dredging), or covering nutrient-rich sediment with clean sediment from deeper in the lake/pond (sediment layer inversion).



### Water Quality Testing

Understanding the physical and chemical composition of a waterbody is a key component to identifying issues threatening the health of the system. Physical parameters occurring throughout the water column such as pH, dissolved oxygen, temperature, specific conductance/salinity help identify watershed and internal contamination sources, as well as thermal or salinity-induced stratification that can affect dissolved oxygen and other chemical profiles in the lake/pond. Testing the chemical composition of a waterbody is needed to confirm the accuracy of nutrient models and leads to a more complete understanding of the system.

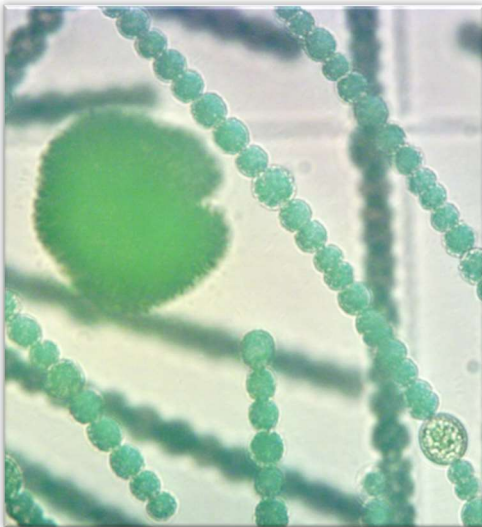


### Nutrient Modeling

Phosphorus and nitrogen are the two nutrients that most greatly influence the water quality of a pond system and can contribute to algal blooms and excessive plant growth. It is important when developing a nutrient budget model to characterize sources of these nutrients. Nutrients locked in the sediments, when present in sufficient quantities, may be released during anoxic conditions, and become available for nuisance or harmful algal blooms. The results from the groundwater and surface water input analysis, water quality testing, and sediment sampling can be used to calculate the hydrologic, phosphorus, and nitrogen budgets for Silver Lake. The nutrient modeling can be incorporated into the discussion of both short-term and long-term management alternatives and the potential benefits of each option toward improving the conditions in the lake.

### Algal Testing

Algal blooms are often an indication of an imbalance in nutrient levels of a given waterbody. Excess nutrients promote algal growth which can occur rapidly, often over the course of a few days. These algae rapidly grow and spread causing the water to turn to green and diminish the natural aesthetics of the waterbody. The extreme growth is followed by a mass of dead organic matter which utilizes large amounts of dissolved oxygen in the decay process. This process can deplete the oxygen levels in the waterbody leading to hypoxic conditions and fish kills or other problems. Cyanobacteria, otherwise known as blue-green algae, may produce toxins that are found to be harmful to human health, including neurotoxins, hepatotoxins, and others. ESS has the capability to sample and quantitatively assess the algal community in Silver Lake, and, if harmful bloom conditions are suspected, conduct an analysis of toxins produced through our lab partners.







### Biological Resources Assessment

Beyond the physical and chemical makeup of a waterbody, the biological community is an extremely valuable resource to be assessed. The aquatic plant and macroinvertebrate communities are key identifiers that can help explain and verify health issues in a watershed. ESS's in-house aquatic ecologists, wetlands scientists, and wildlife biologists can inventory the taxonomic composition and distribution of key biological communities at Silver Lake. ESS believes that aquatic macroinvertebrates in Silver Lake will also serve as a useful indicator of long-term water quality conditions and help improve our understanding of dissolved oxygen regimes in the reservoir. In turn, these will improve our ability to quantify nutrient sources and recommend the most appropriate management strategies for improving conditions.

## PROJECT UNDERSTANDING AND APPROACH

Based on the content of the RFP, the overall goals of the Project are:

1. Collect water quality data to help inform community management decisions to address water quality and quantity issues in Silver Lake and connected water bodies; and
2. Develop a baseline understanding of current water quality and continue to develop solutions-oriented relationships with BWS and the public.

Based on ESS's review of the RFP and associated available resources (Appendix 10 of RFP), ESS has identified the following important conditions and issues for the Project that will help to define our approach.

- Water and sediment quality data in Silver Lake, a designated Class A waterbody and Outstanding Resource Water (ORW) by MassDEP (2017), appears limited to assessments completed in 2004 (ESS) and in 2008-2009 (JRWA; Chase et al., 2013).
- Diversion of water from East Monponsett Pond by City of Brockton's public water supply (BWS) system increases the loading of phosphorus in Silver Lake, resulting in Silver Lake's water quality trending toward a state where the frequency and intensity of harmful algal blooms will likely increase over time.
- During diversions (mainly in October through May) water flows regularly in the reverse direction and flows backward from West Monponsett to East Monponsett, potentially drawing the cyanobacteria and nutrients into Silver Lake.
- The potentially toxic cyanobacterial blooms and excess nutrients in West and East Monponsett Ponds could likely flow into Silver Lake during periods of active diversions.
- In addition to the above potential impacts, one or more of the following can contribute (point and non-point sources) to water and sediment impairments in Silver Lake: lawn fertilizer, sediment recycling, stormwater runoff, septic systems, agricultural loads, and cranberry operations.

Our Scope of Services is designed to address data gaps for each of these important conditions and issues so that a better understanding of the key drivers within the Silver Lake system can be developed. Overall, we believe that our proposed Project design provides the CPCWDC and its partners with a structured but flexible approach to the requested Scope of Services, as described in the next section.

We also propose certain optional tasks to supplement and complement the core Scope of Services. These optional tasks are proposed primarily for the value they will provide in enhancing the quality of the conceptual model inputs, which will result in more useful outputs and, therefore, better recommendations.

## SCOPE OF SERVICES

The Scope of Services proposed by ESS below follows the general outline provided in the CPCWDC's RFP to facilitate review. Based on the information requested in the RFP, ESS believes that we will be able to adequately assess the physical, water quality, and biological features of Silver Lake and its watershed at a sufficient level of detail to provide sound management recommendations.

Where possible, laboratory analyses will be conducted by a Massachusetts certified and accredited commercial laboratory. However, some highly specialized analyses, such as sediment phosphorus fractionation, are not available through local analytical laboratories. These will be sent to specialty



laboratories that ESS has worked with previously to ensure that results are scientifically valid and usable for the data quality objectives of the Silver Lake assessment.

Optional tasks for consideration are provided following the core Scope of Services specifically requested in the RFP.

### **Task 1. Administration and Reporting**

This task covers initial consultation (e.g., kick-off meeting) between ESS and CPCWDC and continued dialogue throughout the Project duration. This task is of utmost importance for ensuring that Project goals, expectations, and schedule are clearly understood by both parties, so that the Project can be successfully launched and conducted. The following action items are covered under this task:

- Project Kick-off Meeting - ESS will schedule a kick-off meeting between CPCWDC and ESS within a month of contract award (assuming to be no later than August 1, 2021). The purpose of the kick-off meeting is to: (i) transfer project information; (ii) establish the Project schedule, deliverables, and timeline; and (iii) establish the schedule/frequency of Project communications. It is expected the kick-off meeting will be attended by designated ESS Project Manager and Field Program Lead.
- Project Detail - ESS will provide CPCWDC with a detailed Project plan including a schedule of deliverables and cost estimates approximately two weeks after the kick-off meeting.
- Monthly Meetings - ESS will provide monthly progress/status reports to CPCWDC at up to four meetings. The verbal reports will provide percent completion for tasks, budgets, draft and/or final deliverables.

All written documents produced by ESS for the above action items will be submitted to the CPCWDC point-of-contact in draft form for review and comment prior to finalization. ESS has taken into account in the Project schedule CPCWDC's up to one-month review timeframe for any deliverable. ESS will respond to one set of CPCWDC comments on each deliverable prior to finalizing the deliverable.

#### *Deliverables:*

- *A detailed Project plan including a schedule of deliverables and cost estimates approximately two weeks after the kick-off meeting.*
- *Participate in (remotely via ZOOM or similar) up to four regularly scheduled CPCWDC monthly meetings to provide verbal status of the Project.*

### **Task 2. Development of Sampling and Analysis Plan and Associated QC Documents**

This task primarily covers: (i) ESS's review of background information; (ii) consultation with stakeholders and the public as agreed with CPCWDC; (iii) preparation of a Sampling and Analysis Plan (SAP); (iv) preparation of a Quality Assurance Quality Control Plan (QAPP); and (v) establishing water quality targets; and (vi) estimating costs for implementing the SAP (Task 4). Public input (Task 3) is linked to the SAP review and finalization process. These primary action items are further described below.

- (i) Review of Background Information – Prior to preparation of the SAP and QAPP, ESS will complete a review of relevant reports/documents that are pertinent to the Project, including those provided by CPCWDC during the Task 1 informational transfer and as readily available on-line. From this

review, ESS will identify the key data and information points, data gaps or unresolved questions that can be carried through in the SAP and QAPP scoping.

- (ii) Consultation with Stakeholders and the Public – ESS proposes to perform stakeholder and public consultation under Task 3 (Public Input).
- (iii) Preparation of the SAP – The SAP will provide the framework for all field components of the water and sediment sampling, as presented in Task 4 (Implementation of Sampling Plan). In general, the SAP will document the procedural and analytical requirements for the collection of water, sediment and other media to characterize Silver Lake. Applicable Standard Operation Procedures (SOPs) established by ESS will be included in the SAP. ESS has significant experience coordinating access for these types of projects and will provide our proposed approach in the SAP.
- (iv) Preparation of the QAPP - The QAPP will provide comprehensive details about the quality assurance/quality control (QA/QC) requirements and technical activities for collection of media samples from Silver Lake. In general, the QAPP will document how QA/QC procedures apply to environmental data collection and analysis in order to ensure that the results obtained are of known and suitable quality and quantity needed to meet the Project goals and objectives. The Draft QAPP will be submitted to the EPA Coordinator for review and approval. A Final QAPP will be prepared thereafter, based on one round of comments from EPA.
- (v) Establishing Water Quality Targets – The QAPP will establish the appropriate and applicable state and/or federal criteria/standards (e.g., water quality targets) for the Project.
- (vi) Estimating Costs for Implementing the SAP – A cost estimate will be prepared after the SAP has been finalized. The cost estimates will include projected labor, expense and subcontractor costs for implementing the SAP.

*Deliverables:*

- *Preparation of a Draft SAP, a Draft Final SAP (following CPCWDC review) and Final SAP (following public input under Task 3).*
  - *Up to six hours has been allocated for ESS to respond to any written and verbal comments received under Task 3.*
  - *Commission will collect all written comments by the public and distribute to ESS.*
  - *CPCWDC will have the final decision, based on consultation with ESS, as to what public written and verbal comments are appropriate for inclusion in the Final SAP. No direct follow-up responses by ESS to the public entity's written responses are proposed.*
- *Preparation of a Draft QAPP and Final QAPP, incorporating one round of EPA comments.*
- *All data generated during preparation of SAP will be provided to CPCWDC in an acceptable file sharing electronic format.*

**Task 3. Public Input**

Under this task, ESS will assist CPCWDC with the public outreach efforts and development of educational materials for the Project. The action items under this task are described below.

ESS will prepare a draft Public Input Plan (PIP; aka Public Outreach Plan) for CPCWDC that provides a summary of tasks, proposed meeting dates and a timeline of tasks/activities. The primary components of the PIP are as follows:

- a. SAP Review Meeting – to review the Final Draft SAP.
- b. Public Listening Session – to present the results of the initial year of sampling.
- c. Informational Leaflets.

ESS will work CPCWDC to determine the preferable method for publicizing meetings, possibly including meeting announcements on CPCWDC website or developing an email contact list of designated stakeholders.

ESS assumes that there will be one CPCWDC meeting to review the Final Draft SAP and solicit any verbal comments. Prior to this meeting, the Final Draft SAP can be posted on the CPCWDC website and a link provided to the designated stakeholders. At the meeting, ESS will present a brief overview of the SAP objectives and scope and then open the floor to public comments.

ESS also assumes that there will be one Public Listening Session to present the results of the initial year of sampling. At this meeting, ESS will provide a brief overview of the Project findings and then open the floor to public questions and comments.

A Launch Informational Leaflet will be prepared and made available for distribution at the SAP Review Meeting and can also be made available to the public through the CPCWDC website. As noted in the RFP, this leaflet will introduce the proposed Project.

A Project Informational Leaflet will be prepared following the finalization of the Public Listening Session and finalization of the Project report and can be made available to the public through the CPCWDC website.

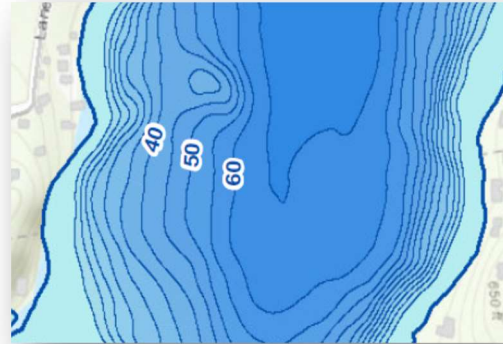
*Deliverables:*

- *Preparation of a draft and final PIP.*
- *Preparation of a draft and final Launch Informational Leaflet.*
- *Preparation of a draft and final Project Informational Leaflet.*
- *For the two proposed meetings, ESS will prepare the following:*
  - *Meeting Agendas.*
  - *Meeting Presentations (in the form of PowerPoint slides).*
  - *Meeting Notes and identified action items.*

## Task 4. Implementation of Sampling and Analysis Plan

### Task 4A. Bathymetric and Aquatic Plant Surveys

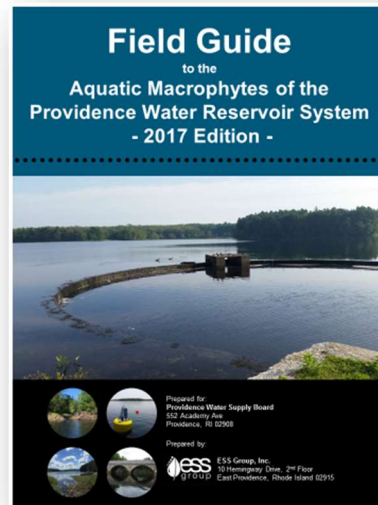
**Bathymetry and Plants and Benthos.** Under this task, ESS will complete a bathymetric and rooted macrophyte survey of Silver Lake. ESS currently anticipates conducting this survey in early fall to try to ensure all rooted plants have had sufficient time to develop topgrowth. Data collected will include macrophyte community composition, vegetative cover (percent of bottom) and biomass/volume (measure of vegetative growth in the water column). Supplemental data on substrate type (muck, sand, etc.) will also be collected, as this will also help to inform our management recommendations.



ESS will use an appropriate combination of methods to assess the rooted plant community at each data point, including a color underwater video camera, macrophyte pole- and/or throw-rakes, sonar depth-finder, and direct observation from the boat. Plant species that cannot be readily identified to genus/species level in the field will be sampled and returned to ESS's office for identification under magnification. Data collected from the aquatic plant survey will be used to generate maps of plant cover and biovolume for the lake. Additionally, ESS will develop a field guide to the aquatic plants of Silver Lake as a resource for future monitoring efforts.

Given the size of Silver Lake, ESS anticipates collection of at least 350 survey points. The location of each data point will be recorded using a Differential Global Positioning System (DGPS) capable of sub-meter horizontal accuracy in the NAD83 Massachusetts State Plane Coordinate system. Lake bathymetry will be tied to a vertical control and used to create a contour map of the lake.

**Macroinvertebrates.** Due to their relatively long lifespan (months to years), benthic macroinvertebrates are one of the most useful organisms for inferring longer term water quality conditions in surface waters. Therefore, ESS proposes to collect benthic macroinvertebrate samples along a transect perpendicular to the long axis of the lake allowing the collection of samples from both shallow and deep environments within the lake.



Depending on the conditions observed in the lake and depth of water at the sampling location, ESS will use a grab sampler (e.g., Ekman grab), clam rake, or dip net to collect macroinvertebrate samples. The total area sampled will be noted for each location so that the data can be used to quantify densities of each organism. Samples will be field-preserved in 75% ethanol and returned to ESS's offices for sorting, identification, and enumeration by a Society for Freshwater Science (SFS) certified taxonomist under a microscope. The target level for macroinvertebrate identification will be genus/species for most organisms. ESS believes this level of identification will be very important to achieve for non-biting midges (Chironomidae), in particular, because these organisms are expected to contribute some of the highest abundances and taxonomic diversity of any group of organisms in the lake. This allows them to be very useful for distinguishing environmental gradients, particularly those related to dissolved oxygen. Therefore, we propose to slide mount non-biting midges, as needed, to achieve this level of identification.



ESS will analyze the macroinvertebrate data and develop a narrative assessment of findings with regard to potential environmental gradients in the lake, based on the macroinvertebrate assemblages observed.

*Deliverables:*

- *GIS figure and shapefiles depicting Silver Lake's water depth contours (to be incorporated into final report).*
- *GIS figures and shapefiles depicting density and biovolume of aquatic plants in Silver Lake (to be incorporated into final report).*
- *Field guide to aquatic plant species observed in Silver Lake.*
- *Data tables and narrative assessment of macroinvertebrates (to be incorporated into final report).*

**Task 4B. Water Column and Water Quality Sampling**

In-lake sampling of water quality will be critical to establishing the current baseline conditions of Silver Lake. To ensure acquisition of the most useful and complete dataset over a short period of time, ESS proposes to include both continuous data logging and collection of discrete water quality samples as part of the field program.

**Continuous Data Logging.** The continuous data logging portion of the field program will include deployment of two monitoring arrays at the deepest location in the lake, in order to detect differences in key parameters (water level, temperature, and chlorophyll) over time and through the vertical water column. One array will be located approximately 5 m below the lake surface and the second array will be located approximately 5 m above the sediment-water interface. Chlorophyll a will only be included in the shallow monitoring array.



ESS would anticipate deploying these data loggers early in the field program (projected to be September 2021) and removing them in November or December 2021, prior to formation of ice cover. Dataloggers would be re-deployed following ice-off (anticipated for March 2022).

**Discrete Water Quality Sampling.** To complement and supplement the continuous data logging program, ESS will collect multiple rounds of discrete in-lake water quality sampling from September 2021 through April 2022, exclusive of January and February 2022, for a total of six sampling events.

During these events, samples would be collected from one of the deeper portions of the lake and include three depth-discrete samples. Only one sample per event will be collected for chlorophyll and phytoplankton enumeration and these samples will be collected from the upper 5 m of the water column.

ESS proposes to collect 6 rounds of in-lake samples (i.e., monthly) to be measured for the following parameters:

- Total Phosphorus (low detect)
- Total Nitrogen (includes nitrite+nitrate-N and TKN)
- Chlorophyll a
- Alkalinity
- Soluble Phosphorus (low detect)
- Phytoplankton Enumeration and ID
- pH
- Secchi Disk Transparency
- Apparent Color
- Turbidity
- Water Temperature (full vertical profile at 1 m increments)
- Specific Conductance (full vertical profile at 1 m increments)
- Dissolved Oxygen (full vertical profile at 1 m increments)

Since there is significant concern regarding the documented impairments in East Monponsett Pond and Furnace Pond and the potential for these impairments to be transferred to Silver Lake during water transfers, ESS recommends collecting samples from these other water bodies concurrent with in-lake sampling in Silver Lake during periods of active water transfers. For the purposes of this proposal, ESS assumes the collection of up to 3 sets of depth-discrete samples from each of these two water bodies for the same suite of analytes.

ESS will present the water quality data in tables and figures and develop a narrative assessment of findings with regard to observed conditions and significance.



*Deliverables:*

- *GIS figure and shapefiles depicting location of the sampling locations (to be incorporated into final report).*
- *Data tables, figures, and narrative assessment of in-lake water quality (to be incorporated into final report).*
- *Lab reports (to be incorporated as an appendix in the final report).*

**Task 4C. Upstream and Downstream Monitoring**

Upstream and downstream sampling of water quality will be critical to understanding the hydrologic and nutrient budgets for Silver Lake. Under this task, ESS will undertake water quality and discharge monitoring upstream and downstream of Silver Lake. ESS proposes to include both continuous data logging and collection of discrete water quality samples and discharge measurements as part of the field program.

**Continuous Data Logging.** The continuous data logging portion of the field program will include deployment of four water level loggers, including one each at Tubbs Meadow Brook, Little Brook and Mirage Brook (inlets) and one at the downstream (outlet to Forge Pond). Additionally, since ESS anticipates using sealed (unvented) water level loggers, we would deploy a fifth pressure logger in a discreet location to allow for continuous atmospheric pressure correction. The deployed loggers would also continuously monitor temperature over the course of the study.



ESS would anticipate deploying these data loggers in September 2021 and operating through April 2022.

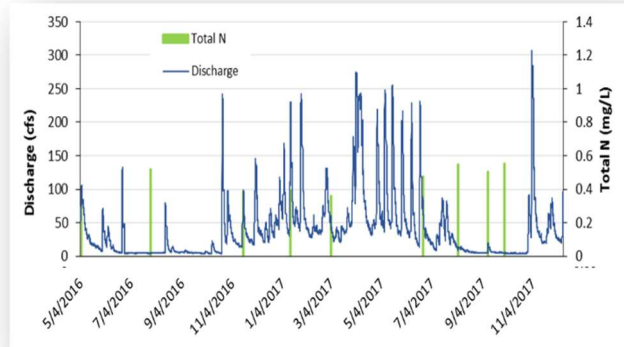
**Discrete Water Quality and Discharge Sampling.** To complement and supplement the continuous data logging program, ESS will collect monthly rounds of discrete upstream and downstream water quality and discharge sampling from September 2021 through April 2022, for a total of 8 sampling events. At least one of the rounds will be collected during wet weather conditions.

Over this time period, ESS proposes to collect eight rounds of sampling (i.e., monthly), to be measured for the following parameters:

- Stream Discharge – using methodology consistent with USGS midsection method
- Total Phosphorus (low detect)
- Total Nitrogen (includes nitrite+nitrate-N and TKN)
- Specific Conductance
- Soluble Phosphorus (low detect)
- Temperature
- pH

- Apparent Color
- Turbidity
- Dissolved Oxygen

The discharge measurements collected in each stream monitoring location will be used to develop stage-discharge rating curves. ESS believes that collection of approximately six discharge measurements at each location will be sufficient for development of useful stage-discharge rating curves. These curves will, in turn, be used to convert logger water levels into a continuous discharge record for the period of study. This is a critical piece of the study because it will also allow ESS to estimate surface water contaminant loads into and out of Silver Lake.



**Deliverables:**

- GIS figure and shapefiles depicting location of the logger and sampling locations (to be incorporated into final report).
- Data tables, figures, and narrative assessment of upstream and downstream water quality (to be incorporated into final report).
- Lab reports (to be incorporated as an appendix in the final report).

**Task 4D. Groundwater Assessment**

Given the location of Silver Lake proximal to the extensive Plymouth-Carver-Kingston-Duxbury Aquifer, and a separate aquifer area to the north, groundwater could have a substantial influence on the hydrology and potentially the water quality of the lake. To assess this influence, ESS proposes to advance our groundwater assessment through a field sampling and testing program.

**Shallow Groundwater Seepage Sampling Program.**

Direct groundwater seepage can sometimes be a major source of pollutants to surface water bodies, including densely developed shorelines. Measuring the quantity and quality of these groundwater inputs can be important for understanding why the system is no longer meeting its water quality goals. In order to assess groundwater inputs directly, ESS proposes to conduct a groundwater seepage survey. A seepage survey measures the quantity and quality of groundwater entering the lake along the immediate shorelines where groundwater in seepage is typically the highest and also most influenced by human behaviors and activities.

ESS proposes to deploy eight seepage meters along four key shoreline segments to measure the rate of in- or out-seepage. A seepage meter is a device that allows the rate of water influent to or effluent from the lake to be measured. Two meters will be deployed along each shoreline segment to adequately capture the local variability in groundwater movement.

On the same day, ESS will also collect shallow porewater samples from each of the four shoreline segments using a littoral interstitial porewater (LIP) sampler, which is essentially a mini-well that extracts groundwater from sediments for water quality testing. Samples will be measured in the field for temperature, pH, and specific conductance and compared to surface water quality measurements to ensure that groundwater is being obtained by the LIP sampler. Laboratory analysis will be conducted for the following at each shoreline sampling segment:

- Phosphorus (dissolved)
- Ammonia-nitrogen
- Nitrate-nitrogen

The sum of nitrate and ammonia nitrogen, or soluble inorganic nitrogen (SIN) is typically the most reliable indicator of septic leachate contamination. Phosphorus (in dissolved form) may also migrate through soils but tends to move much slower than nitrogen. By sampling for both, we will be able to provide the CPCWDC with an assessment of whether local groundwater sources of contamination are making a significant contribution to the nutrient budget for Silver Lake.

ESS anticipates completing the seepage sampling program in spring of 2022 to capture seasonal high water-table conditions.

*Deliverables:*

- *GIS figure and shapefiles depicting location of estimated groundwater watershed boundary, potential watershed groundwater contamination sources, and seepage survey locations (to be incorporated into final report).*
- *Data tables, figures, and narrative assessment of groundwater (to be incorporated into final report).*
- *Lab reports (to be incorporated as an appendix in the final report).*

**Task 4E. Technical Memorandum**

Under this task, ESS will synthesize and present the results of implementation of the SAP as a Technical Memorandum (the Memorandum). The Memorandum will provide a final diagnosis of the Silver Lake media sampling and analysis program and include: a summary of the completed field activities, analytical summary tables, applicable figures, laboratory data reports, data gaps and recommendations.

The Memorandum will provide an interpretation of the lake's current trophic state and identify the relative contributions of pollutant loading to the lake from potential surface and groundwater sources.

*Deliverables:*

- *A Draft Memorandum for review and comment by CPCWDC.*
- *One revision the Memorandum, incorporating CPCWDC comments and feedback.*

### Contingent/Optional Tasks

In order to provide CPCWDC with the flexibility to select an alternative approach in lieu of or in complement to portions of the base Scope of Services, ESS has developed the following contingent/optional tasks for CPCWDC’s consideration. We believe there are two critical times at which CPCWDC may wish to elect moving forward with one or more of these contingent/optional tasks: 1) at project kickoff and 2) following the presentation of the initial year of study data.

#### Task O1 – In-Lake Bacteria Testing

Bacterial testing can provide important information, particularly given that Silver Lake is a drinking water reservoir. If CPCWDC elects to authorize bacterial testing, ESS would recommend samples to be analyzed for the following indicators, at a minimum:

- *E. coli*

A unit cost for the analysis of one sample for this parameter is provided assuming that the sample is collected during one of the proposed sampling events.

#### Task O2. Internal Phosphorus Loading Analysis and Water Quality Modeling

Under this task, ESS will collect and analyze sediment samples to determine the likely impact of internal nutrient recycling on water quality within Silver Lake. ESS will be able to provide CPCWDC with more information on the value of this investigation upon reviewing water quality data from the lake. However, this is a potentially critical source of phosphorus loading in lakes that experience dissolved oxygen depletion from deep waters.

Under this approach, ESS will use a core extrusion and phosphorus fractionation method to collect and assess determine the maximum nutrient release rate. We will then couple this with a water quality model that simulates pulses of nutrient release based on dissolved oxygen concentrations in Silver Lake.

**Sediment Coring.** For the purposes of this study, we believe that six to eight cores will be sufficient to characterize sediment phosphorus loading in Silver Lake. ESS will collect these cores from locations distributed across a range of depths and geographic positions. We will use a gravity corer or similar device to collect undisturbed and uncontaminated cores for use in evaluating nutrient release.

Sediment cores will be collected and sliced into multiple 2-4 cm sections (for an anticipated total of up to 40 sections). These core samples will be sent to BEC’s specialty phosphorus fractionation laboratory and analyzed for the following specialty parameters:

- Iron-bound phosphorus
- Aluminum-bound phosphorus
- Calcium-bound phosphorus





- Organically-bound phosphorus
- Percent water
- Loss on ignition-organic carbon content
- Density

These data will help to define the spatial variability of phosphorus across the lake bottom, as well as vertically within the bottom sediment. This will help to provide some indication of how deep into the sediment phosphorus release occurs, as well as provide critical information for dosing if nutrient inactivation is advanced as a desired management approach.

**Water Quality Modeling.** ESS proposes to develop a water quality, ecological, and hydrodynamic model for Silver Lake to provide the link between management actions and the expected water quality outcome of those actions. There are several benefits of constructing a model for this lake, including the following:

- Linking the sources (e.g., surface inputs, septic seepage, internal loading, and direct stormwater runoff) of nutrient loading to Silver Lake and the relative effect of those loading sources on in-lake nutrient concentrations. This includes seasonal effects as well as different nutrient forms. This is important as different nutrient species have widely different effects on phytoplankton growth. For example, dissolved nutrients from septic systems or internal loading (lake bottom sediment) will have a greater effect on phytoplankton blooms compared to particulate phosphorus from surface runoff.
- Quantification of internal phosphorus loading (from bottom sediments) as a function of:
  - Phosphorus concentrations in the sediment.
  - Lake bottom dissolved oxygen concentrations.
  - Lake temperature.
- Quantification of the effect of phosphorus and nitrogen concentrations on phytoplankton growth (e.g., algal blooms). This includes the combined effect of temperature and nutrient species. The inclusion of each of these factors will help to define which source reduction strategies will have the greatest benefit.

We propose to use a custom one-dimensional water quality model of the Silver Lake system to include the following:

- Temperature-driven stratification and destratification dynamics, which impact dissolved oxygen.
- Dynamic settling of particles, including phytoplankton, phosphorus, nitrogen, and solids to account for stratification and flushing.
- Phytoplankton and aquatic plant growth and mortality kinetics to capture daily changes in flushing, solar radiation, and nutrient availability, which determine when phytoplankton blooms occur.

The inputs to the model include inflow and outflow volume, direct precipitation, water quality of inflows, climate data, and bathymetry, each of which will be available from the Silver Lake watershed assessment.

**Deliverables:**

- *GIS figure and shapefiles depicting location of sediment core locations (to be incorporated into final report).*
- *Data tables, figures, and narrative assessment of sediment core analytical results (to be incorporated into final report).*

- *Lab reports (to be incorporated as an appendix in the final report).*
- *Model setup and outputs (to be incorporated as an appendix in the final report).*

### **Task O3. Cyanotoxin Testing**

Under this task, ESS would collect and analyze samples for cyanotoxins. This may be useful if, upon arriving at the lake for sampling, ESS were to detect a likely cyanobacteria bloom (either visually or via instrumentation). It may also be useful should CPCWDC desire ESS to sample water diversions during or after suspected or documented blooms in source waters. Although it is possible to test using a variety of methods (e.g., LC/MS) and for a number of congeners, to facilitate costing of this contingent task, ESS has assumed use of ELISA methods for testing of Total Microcystins.

#### *Deliverables:*

- *Interim email or memo to the CPCWDC, summarizing ESS's observations and providing updates on test results.*
- *Data tables, figures, and narrative assessment of cyanotoxin testing results (to be incorporated into final report).*
- *Laboratory report.*
- *Scope assumes a separate trip to collect one sample during a scheduled sampling event and analysis using the ELISA method for microcystins.*



## SCHEDULE

ESS is prepared to begin work on this Scope of Services immediately upon execution of a contract with the CPCWDC. ESS understands from the RFP that the start of the Project is set at no later than July 1, 2021 with a duration of one calendar year. We have used the start and end dates to guide the development of our anticipated Schedule. This is a proposed Project Schedule, however, ESS is flexible in negotiating a Schedule that best meets the needs and interests of the CPCWDC.

Task	2021												2022											
	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
1. Administration and Reporting						M																		
2. SAP and QAPP							D	R																
3. Public Input								M															M	
4. SAP Implementation																							D	
4A. Bathymetric and Aquatic Plant Surveys																								
4B. Water Column and Water Quality Sampling (In-Lake)																								
4C. Upstream and Downstream Monitoring																								
4D. Groundwater Assessment																								
4E. Technical Memorandum																								

**LEGEND**

D=Key Deliverable; R=Revision of Key Deliverable (where applicable); and M = Meeting

**Schedule Notes:**

- It will be important to work expeditiously through the preparation and finalization of the SAP and QAPP to allow the field work to proceed as early as possible in September 2021.
  - This is particularly important for the proposed Plant Mapping effort.
- The schedule for the Optional Tasks is not shown above due to the uncertainty in if these tasks will be performed and when they could be initiated. The schedule for any Optional Tasks that are selected to be performed during this initial year of monitoring can be provided under Task 1.



## REFERENCES

NAME	PROJECT	CONTACT INFORMATION
<b>Massachusetts Department of Conservation and Recreation</b>	Numerous projects completed with this client.	Jim Straub Aquatic Biologist jim.straub@state.ma.us (617) 626-1411
<b>Massachusetts Water Resources Authority</b>	Monitoring of Ten Source and Emergency Reservoirs (Annually 2010 and 2013-Present)	John Gregoire Program Manager, Reservoir Operations john.gregoire@mwra.com (508) 424-3608
<b>Town of Concord Division of Natural Resources</b>	Numerous projects completed with this client.  The White Pond Watershed Management Plan and subsequent Monitoring Programs and stormwater are recent examples.	Delia Kaye Director of Natural Resources dkaye@concordma.gov (978) 318-3285
<b>Town of Groton Lost Lake Watershed Advisory Committee and Groton Lakes Association</b>	Lost Lake Watershed Management Plan.	Art Prest Chairman aprest@verizon.net; prest@prest.biz (978) 448-2384
<b>Town of Walpole Conservation Commission</b>	Restoration of Memorial Pond and Traphole Brook Project are recent examples.	Landis Hershey Conservation Agent lhershey@walpole-ma.gov (508) 660 -7253
<b>Providence Water</b>	Scituate Reservoir Limnological Assessment	Rich Blodgett, Environmental Resources Manager Providence Water rblodgett@provwater.com (401) 521-6300 x7316



## CONFLICT CHECK

In addition to the Conflict of Interest Certification for (refer to Attachments), ESS is unaware of any conflict of interest based on previous (5-years) and/or current contracts with municipalities within the District, nonprofit agencies with relevant activity and interests in the District, and any other potential conflicts for the CPCWDC to evaluate. ESS expects that we will execute the contract for its duration without undue influence from other parties.

## GENERAL ASSUMPTIONS

The following general assumptions have been made with regard to the proposed work described within this document.

- To reduce costs and impacts to the environment associated with paper deliverables, ESS deliverables will be provided in electronic format (e.g., PDF) unless otherwise noted.
- ESS will provide one revised version of project deliverables in response to client comments, unless otherwise noted in this proposal or negotiated as part of the fully executed contract.
- ESS will designate up to two attendees for project meetings unless otherwise noted.
- Remote teleconferences or videoconferences hosted by ESS will use Zoom (zoom.us) or Fuze (fuze.com) platforms. Should the client desire to use a different communications platform, the client will host the meeting or otherwise assume associated hosting costs, if any.





**Attachment A**

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**Required Forms**



Central Plymouth County Water District Commission

**Appendix 1 CPCWDC Response Form**

The undersigned hereby submits a sealed Response for the provision of Water Quality Monitoring related to Silver Lake as detailed in the RFP.

Printed Name of Responder: ESS Group, Inc.

Address: 404 Wyman Street, Suite 375, Waltham, MA 02451

The Responder hereby pledges to deliver the complete scope of goods required. Responder certifies as follows:

1. Responder is an established business with a minimum of five (5) years of experience in providing services related to projects in the Commonwealth of Massachusetts.
2. Responder provides supervision of all workers performing under all Contracts held and pledges to provide such supervision under any Contract.
3. Responder holds all applicable documentation and Insurance in accordance with this RFP. (Responder shall attach to the Response Form copies of all relevant insurance certificates hereto. Nothing in this provision, however, shall eliminate the requirement that the Responder, if chosen as the Successful Responder, shall submit to the District an endorsement or a rider in compliance with the Contract.)
4. Responder has not defaulted on any Contract within the last five (5) years.
5. Responder maintains a permanent place of business. (Responder shall attach to the Response Form the address of its place of business).
6. Responder has adequate personnel and equipment, if any, to perform the work expeditiously. (Responder shall attach to the Response form a statement of experience of its personnel and the proposed staffing plan it shall offer in reference to the work for which qualifications are sought. Responder shall attach to the Response Form a description of its equipment, if any, and shall explain how such equipment satisfies the requirements stated herein.)
7. Responder has suitable financial status to meet obligations incidental to the RFP.
8. Responder is registered with the Secretary of the Commonwealth of Massachusetts to do business in Massachusetts. (Responder shall attach to the Response Form a copy of a Letter of Good Standing from the Secretary of the Commonwealth's Office.)
9. Responder has not failed to perform satisfactorily on Contracts of a similar nature.

The undersigned agrees that all specifications and Contract documents are hereto made part of any Contract executed with the District and are binding on the Successful Responder.

Authorized Signature: 

Charles J. Natale, Jr.

Printed Name: \_\_\_\_\_

President & CEO

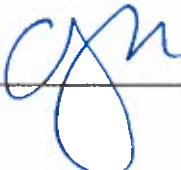
Printed Title: \_\_\_\_\_

Central Plymouth County Water District Commission

Date: 6/1/2021

If a Corporation, Full Legal Name: ESS Group, Inc.

Officers of Corporation and Addresses

Charles J. Natale, Jr., President & CEO   
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

State of Incorporation: State of Delaware

Principal Place of Business: 404 Wyman Street, Suite 375, Waltham, MA 02451

Telephone Number: 781.419.7696

Qualified in Massachusetts    Yes    No    yes  
Principal Place of Business in Massachusetts: 404 Wyman Street, Suite 375, Waltham, MA 02451

Years at the Location: 3 years at this location; 24 years in business at different MA addresses.

Telephone Number: 781.419.7696



## CERTIFICATE OF GOOD STANDING AND/OR TAX COMPLIANCE



ESS GROUP INC  
404 WYMAN ST STE 375  
WALTHAM MA 02451-1219

### *Why did I receive this notice?*

The Commissioner of Revenue certifies that, as of the date of this certificate, ESS GROUP INC is in compliance with its tax obligations under Chapter 62C of the Massachusetts General Laws.

This certificate doesn't certify that the taxpayer is compliant in taxes such as unemployment insurance administered by agencies other than the Department of Revenue, or taxes under any other provisions of law.

**This is not a waiver of lien issued under Chapter 62C, section 52 of the Massachusetts General Laws.**

### *What if I have questions?*

If you have questions, call us at (617) 887-6400 or toll-free in Massachusetts at (800) 392-6089, Monday through Friday, 9:00 a.m. to 4:00 p.m..

### *Visit us online!*

Visit [mass.gov/dor](http://mass.gov/dor) to learn more about Massachusetts tax laws and DOR policies and procedures, including your Taxpayer Bill of Rights, and MassTaxConnect for easy access to your account:

- Review or update your account
- Contact us using e-message
- Sign up for e-billing to save paper
- Make payments or set up autopay

Edward W. Coyle, Jr., Chief  
Collections Bureau

Central Plymouth County Water District Commission

**Appendix 2 Certificate of Non-Collusion**

The undersigned certifies, under penalties of perjury, that this Response has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word "person" shall mean any natural person, business, partnership, corporation, union, committee, club or other organization, entity, or group of individuals.

Name of Responder: ESS Group, Inc.

Address of Responder: 404 Wyman Street, Suite 375, Waltham, MA 02451

Telephone Number: 781.419.7696

By:   
(Signature)

Printed Name: Charles J. Natale, Jr.

Printed Title: President & CEO

Date: 6/1/2021



Central Plymouth County Water District Commission

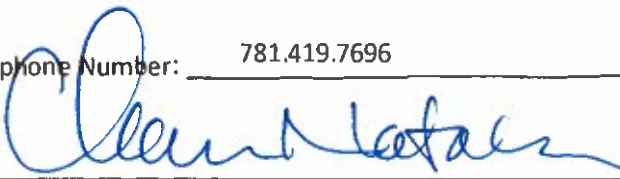
**Appendix 3 Certificate of Tax Compliance**

Pursuant to Massachusetts General Laws (M.G.L.) c. 62C, §49A, I certify under the penalties of perjury that the Responder named below has complied with all laws of the Commonwealth of Massachusetts pertaining to the payment of taxes, to the reporting of employees and contractors, and to the withholding and remitting of child support.

Name of Responder: ESS Group, Inc.

Address of Responder: 404 Wyman Street, Suite 375, Waltham, MA 02451

Telephone Number: 781.419.7696

By:   
(Signature)

Printed Name: Charles J. Natale, Jr.

Printed Title: President & CEO

Date: 6/1/2021

Central Plymouth County Water District Commission

**Appendix 4 Conflict of Interest Certification**

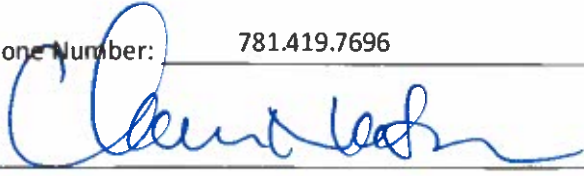
The Responder hereby certifies that:

1. The Responder has not given, offered, or agreed to give any gift, contribution, or offer of employment as an inducement for, or in connection with, the award of a Contract pursuant to this Request for Qualifications.
2. No consultant to, or subcontractor for, the Responder has given, offered, or agreed to give any gift, contribution, or offer of employment to the Responder, or to any other person, corporation, or entity as an inducement for, or in connection with, the award to the consultant or subcontractor of a Contract by the Responder.
3. No person, corporation, or other entity, other than a bona fide full time employee of the Responder has been retained or hired to solicit for or in any way assist the Responder in obtaining the Contract (pursuant to this Request for Qualifications) upon an agreement or understanding that such person, corporation or entity be paid a fee or other compensation contingent upon the award of a Contract to the Responder.
4. The Responder understands that the Massachusetts Conflict of Interest Law, Chapter 268A of the Massachusetts General Laws, applies to the Responder with respect to the services described in the Request for Qualifications.
5. The Responder understands that the Responder, its officers, employees, agents, subcontractors, and affiliated entities, shall not participate in any activity which constitutes a violation of the Massachusetts Conflict of Interest Law or which creates an appearance of a violation of the Massachusetts Conflict of Interest Law.

Name of Responder: ESS Group, Inc.

Address of Responder: 404 Wyman Street, Suite 375, Waltham, MA 02451

Telephone Number: 781.419.7696

By:   
(Signature)

Printed Name: Charles J. Natale, Jr.

Printed Title: President & CEO

Date: 6/1/2021

Central Plymouth County Water District Commission

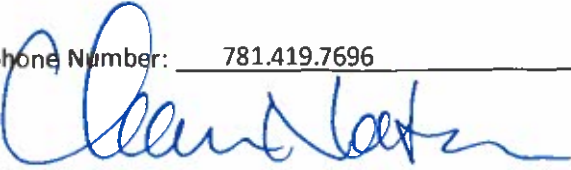
**Appendix 5 Certificate of Corporate Responder**

I, Charles Natale, Jr., certify that I am the Clerk of the Corporation named as Responder in the attached Response Form; that Charles Natale, Jr., who signed said Response on behalf of the Responder was then President & CEO of said Corporation and was duly authorized to sign said Response Form; and that I know his/her signature thereto is genuine. (Use raised Corporate Seal to certify)

Name of Responder: ESS Group, Inc.

Address of Responder: 404 Wyman Street, Suite 375, Waltham, MA 02451

Telephone Number: 781.419.7696

By:   
(Signature)

Printed Name: Charles J. Natale, Jr.

Printed Title: President & CEO

Date: 6/1/2021

This Certificate shall be completed where Responder is a Corporation and shall be so completed by its Clerk. In the event that the Clerk is the person signing the Responder on behalf of the Corporation, this certificate shall be completed by another officer of the Corporation.

Central Plymouth County Water District Commission

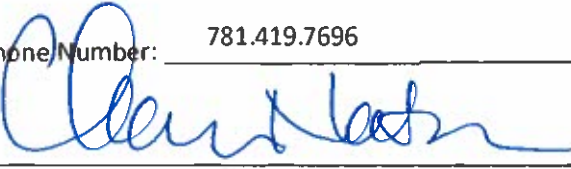
**Appendix 6 Certificate of Compliance with M.G.L c. 151B**

The Responder hereby certifies that it is in compliance with and shall remain in compliance with Massachusetts General Laws (M.G.L.) Chapter 151B and shall not discriminate on any prohibited basis outlined therein.

ESS Group, Inc.  
Name of Responder: \_\_\_\_\_

404 Wyman Street, Suite 375, Waltham, MA 02451  
Address of Responder: \_\_\_\_\_

781.419.7696  
Telephone Number: \_\_\_\_\_

  
By: \_\_\_\_\_  
(Signature)

Charles J. Natale, Jr.  
Printed Name: \_\_\_\_\_

President & CEO  
Printed Title: \_\_\_\_\_

6/1/2021  
Date: \_\_\_\_\_

Central Plymouth County Water District Commission

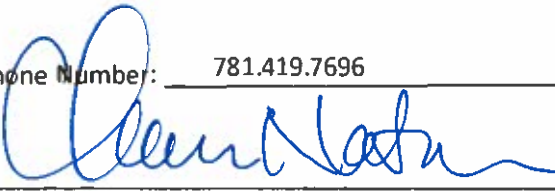
**Appendix 7 Certificate of Compliance with Applicable EEO/AA/SDO PROVISIONS**

The Responder hereby certifies that it shall comply with all applicable minority workforce percentage ratio and specific affirmative action steps contained in any EEO/AA/SDO provisions of this Contract, including, without limitation any imposed by the Massachusetts Supplier Diversity Office (SDO).

Name of Responder: ESS Group, Inc.

Address of Responder: 404 Wyman Street, Suite 375, Waltham, MA 02451

Telephone Number: 781.419.7696

By:   
(Signature)

Printed Name: Charles J. Natale, Jr.

Printed Title: President & CEO

Date: 6/1/2021



Central Plymouth County Water District Commission

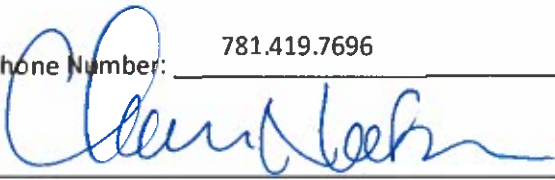
**Appendix 8 Certificate of Non-Debarment**

The Responder hereby certifies that it is presently not debarred, suspended, or otherwise prohibited from practice by any federal, state, or local agency, and that, should any proceeding arise in which it is debarred, suspended, or otherwise prohibited from practice by any federal, state, or local agency, the Responder shall inform the Onset Fire District within one (1) business day of such debarment, suspension, or prohibition from practice.

ESS Group, Inc.  
Name of Responder: \_\_\_\_\_

404 Wyman Street, Suite 375, Waltham, MA 02451  
Address of Responder: \_\_\_\_\_

781.419.7696  
Telephone Number: \_\_\_\_\_

  
By: \_\_\_\_\_  
(Signature)

Charles J. Natale, Jr.  
Printed Name: \_\_\_\_\_

President & CEO  
Printed Title: \_\_\_\_\_

6/1/2021  
Date: \_\_\_\_\_

**Attachment B**

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**Certificate of Insurance**





ESSGROU-01

MVERTENTES

# CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)  
1/8/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

**IMPORTANT:** If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

<b>PRODUCER</b> License # 1780862 HUB International New England 222 Milliken Boulevard Fall River, MA 02721	<b>CONTACT NAME:</b> Amanda Pepin	
	<b>PHONE (A/C, No, Ext):</b> (508) 235-2274	<b>FAX (A/C, No):</b>
<b>E-MAIL ADDRESS:</b> amanda.pepin@hubinternational.com		
<b>INSURER(S) AFFORDING COVERAGE</b>		<b>NAIC #</b>
<b>INSURER A:</b> Nautilus Insurance Company		<b>17370</b>
<b>INSURER B:</b> Massachusetts Bay Insurance Company		<b>22306</b>
<b>INSURER C:</b> Key Risk Insurance Company		<b>10885</b>
<b>INSURER D:</b>		
<b>INSURER E:</b>		
<b>INSURER F:</b>		

**INSURED**

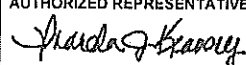
ESS Group, Inc.  
 404 Wyman Street Suite 375  
 Waltham, MA 02451

**COVERAGES**                      **CERTIFICATE NUMBER:**                      **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
A	<input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR  GEN'L AGGREGATE LIMIT APPLIES PER: <input checked="" type="checkbox"/> POLICY <input type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC OTHER:	X		ECP2007512	12/31/2020	12/31/2021	EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 100,000 MED EXP (Any one person) \$ 5,000 PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMP/OP AGG \$ 2,000,000 \$
B	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO OWNED AUTOS ONLY <input checked="" type="checkbox"/> HIRED AUTOS ONLY <input checked="" type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> NON-OWNED AUTOS ONLY			ADN7938577	12/31/2020	12/31/2021	COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$ \$
A	<input type="checkbox"/> UMBRELLA LIAB <input checked="" type="checkbox"/> OCCUR <input checked="" type="checkbox"/> EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DED      RETENTION \$			FFX2007514	12/31/2020	12/31/2021	EACH OCCURRENCE \$ 5,000,000 AGGREGATE \$ 5,000,000 \$
C	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	Y/N	N/A	KEY0139831	12/31/2020	12/31/2021	<input checked="" type="checkbox"/> PER STATUTE <input type="checkbox"/> OTH-ER E.L. EACH ACCIDENT \$ 1,000,000 E.L. DISEASE - EA EMPLOYEE \$ 1,000,000 E.L. DISEASE - POLICY LIMIT \$ 1,000,000
A	Professional Liab			ECP2007512	12/31/2020	12/31/2021	Each Claim 1,000,000
A	Pollution			ECP2007512	12/31/2020	12/31/2021	Each Claim 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

<b>CERTIFICATE HOLDER</b>  INFORMATION ONLY	<b>CANCELLATION</b>  SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.
	AUTHORIZED REPRESENTATIVE 

**Attachment C**

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**Key Personnel Resumes**





### Experience

ESS Group, Inc.: 2006 to present

Years of Prior Related Experience: 3

### Education

MS, Aquatic Resource Ecology and Management, University of Michigan, 2006

BA, Physical Geography, University of Illinois at Urbana-Champaign, 2000

### Professional Certifications

North American Lake Management Society – Certified Lake Manager

Society for Freshwater Science – Chironomidae and Eastern EPT Taxonomist

Alum for Phosphorus Control in Lakes and Ponds, 8-hour Workshop (2017)

40-hour OSHA HAZWOPER Training and 8-hour Supervisor Refreshers (through May 13, 2017)

Boat Massachusetts Boat Safety Certification

8-hour Offshore Water Survival Certification

SafeGulf Marine Safety Certification

### Affiliations

Rhode Island Environmental Monitoring Collaborative – Appointed Member (2013 to present)

### Qualifications

Mr. Ladewig is a Certified Lake Manager and ecologist with 15 years of experience in the monitoring, modeling, and management of aquatic ecosystems. He has completed studies on over 75 lakes and ponds for a variety of clients, including water suppliers, state and municipal governments, lake associations, and private landowners. Mr. Ladewig has also developed and implemented numerous surface water sampling, sediment testing, and biomonitoring programs for a wide variety of water resource projects.

Mr. Ladewig is an experienced taxonomist who has analyzed thousands of macroinvertebrate samples collected from freshwater and marine habitats in the Northeast, the Mid-Atlantic and the Bahamas. He holds certifications from the Society for Freshwater Science and oversees the ESS invertebrate taxonomy lab. Mr. Ladewig's taxonomic experience extends to a wide variety of other biological resources, including fish, birds, aquatic plants and a number of rare species.

In addition to his water resources work, Mr. Ladewig regularly completes field studies and environmental impact assessments associated with all phases of submarine cable, upland transmission, and renewable energy generation projects.

### Representative Project Experience

**Providence Water Supply Board – Moswansicut Reservoir Alum Treatment Monitoring and Oversight – Scituate, RI.** Project manager overseeing a sediment nutrient inactivation (alum) implementation program for Moswansicut Reservoir, a 286-acre reservoir. Following extensive study of five secondary reservoirs in the Providence Water reservoir network, ESS developed a long-term management plan for each reservoir. Due to excessive internal phosphorus loading and recurring cyanobacteria blooms, Providence Water elected to move forward with priority implementation of the management plan at Moswansicut Reservoir, which is located near Providence Water's primary source water reservoir. In response, ESS provided Providence Water with bid specifications to solicit competitive bids from highly qualified application firms. ESS continues to assist Providence Water with water quality monitoring, including operation of a real-time data buoy, to track the results of the nutrient inactivation program.

**City of Amesbury Department of Public Works – Permitting and Oversight of Buffered Alum Treatment at Lake Attitash – Amesbury and Merrimac, MA.** Permitting lead for a nutrient inactivation project designed to reduce the internal load of phosphorus to Lake Attitash. ESS

presented the project in front of the Amesbury and Merrimac Conservation Commissions and successfully obtained Orders of Conditions to proceed with the project. Additionally, ESS assisted the Department of Public Works with development of technical specifications for the Request for Proposals to implement the project. ESS also provided feedback to the City regarding the proposals submitted and assisted with contractor oversight. It is anticipated that the application of buffered alum to Lake Attitash will significantly reduce in-lake phosphorus concentrations and the occurrence of severe cyanobacteria blooms.



**US Environmental Protection Agency (US EPA) – National Aquatic Resource Surveys (NARS) National Rivers and Streams Assessment Fish Taxonomy Quality Assurance – Nationwide.** Project manager for task order providing taxonomic quality assurance for fish vouchers collected and field-identified as part of the 2018-2019 National Rivers and Streams Assessment. Adheres to a strict Quality Management Plan (QMP) to ensure compliance with the program-specific Quality Assurance Program Plan (QAPP) and Laboratory Operations Manual (LOM), and ultimately meet the data quality objectives of the NARS program. Participates in kick-off teleconferences with US EPA, state agencies, and other contractors, coordinates shipment and analysis of samples, and facilitates quality assurance review of laboratory data.

**Town of Westford – Development of Nutrient Budgets for Four Water Bodies, Westford, MA.** Designed and implemented a field program to identify key sources of nutrients for four Town-managed lakes. The results of the field program are being used to develop nutrient budgets for each water body and provide cost-effective prioritized recommendations for reducing and mitigating nutrient loads. Nutrient sources evaluated include stormwater, streamflow, groundwater and internal loading.

**Town of Norton – Design and Permitting of Lake Management Plans for Four Water Bodies, Norton, MA.** Project manager for the design and permitting of lake management plans for Winnecunnet Pond, Norton Reservoir, Chartley Pond, and Barrowsville Pond. The four ponds suffer from substantial infestations of exotic aquatic plants, including water chestnut, fanwort, Eurasian milfoil, and variable-leaf milfoil. Management programs for each pond were successfully permitted and implementation is currently underway. Winnecunnet Pond presented a significant management challenge, given its location within a designated Area of Critical Environmental Concern and state-listed freshwater mussel habitat, as well as the rapid flushing rate of the pond. The first granular fluridone treatment in Massachusetts state-listed freshwater mussel habitat was approved for Winnecunnet Pond and will be implemented as a pilot project.

**Town of West Tisbury – Stream Water Quality and Discharge Monitoring for the Mill Brook Watershed Assessment, West Tisbury, MA.** Assisted the Town of West Tisbury with the design and implementation of a baseline assessment of nutrient loading in the Mill Pond watershed. Also coordinated technical assistance from local project partners, including the Martha's Vineyard Commission and the Polly Hill Arboretum. A primary goal was to identify nutrient sources that may be negatively impacting water quality throughout the watershed and, ultimately, Tisbury Great Pond. Additionally, the study sought to collect continuous water level data to allow the quantification of water withdrawals and diversions from Mill Brook.

**Town of Concord, Development of a Watershed Management Plan for White Pond, Concord, MA.** Prepared a Quality Assurance Project Plan for the implementation of a comprehensive biological, groundwater, surface water and sediment sampling program at White Pond, a sensitive kettlehole pond and community resource with recurring algae blooms and declining long-term water quality trends. The results from these efforts were used to develop nutrient and hydrologic budgets and complete a watershed management plan with prioritized short- and long-term recommendations. Recommendations included in-pond, shoreline, and watershed management actions. The watershed management plan was presented at two public meetings.

**Town of Weymouth, Whitman's Pond Vegetation Management Action Plan, Weymouth, MA.** Completed a comprehensive Vegetation Management Action Plan for the Whitman's Pond Working Group, a town-appointed committee charged with task of identifying a restoration strategy for the 190-acre pond. Although Whitman's Pond suffers from excessive growth of invasive plants, sedimentation, and water quality impairments, it supports a significant run of anadromous alewife (*Alosa pseudoharengus*), provides diverse recreational opportunities for the public, and serves as a backup water supply for the town. The Vegetation Management Action Plan was developed to address the problems in Whitman's Pond while being protective of the multiple resources it provides to a diverse

group of stakeholders. Bathymetric and sediment isopach mapping, biological surveys (plants, fish, birds, and invertebrates), sediment sampling, water quality sampling, and hydrologic assessments were conducted to support the development of the Vegetation Management Action Plan. The final plan was presented to the town at a public meeting.

**Charles River Watershed Association, Wadeable Stream Biomonitoring Pilot Study. Five Watershed Locations, MA.** Worked with the client to develop and implement a macroinvertebrate biomonitoring pilot study targeting five wadeable stream locations in the Charles River watershed. Each study reach was assessed based on water quality, habitat, and the macroinvertebrate community using methods comparable to those used by the Massachusetts Division of Watershed Management. The client used the results of this study to provide comments on the biannual integrated assessment report for surface waters of the state. The report was also used to successfully obtain funding to continue the biomonitoring program.

**Massachusetts Department of Conservation and Recreation, Lakes and Ponds Program, Restoration of Flowering Pond. Newburyport, MA.** Analyzed the results of the algae sampling program and conducted a hydrologic analysis for pond drawdown. Provided a dredge feasibility analyses for Flowering Pond based on sediment isopach mapping and sediment physicochemical characterizations conducted as part of the project. The goal of the project is to restore the aesthetic and recreational attributes of Flowering Pond while maintaining its ecological value. ESS successfully obtained all local, state, and federal permits necessary for completing the dredging of Flowering Pond and oversaw the dredging operation. The challenges overcome in this project were large as the goal was to dredge wetland areas to create open water for the purpose of improving aesthetics. This was overcome through creative design that integrated a newly created wetland area along a portion of the pond's shoreline.

**Brooks Pond Conservation Association, Development of a Lake Management Plan. North Brookfield, New Braintree, Oakham, and Spencer, MA.** Led field program at Brooks Pond, including water quality sampling and aquatic macrophyte mapping. Developed a lake management plan with short- and long-term recommendations for maintaining the recreational and ecological assets of the pond. Also assisted the Brooks Pond Conservation Association and Town of North Brookfield with submittal of a proposal for grant funding under Section 319 of the Clean Water Act.

**Town of Concord, Development of a Lake Management Plan for Warner's Pond. Concord, MA.** Prepared a Quality Assurance Project Plan and collected sediment and water quality samples at Warner's Pond, a water body that is impacted by cultural eutrophication and infestations of multiple invasive species. The results from these efforts were used to develop a lake management plan for the pond to improve recreational opportunities while maintaining or improving ecological services provided by the pond.

**Mill Pond Committee, Development of a Pond Restoration Plan for Mill Pond. West Tisbury, MA.** Evaluated the economic and technical feasibility of various lake management options for the cost-effective restoration of Mill Pond, a small pond that is currently used for passive recreation and fishing. Recommended management actions for restoration of the pond included dredging of the southern basin to restore water volume and reduce a significant source of nutrients (internal recycling) as well as creation of a treatment wetland at the pond inlet to sequester nutrients sourced from the watershed.

**Massachusetts Water Resources Authority (MWRA), Aquatic Invasive Macrophyte Surveys. MA.** Project manager for the last six comprehensive annual surveys of aquatic macrophytes at ten source and emergency reservoir areas jointly managed by MWRA and the Massachusetts Department of Conservation and Recreation. Developed aquatic macrophyte monitoring and management plan that included an assessment of winter drawdown and other management techniques suitable for a public water supply. Compiled and updated the first comprehensive field guide to the aquatic macrophytes of the entire MWRA/DCR reservoir system.

**Northern Rhode Island Conservation District, Development of Lake Management Plans for Bowdish Lake and Smith and Sayles Reservoir. Gloucester, RI.** Prepared a Quality Assurance Project Plan (QAPP) for field surveys, including aquatic macrophyte mapping. Field data collected during this

effort were integrated with existing data on the lakes and their watersheds and used to prepare separate lake management plans for Bowdish Lake and Smith and Sayles Reservoir. Once approved these will be among the first lake management plans in the state. A comprehensive short and long term management strategy was developed to maintain the high water quality in each lake while controlling the growth of aquatic invasive weeds, including variable-leaf milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba caroliniana*).

**Town of Wellesley, Phytoplankton and Water Quality Monitoring of Morses Pond. Wellesley, MA.** Conducted monitoring of in-lake conditions at Morses Pond, a 103-acre lake within a highly urbanized setting. Responsibilities included water quality sampling and collecting Secchi disk readings and phytoplankton samples. Also provided rapid turnaround screening level identification of phytoplankton samples to detect incipient algae blooms that could impact recreational use at the pond. Analyzed water quality and phytoplankton data for final reporting.

**Rhode Island Department of Environmental Management (RIDEM), Characterization of Buckeye Brook Biological Impairment. Warwick, RI.** Collected and identified quantitative macroinvertebrate samples from six sites in the Buckeye Brook system and one reference site used in the annual statewide biomonitoring program for wadeable streams. Also collected and analyzed results of quantitative periphyton and particulate organic matter samples. Buckeye Brook is on the Rhode Island 303(d) list for biodiversity, *Enterococcus*, and fecal coliform impairments. Results of the study are being used to help identify potential sources of contamination within this highly urbanized watershed.

**Pawtuxet River Authority and Watershed Council (PRAWC) – Tiogue Lake Assessment – Coventry, RI.** Conducted plant mapping, water quality, wildlife, and invertebrate surveys and analysis in Tiogue Lake. The results of these surveys were used to assess the general condition of Tiogue Lake with regard to water quality, nuisance vegetation and other aquatic life, and to provide PRAWC and its partners with management recommendations that are compatible with ecological and recreation goals at the lake.

**Town of Hopedale, Diagnostic/Feasibility Study of Hopedale Pond. Hopedale, MA.** Led seepage survey of Hopedale Pond shoreline to evaluate potential groundwater sources of bacteria and nutrients. Also assisted with collection of dry weather surface water samples within the pond and at strategic locations within the watershed. Drafted several sections of the diagnostic/feasibility study report, such as management recommendations to control Canada goose overpopulation and associated nutrient pollution, fecal contamination, and general incompatibility with public uses at the pond. Additionally, developed a Canada goose pilot study to assess and evaluate the success of management options as they are adopted by the town.

**Housatonic River Natural Resource Damage (NRD) Fund, Enhancement of Housatonic River Public Access. Western MA.** Assessed hydrologic, geomorphic, and biological conditions at potential public access points along the Housatonic River to select priority sites (from a total of 41 locations) for construction of public access improvements. Conducted cross section surveys and discharge measurements at sites with the highest priority for public access. Also assessed high priority locations for the presence of rare, threatened, and endangered fish, mussel, and invertebrate species and their habitats. The assessment was based mainly on feasibility of access, ecological constraints and distance to the nearest existing river access point. Four access sites were successfully permitted and constructed.

**Massachusetts Department of Conservation and Recreation, Ponkapoag Golf Course, Water Supply Development and Ecological Monitoring. Canton, MA.** Conducts biological surveys for several state-listed butterflies, damselflies and dragonflies. Monitors water levels in Ponkapoag Pond and Bog in compliance with an Order of Conditions and Water Level Monitoring Plan issued by the Canton Conservation Commission. These efforts are conducted to preserve the fragile ecosystem of an Atlantic white cedar/emergent/scrub-shrub wetland.

**Rhode Island Department of Environmental Management (RIDEM), Cyanobacteria Monitoring and Statewide Stream Habitat Assessment and Biomonitoring.** Assists with management and execution of the state's new lake and pond cyanobacteria monitoring program. Manages the field effort for the

annual collection and identification of macroinvertebrates from 50 sites across the state of Rhode Island. Analyzes the habitat, water quality and macroinvertebrate community data. Additionally, participated in an August 2007 review of Rhode Island's stream biomonitoring program. The program is a multi-year assessment of all of the waters of the state and the data reports prepared by the ESS team are used to support the state's routine water quality reporting requirements (305 (b) Assessment) to U.S. EPA.

### Presentations

Ladewig, M. D. So Your Pond Has Issues...Now What? Save the Lakes Rhode Island Annual Workshop. April 2017. Johnston, RI.

Ladewig, M. D. Where's Walden? A Look at the Evolving Health of One of Massachusetts' Most Treasured Water Resources. Massachusetts Congress of Lake and Pond Associations Annual Workshop. April 2017. Westborough, MA.

Ladewig, M. D. Quantifying Pollutant Loads from Lake Shorelines Using Stormwater First-flush Samplers. New England Association of Environmental Biologists 39<sup>th</sup> Annual Meeting Joint with the New Hampshire Water/Watershed Conference. March 2015. Bartlett, NH.

Ladewig, M. D. and C.D. Nielsen. Use of Stormwater First-flush Samplers to Quantify Shoreline Pollutant Sources. New England Chapter of the North American Lake Management Society, 2014 Annual Meeting. June 2014. Storrs, CT.

Ladewig, M.D. and C.D. Nielsen. Inland Dredging for Enhancement of Habitat, Water Supply and Recreation. Presentation to the Army Corps of Engineers, New England District. April 2014. Concord, MA.

Ladewig, M.D. and C.D. Nielsen. Is Your Pond's Algal Bloom Harmful? Observations of Blue-green Algae in Southern New England. Massachusetts Congress of Lake and Pond Associations Winter Workshop. January 2013. Worcester, MA.

Ladewig, M.D. and C.D. Nielsen. The Ups and Downs of Winter Lake Drawdown as Part of a Long-term Invasive Weed Control Program in a Massachusetts Lake. New England Association of Environmental Biologists 34<sup>th</sup> Annual Meeting. March 2010. Newport, RI.

Ladewig, M.D. and C.D. Nielsen. The Benefits of Biomonitoring for Watershed Assessment. Charles River Watershed Association. June 2007. Weston, MA.

Ladewig, M.D. and M.J. Wiley. Estimation of Sediment Transport Rates in the Lower Muskegon River, Michigan. 48<sup>th</sup> Annual Conference of the International Association for Great Lakes Research. May 2005. Ann Arbor, MI.



## CARL D. NIELSEN, CLM Vice President and Director of Water Resources

### Experience

ESS Group, Inc.: 1998 to present

Years of Prior Related Experience: 8

### Education

MS, Fisheries and Wildlife,  
University of Missouri -  
Columbia, 1994

BA, Biology, Colgate  
University, 1990

Tufts University, Water  
Quality Modeling for  
TMDLs, 40-hr. Workshop,  
2001

### Professional Registrations and Affiliations

North American Lake  
Management Society –  
Certified Lake Manager  
(CLM)

New England Chapter –  
North American Lake  
Management Society

North American  
Benthological Society

Northeast Aquatic Plant  
Management Society

NAUI Open Water SCUBA  
Diver Certification

American Heart Association  
– CPR and First Aid

### Qualifications

Mr. Nielsen has over 28 years of experience in the assessment and evaluation of marine and freshwater ecosystems. Mr. Nielsen has worked extensively in identifying and understanding the ecology of most aquatic organisms including aquatic plants, algae, zooplankton, aquatic invertebrates, corals, fish, reptiles and amphibians. Mr. Nielsen is also actively involved in the restoration of aquatic systems and has worked to improve water quality and aquatic habitat conditions in numerous lake and river systems throughout New England. As part of these efforts, Mr. Nielsen regularly uses water quality data collected to develop customized scientific watershed models to assist in locating sources of pollution and to evaluate the potential effectiveness of a variety of watershed management strategies. Mr. Nielsen has been Senior Project Scientist for more than 200 aquatic resource studies which have been performed for numerous clients including: federal, state and local governments, municipal water districts, local lake and watershed associations, industrial facilities, property developers, major corporations, utilities, golf courses, ski areas, and airports.

### Representative Project Experience

**Town of Sandwich – Shawme Ponds Septic Leachate Study – Sandwich, MA:** Responsible for designing and implementing a groundwater sampling program for Upper and Lower Shawme Pond, waterbodies which were suspected to be influenced by infiltration of septic leachate from adjacent shoreline homes. Groundwater seepage quantity and quality was assessed through the use seepage meters and littoral interstitial porewater (LIP) samplers. Data analysis revealed that nutrient loading via groundwater is a significant annual source of nutrient to the ponds and therefore, management recommendations emphasized increased septic system maintenance, innovative septic system technologies and continued monitoring of in-pond conditions.

**MassDCR – Statewide Beach Bacterial Assessment for DCR Lakes and Ponds –** Mr. Nielsen was responsible for designing and conducting an

assessment to determine sources of bacterial impairment at nine Massachusetts freshwater beaches managed by MassDCR, including Walden Pond. The approach used innovative bacterial source tracking techniques including qPCR to identify sources of bacterial contamination using E.coli DNA to identify bacteria from cow, horse, pig, ruminant, dog, avian, gull, goose, and human sources. Samples were collected over five rounds and included dry and wet weather events. Bacteria at the sites were quantified and the fraction of contamination from the various potential sources was identified to enable DCR to more effectively target sources and to develop site-specific solutions for reducing bacteria and improving the overall health and safety at their beaches.

**Town of Groton – Diagnostic/Feasibility Assessment for Lost Lake and Knopps Pond –** Mr. Nielsen was responsible for designing and implementing a comprehensive assessment of Lost Lake and Knopps Pond in Groton, MA to identify potential sources of impairment. Work included assessment of groundwater, stormwater runoff, in-lake water and sediment quality, wildlife, and sampling in the upstream watershed. Mr. Nielsen developed a hydrologic and nutrient budget for each of the lakes and determined that stormwater was a major contributor to the water quality impairment at the lakes. Mr. Nielsen recommended additional stormwater sampling in the watershed, reducing erosion along the



shoreline of the lakes, and management of geese as solutions to be implemented. In addition, the potential to manage in-lake phosphorus through the use of an alum application was also recommended for Knopps Pond. Work is ongoing to implement these recommendations.

**Town of Hull – Straits Pond Monitoring and Management Plan – Hull, MA:** Mr. Nielsen worked to prepare Notice of Intent (NOI) for a larvicide application for controlling midges in a Straits Pond, a coastal pond in Hull, Massachusetts. Mr. Nielsen also prepared a MassDEP approved QAPP for pre- and post-larvicide application midge assessment based on a sampling designed that he developed. The sampling program included an assessment of midge densities at numerous locations within the pond along with the associated habitat and water quality parameters at each location. Management recommendations developed focused on efforts designed to control the degree of midge infestation and aquatic plant and algae growth that was detrimentally affecting the overall habitat quality of this tidally influenced pond. Mr. Nielsen received a Certificate of Appreciation from the President of the Straits Pond Watershed Association following a presentation made to the Town regarding this project.

**Wampanoag Tribe of Gay Head – Restoration of Herring Creek – Aquinnah, MA:** Mr. Nielsen managed a project to design and permit the stabilization of shoreline and hydraulic dredging of a tidal creek between two coastal ponds on the island of Martha's Vineyard that had infilled during hurricane Sandy. Funding for the project was through the US Fish & Wildlife Service. Mr. Nielsen's work supported the preparation of an EIS and included the filing of permits through the USACE 404, Chapter 91, MassDEP 401 Water Quality Certificate, MEPA ENF, and local wetland permit. This project was undertaken to restore and enhance herring migration and spawning. Project is currently under construction.

**Tiah Cove Dredging, West Tisbury, MA:** Mr. Nielsen is currently managing a project to design and permitting for a 5,000 cubic yard hydraulic dredging project in a coastal pond on Martha's Vineyard. Mr. Nielsen's work supported the initial project site assessment, development of the proposed design and preparation of permits through the USACE 404, Chapter 91, MassDEP 401 Water Quality Certificate, MEPA ENF, and local wetland permit. Work is currently ongoing.

**Narragansett Bay Commission – Midge Larvae Monitoring, Dye Flushing Study, and Management Recommendations for Bishop Cove. Seekonk River, RI:** Mr. Nielsen was responsible for the design and implementation of a study to identify the issues regarding a nuisance midge population associated Bishop Cove in the Seekonk River. The study included extensive sampling of midge larvae and their associated habitat over the 28 acre cove. In addition, a dye study was conducted to evaluate the patterns of tidal and river flushing within the cove to gain an understanding of how the water movement may be contributing to habitat conditions that were deemed favorable to midge production. Based on the study, Mr. Nielsen developed a list of recommendations for the Commission that have since been implemented and have resulted in the control of the nuisance midge issues that had formerly plagued the residents along the shore of the cove.

**Sconset Beach Preservation Association – Meiofauna Investigation – Nantucket Island, MA:** Mr. Nielsen performed an evaluation of meiofauna, the microscopic organisms present in sand, from the beaches of Sconset, Nantucket Island, Massachusetts to establish the long-term impact of an innovative beach erosion control system on biological resources. Results of the two-year monitoring program showed no significant impact to the meiofauna.

**Town of Walpole – Memorial Pond Dredge Design and Permitting – Walpole, MA:** Mr. Nielsen has worked with the Town of Walpole of several years to advance a major restoration project for the town from conceptual design through the design and permitting stages. Construction of this 23,000 cubic yard pond dredging and wetland restoration project is on schedule. Permits obtained included the USACE 404, the MassDEP 401 Water Quality Certificate, Chapter 91, a MA Environmental Policy Act (MEPA) certificate, and a local wetlands permit.

**MassDCR – Massasoit State Park Dredge & Beach Replacement Permitting – East Taunton, MA:**

Project Manager for engineering design and permitting to support dredging, beach replacement, and sediment re-use to restore and reopen swim beach after being closed for a decade. Client point of contact responsible for oversight and guidance of field work, engineering, dredge design, sediment sampling, wetland assessment, waterline delineation, wildlife habitat assessment, evaluation of sediment disposal options, and permitting. Federal, state, and local permitting includes MEPA ENF, NOI, MESA, SWPPP, 401 Water Quality Certification, USACE Section 404.

**Town of Wellesley – Multi-Year Limnological Monitoring of Morses Pond – Wellesley, MA:**

Project manager for the multi-year monitoring of in-lake conditions at Morses Pond, a 103-acre lake within a highly urbanized setting. Investigations to date have revealed infestation of the pond by Water Chestnut (*Trapa natans*), an exotic plant that can grow to nuisance levels. Additionally, algal blooms within the pond have become a concern. On-going monitoring and management recommendations are required to ensure proper protection of the Town's public beach.

**Town of Concord – White Pond BMP Design and Permitting – Concord, MA:**

ESS provided planning and engineering services for the preparation of soil erosion and sediment control BMPs to address recommendations highlighted in the White Pond Watershed Management Plan. The project involved advancing conceptual designs to permit-level and construction level designs, as well as facilitating the bidding process for the construction of the BMPs.

**Town of Concord - White Pond Limnological Investigation – Concord, MA:**

Mr. Nielsen was the Project Manager and lead scientist for a year-long study of this 50 acre kettle pond. The goal of the study was to identify sources of nutrients to the pond that were likely contributing to algal blooms and threatening water quality. ESS studied the pond to model hydrologic and nutrient inputs, utilized innovative sheet-flow stormwater sampling devices, and assessed groundwater inputs with seepage meters. Additional work focused on an extensive analysis of the history of the pond and development within its watershed. The report prepared now serves as the basis for the long-term protection and improvement of the system.

**Northern Rhode Island Conservation District – QAPP for Bowdish Lake and Smith and Sayles Reservoir – Glocester, RI:**

Project Manager and lead scientist directing development of the first two lake management plans for Rhode Island lakes. ESS worked closely with the client, the lake associations, and the RIDEM to prepare a QAPP for field surveys and conduct the assessments. Field data collected was integrated with existing data on the lakes and their watersheds in order to prepare separate lake management plans for Bowdish Lake and the Smith and Sayles Reservoirs. A comprehensive short- and long-term management strategy was developed in order to maintain the high water quality in each lake, while controlling the growth of aquatic invasive weeds, including variable-leaf milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba caroliniana*).

**MassDCR – Design and Permitting for Erosion Control BMPs at Myles Standish State Forest – Plymouth/Carver, MA:**

Project manager and lead scientist for a comprehensive evaluation of sediment sources and stormwater inputs to two sensitive lakes on state land. ESS provided erosion control design services at that included scientific assessments, such as including wetlands delineations and rare species assessments, and engineering design which was used in our permitting of the project and will be used for future bid document development by ESS.

**MassDCR - Long-term Restoration Plan and Permitting for Flowering Pond – Newburyport, MA:**

Project manager and lead scientist for a watershed and pond restoration project on state land. The goal of this restoration plan was to restore aesthetic and recreational attributes of the pond while maintaining ecological value. ESS implemented a bathymetric survey, performed aquatic plant mapping and sediment sampling, conducted water quality analysis, conducted a hydrologic modeling assessment for the watershed, and provided a dredge feasibility analyses based on sediment isopach mapping and sediment physicochemical characterizations. ESS also prepared engineering plans to support permit applications

for our work. Work has since been permitted by ESS and construction was performed and overseen by Mr. Nielsen.

**New England Interstate Water Pollution Control Commission (NEIWPC) – Mashapaug Pond Storm Water Evaluation – Providence, RI:** Project Manager and lead scientist for a pilot project that received federal funding by the US EPA to support development of a nutrient Total Maximum Daily Load (TMDL). The ESS team developed a detailed water quality assessment of the pond, including development of a Quality Assurance Project Plan (QAPP); assessment and survey of all tributaries, pipes, and apparent sources of pollution; delineation of the pond's watershed; a bathymetric survey; sediment analysis; and an analysis of species composition and coverage of the aquatic macrophyte community.

**Providence Water Supply Board – Limnological Studies of Ponaganset and Regulating Reservoirs – Gloucester and Scituate, RI:** Served as Project Manager and lead scientist for a limnological study to address water quality issues at Ponaganset and Regulating reservoirs in the Providence Water Supply system. ESS conducted watershed assessments, water quality surveys, groundwater seepage surveys, bathymetric mapping, and aquatic macrophyte mapping for both reservoirs. The water quality issues stemmed mainly from concerns over aquatic invasive species, land use density in the watershed, and shoreline encroachment.

**Providence Water Supply Board – Limnological Studies of Moswansicut, Barden, and Westconnaug Reservoirs – Scituate and Foster, RI:** Principal Director as Scientist for a limnological investigation at Moswansicut, Barden and Westconnaug reservoirs in the Providence Water Supply system. ESS conducted watershed assessments, water quality surveys, groundwater seepage surveys, bathymetric mapping, sediment sampling, biological surveys, and aquatic macrophyte mapping for all three reservoirs and issued separate reports on each. The objective of the studies was to characterize the current trophic status, identify the probability of “turning,” and provide specific management recommendations to maintain or improve the water quality of each reservoir.

**Town of Concord – Warner’s Pond Diagnostic/Feasibility Assessment – Concord, MA:** Project manager in charge and lead scientist for a comprehensive Diagnostic/Feasibility Assessment for Warner’s Pond. Prepared a Quality Assurance Project Plan and collected sediment and water quality samples at Warner’s Pond, a water body that is impacted by cultural eutrophication and multiple invasive species. The results from these efforts were used to develop a lake and watershed management plan for the pond to improve recreational opportunities while maintaining or improving ecological value provided by the pond.

**Town of Wrentham – Multi-Lake Diagnostic/Feasibility Assessment – Wrentham, MA:** Responsible for designing and conducting an assessment of the physical, chemical and biological characteristics of Lake Pearl, Lake Archer and Mirror Lake in Wrentham, Massachusetts in order to determine the cause of lake eutrophication. A key concern was the potential for the groundwater entering these lakes to be contaminated by septic systems within their watersheds. The investigation focused on answering this question through the use of seepage meters (to measure groundwater quantity) and littoral interstitial porewater sampling (to measure groundwater quality). Results from this study were used to evaluate the potential benefits of installing sewer lines through portions of the watershed.

**Quaboag and Quacumquasit Lake Association – Quaboag and Quacumquasit Long Term Management Plan Development and Implementation – Brookfield, East Brookfield, and Sturbridge, MA:** Mr. Nielsen worked with QQLA to develop a comprehensive Long Term Management Plan for the Quaboag and Quacumquasit lake system. The plan included efforts to improve water quality, reduce algal growth, and manage rooted weed growth. As part of these efforts, an extensive public education component was developed and advanced by Mr. Nielsen through the QQLA organization and with the three town Conservation Commissions.

**Town of West Brookfield – Tributary and Groundwater Assessment for Wickaboag Pond – West Brookfield, MA:** Mr. Nielsen was responsible for developing and overseeing a tributary and groundwater assessment program for Lake Wickaboag. Work was performed in accordance with a QAPP developed for the project and included water quality assessment and hydrologic and nutrient modeling. Recommendations made were included in a comprehensive study report.

**Lake Wickaboag Preservation Association– Lake Wickaboag – West Brookfield, MA:** Designed and implemented an evaluation of the quantity and quality of accumulated sediments within this large recreational waterbody. The lake has a long history of algal problems, which have been regularly controlled through copper sulfate treatment rather than by assessing the source of the nutrients that are causing the algal blooms. Concern was also raised that the copper may be accumulating to toxic levels in the sediments of the lake. Consequently, sediment quality was evaluated to determine its potential to influence in-lake water quality and to assess its potential to adversely affect the aquatic biota.

**Town of Brookfield – Non-Point Source Pollution Remediation at Quaboag and Quacumquasit Ponds – Brookfield, MA:** Responsible for managing a project to assist the Town of Brookfield in carrying out the variety of tasks associated with a large 319 Non-Point Source Grant that they received from EPA through the State of Massachusetts. The project included structural BMP design and implementation, public educations, evaluations of a flow barrier device for nutrient management, and a pilot program to evaluate the effectiveness of using artificially created boating channels to manage people’s perception of weeds at their lake rather than lake-wide herbicide application.

**Vespera, Inc., Darrow Pond Baseline Assessment – Nutrient Modeling and Long-Term Management Plan – East Lyme, CT:** Responsible for design and implementation of a pond study to establish baseline conditions at a pond in East Lyme, CT that was downgradient of an innovative Low Impact Development (LID) consisting of over 1,200 acres and 600 individual residences. Mr. Nielsen was responsible for modeling the benefits of LID vs. standard design runoff management practices and making additional recommendations for further enhancing the projects ability to infiltrate runoff and treat pollutants. The project is still currently in the permitting process.

**Town of Hopedale – Dredging Feasibility Assessment – Hopedale Pond, Hopedale, MA:** Mr. Nielsen is the project manager and principal scientist for an extensive pre-dredging evaluation of Hopedale Pond, a 35 acre mill pond in Hopedale, MA that is suffering the effects of eutrophication and in-filling from its watershed. A goal of the study is to evaluate the quantity and quality of sediment in the pond as well as to assess the nutrient, bacteria, and other water quality issues related to ongoing inputs from its watershed. The results of the study will be used to provide the town with management recommendations for restoring this pond to its former condition through dredging. Management recommendations will include a detailed description of existing sources of pollution from its watershed and conceptual engineering designs for solving these issues on a site-by-site basis. The Best Management practices (BMPs) that ESS will be recommending will be designed to be economical yet effective. A focus of the ESS strategy will be to implement or retro-fit Low Impact Design (LID) techniques into the existing watershed landscape.



### **Experience**

ESS Group, Inc.: 1998 to present

Years of Prior Related Experience: 9

### **Education**

MS, Geology, University of Massachusetts, 1992

BS, Geology, Juniata College, 1985

### **Professional Registrations and Affiliations**

Professional Geologist Registration, Pennsylvania (PG-002185-G; inactive)

Professional Geologist Registration, New Hampshire (No. 276)

National Groundwater Association - Association of Groundwater Scientists and Engineers

OSHA Hazardous Materials for Hazardous Waste Site Workers (40-hour training in accordance with 29 CFR 1910.120[e]), 1989, and annual refresher training

RI Water Resources Board, Water Allocation Program Advisory Committee, Out-of-Basin Transfer Committee, member, 2003-2004

Town of Upton, Water and Wastewater Advisory Committee, member, 2003-2008

RI Society of Environmental Professionals, Standards Committee, member, 2016 - 2017

### **Qualifications**

Mr. Hershberger's professional experience includes over 30 years of environmental consulting focusing on the assessment of impacts to soil, sediment and groundwater resources, hydrogeologic investigations and water supply feasibility evaluations, permitting and development. His experience emphasizes evaluation and quantification of hydrogeologic processes as related to groundwater flow and contaminant transport, aquifer remediation, aquifer yield, capture zone modeling for remedial design and wellhead protection, analysis of the fate and transport of contaminants in the subsurface and within freshwater and marine environments, assessment of natural degradation of contaminants and development of conceptual site models of hydrogeology and contaminant fate and distribution. Mr. Hershberger has significant experience at CERCLA NPL sites as the technical lead or project manager for the Remedial Investigation/Feasibility Study (RI/FS), Pre-Design and Remedial Action Implementation work phases at sites throughout New England. Project management experience also includes site investigations and feasibility evaluations under various state regulations, complex field investigation and sampling programs, and water supply development and groundwater resource assessments.

### **Representative Project Experience**

#### ***Federal CERCLA Superfund Sites, RCRA Site Investigations and Remediation***

**Confidential Client – Davis Liquid Waste Superfund Site, North Smithfield, RI.** Supervising Contractor (PM) and Senior Hydrogeologist for implementation of field activities, technical assessments and supporting regulatory actions and negotiations. Initial work included development and negotiation of the Pre-Design Work Plan, including compilation and evaluation of existing data and development of an initial conceptual site model. The pre-design investigation focused on evaluation of alternative remedial approaches acceptable to the PRPs and Agencies (USEPA and RIDEM). Extensive regulatory negotiations were subsequently conducted with USEPA, DOJ and RIDEM to support development of the Statement of Work (SOW) for Operable Unit No. 2 (Overburden Groundwater) and the scope for various supplemental investigations. Provided detailed technical, regulatory and budgetary support to the PRPs and actively participated in negotiations. The Consent Decree for OU-2 has been signed and the SOW has been implemented, including a detailed evaluation of bedrock groundwater conditions, wetland hydrogeology and surface water and sediment conditions to support an evaluation of remedial approaches for these media. Recent findings have been incorporated into a significant refinement of the Conceptual Site Model and used to support a comprehensive Human Health and Ecological Risk Assessment. This information has subsequently been used to support a groundwater fate and transport model and performance of a detailed Feasibility Study of potential groundwater remedial alternatives. A Proposed Plan and ROD Amendment in support of a proposed Interim Remedy at the Site have been issued.



**Housatonic Rest of River Municipal Committee – Technical Support, Negotiation of Settlement Agreement with EPA and General Electric, Rest of River Operable Unit, Housatonic River, MA.**

Provided technical support to Committee, which consists of representatives of five municipalities, and their legal counsel during negotiation of settlement agreement for Rest of River Operable Unit. Technical support focused on review of existing Project documents, evaluation of regulatory and technical constraints for the development of a local landfill for disposal of PCB-impacted soils and sediments, development of the design specifications for the landfill, and approaches to ensure that the most significantly impacted soils and sediments were managed at an out-of-state hazardous waste landfill. Attended negotiation sessions with Committee members, legal counsel, EPA staff, and representatives of GE. Provided review and comment on draft Settlement Agreement and supporting document summarizing approach for managing impacted soils and sediments and supported the Committee at public meetings to present the final Settlement Agreement. Subsequently provided technical review and comment on the draft 2020 Modification of the 2016 RCRA Permit and the associated Rest of River Statement of Work prepared by GE.

**Wilmington Environmental Restoration Committee – Technical and Regulatory Support, Olin Chemical Superfund Site, Wilmington, MA.**

Project Manager providing technical and regulatory support to the WERC through an Environmental Protection Agency (EPA) Technical Assistance Grant related to ongoing assessment and remedial activities at this CERCLA Superfund site. Support focuses on the nature and extent of groundwater impacts within the unconsolidated deposits and underlying bedrock and the presence of dense aqueous phase impacts (NDMA).

**Confidential Client – Savage Well Superfund Site, Milford, NH.** Designed and implemented a long-term aquifer pumping test to evaluate the hydrogeologic characteristics of a highly productive aquifer adjacent to the Souhegan River. The task also included the analysis and presentation of pump test data and aquifer characteristics and the development of recovery well capture zones to assist in the design of a groundwater pump and treat containment system for an extensive plume of VOC-impacted groundwater within a significant water supply aquifer.

***Hydrogeologic and Watershed Investigations***

**USEPA – National Aquatic Resource Surveys (NARS), Various.** Mr. Hershberger serves as the Quality Assurance Officer for ESS Group on the NARS 2 contract, including the following assignments, and also on the San Juan Watershed (Gold King Mine) Monitoring Program project.

**National Coastal Condition Assessment**

- Great Lakes Connecting Channels Research Project: Laboratory Analysis of Water Chemistry Samples
- Great Lakes Connecting Channel Research: Sediment Chemistry

**National Wetland Condition Assessment 2021**

- Algal Toxins Analysis

**National Aquatic Resource Surveys**

- Mercury Concentrations in Fish Plugs
- Development of Streamflow Duration Assessment Methods (Northern and Southern Plains; Northeast and Southeast)

**Aquarion – Watershed Assessments, Mianus and Rippowam Rivers, Stamford, CT.** Hydrogeologist supporting the Project Team in the evaluation of hydrologic conditions in these two watersheds which are part of the Aquarion Water Company water supply system. Developed streamflow estimates for various



locations within both watersheds for use as benchmarks for field-collected flow measurements. Also evaluated potential long-term streamflow gaging stations and assisted with the acquisition of property owner access. A subsequent task focused on a watershed-wide assessment of potential sources of PFAS in the finished water from the Mianus Reservoir.

**Town of Plymouth – Bartlett Pond Watershed Assessment – Plymouth, MA.** As task manager, assisted in the design and implementation of the first comprehensive assessment of Bartlett Pond and its groundwater and surface water watersheds. Also developed field sampling plan for the collection and analysis of surface water samples for PFAS and managed the watershed-wide evaluation of potential sources of water quality impairment.

After suffering a cyanobacteria bloom and high bacteria indicator counts in 2018, the Town of Plymouth commissioned a comprehensive study of 30-acre Bartlett Pond and its much larger watershed to assess and address the many management issues facing the pond. The water quality within the pond was also suspected to have played a part in frequent beach closures as the pond discharges through adjacent White Horse Beach. The Town was also concerned about any potential impact on water quality from anthropogenic sources, including PFAS and phthalates.

The findings of this Study and supporting nutrient modeling were used to develop a management and implementation plan that included prioritized mechanical, chemical, biological, and policy-based lake and watershed management recommendations. ESS also supported the Town by presenting the findings of the Project to the public at multiple meetings.

**Providence Water Supply Board – Limnological Evaluation, Scituate, RI –** Senior Hydrogeologist working with ESS ecological staff to develop and implement the assessment of the Scituate Reservoir, the largest potable water source in Rhode Island, focusing on the evaluation of the quantity and quality of groundwater discharges to the reservoir. Selected locations for seepage meter and LIP sampler measurements of groundwater inflow/outflow and groundwater quality in the littoral zone of the reservoir and assessed resulting data.

**Private Residential Developer – Hydrogeologic Investigation to Support Major Groundwater Discharge Permit Application, Cotuit, MA.** Project Manager and Senior Hydrogeologist for the performance of a hydrogeologic investigation performed to support the application for a Major Groundwater Discharge Permit for a combined wastewater treatment facility to serve a proposed 124-unit residential development. Designed and directed the subsurface investigation of the property and the groundwater modeling of the hydraulic impact of the proposed groundwater discharge. Technical activities also included evaluation of nitrogen loading and development of a water quality monitoring program. Work included presentation of findings at Town of Hyannis Zoning Board of Appeals hearings.

**Cat Island LLC – Environmental Impact Assessment and Hydrogeologic Investigation, Cat Island Beach Resort, Cat Island, The Bahamas.** Directly responsible for the assessment of baseline and proposed groundwater conditions and associated mitigation measures in support of the preparation of the Environmental Impact Assessment, and Environmental Management Plan. Provided senior technical leadership during the completion of subsurface investigations on the property in support of groundwater quality investigations, well yield assessments, and design of intake wells for the proposed reverse osmosis water treatment facility.

**Town of Westford – Drawdown Feasibility Assessment, Nabnasset Lake, Westford, MA.** Senior Hydrogeologist to determine the nature of impacts that could be anticipated as a result of a proposed winter lake drawdown for the purpose of controlling nuisance aquatic plants. The evaluation focused on potential adverse impacts to certain municipal water supply wells located proximal to the lake as well as other potential supply wells located on the lake.

**Town of Wrentham – Wrentham Lakes Study, Wrentham, MA.** Task Manager for the hydrogeologic assessment and evaluation of potential impacts to existing and proposed municipal water supply wells due to potential sewer installation. The scope of work included evaluation of available hydrogeologic information from the Town of Wrentham, the U.S. Geological Survey, and the Charles River Watershed Association; collection of groundwater samples from existing monitoring wells and two existing municipal supply wells to evaluate nutrient loading within the unconsolidated aquifer; evaluation of watershed characteristics in conjunction with the concurrent surface water assessment; preparation of a final technical report; and public presentation of findings.

**Village Crossing Residential Development – Application for a Major Groundwater Discharge Permit, Plymouth, MA.** Task Manager and Senior Hydrogeologist supporting the preparation of the application for a proposed development including a centralized wastewater treatment and disposal system designed for approximately 20,000 gallons per day. Project work included regional hydrogeologic research, identification of potential sensitive receptors, installation of observation wells to monitor groundwater elevations and determine site stratigraphy, physical laboratory testing of soil samples, predictive modeling of potential groundwater mounding, and preparation of a technical report to support the application to the MassDEP for a Major Groundwater Discharge Permit in accordance with Massachusetts regulation 314 CMR 5.00 (Ground Water Discharge Program).

**The Mayaguana Development Company – Study of the Water Quality and Aquatic Life Associated with Coastal Ponds and Embayments, Mayaguana Island, The Bahamas.** Responsible for the assessment of baseline conditions for the groundwater resources associated with the proposed project area and for preparing the corresponding sections of the Environmental Impact Assessment document for submission to the Bahamas, Environment, Science, and Technology Commission. The Project proposed is a boutique resort and associated utilities, marina, real estate development, airport improvements and community projects and involves development of three geographic areas (Flamingo Island/North Beach, Pirate's Well Creek/Northwest Point, and the Airport).

### *Water Supply Investigations*

**Friends of Herring River - Herring River Restoration Project, Wellfleet, MA.** Project Manager for the evaluation of potential sources of irrigation water for the proposed, re-designed golf course at the Chequessett Yacht and Country Club (CYCC). The course is being re-designed to mitigate potential impacts from the proposed restoration of the adjacent Herring River saltwater estuary. CYCC has also been experiencing elevated salinity in their irrigation supply, particularly during the latter months of the golf season. Extensive subsurface data collected by the U.S. Geological Survey was compiled and evaluated to prepare an updated conceptual model of hydrogeology and groundwater quality to identify preferred locations for the installation of additional irrigation water supply wells. Groundwater sampling was performed within the available USGS monitoring wells and long-term groundwater elevation data was also evaluated. A ranking system was developed that used the available data to rank locations based on hydrogeology, potential well yield and water quality. Recommendations for further assessment were provided based on the available data to address data gaps and allow for a prioritization of potential water source locations. An evaluation of the projected water demand for both the turf grow-in period and long-term operations was also performed to determine any local and state permitting needs.

**Town of Sharon – Hydrogeologic Evaluation of Potential Municipal Water Supply Sites, Sharon, MA.** Project Manager and Senior Hydrogeologist for the ongoing evaluation of potential water supply sites within the Town. The initial phase of the project consisted of the desktop evaluation of five potential well sites using MassDEP Site Screening Criteria. Based on the results of the initial phase and discussions with the Superintendent of Public Works and various Town boards, four locations were proposed for further evaluation. The second phase is currently underway, including test drilling and aquifer testing to develop comparable hydraulic data for each site. As the project has progressed, field investigations have

been performed to assess additional potential water supply sites. Developed and presented a matrix providing a summary of the information collected for each potential site and ranking the sites relative to each other to support decision-making by Town representatives. Based on the findings, the town has decided to move forward with state and local permitting of a new groundwater source. Initial permitting has been completed in support of the long-term testing of the proposed site which was completed in fall 2010. Data evaluation and modeling of zones of contribution to the proposed wellfield are ongoing.

**Covanta – SEMASS – Water Resources Permitting Support, Wareham, MA.** Managed the permitting of the transition of an existing potable water supply well to non-potable use. Work included obtaining approval for the increased withdrawal from the other existing potable supply well and submittal of the permit application to the MADEP for the associated distribution system modifications. This Project has been approved and completed. Also, prepared and submitted the application for the renewal of the Water Management Act permit for the ongoing groundwater withdrawals (potable and non-potable) at the facility, including communications with MADEP staff.

**Winchester Country Club – Water Management Act Permit Renewal, Winchester, MA.** Managed and coordinated the renewal of the Water Management Act that allows the country club to pump groundwater and surface water to provide irrigation water for the 18-hole golf course. Renewal process required coordination with golf course personnel, compilation of historic use records, evaluation of potential water demand for proposed golf practice facility, documentation of any modifications to the Water Conservation Program and development of a Seasonal Demand Management Plan. The permit renewal application has been submitted to the MassDEP. In 2020, WCC received a second Order to Complete from the MassDEP in support of the renewal of their water withdrawal permit. Mr. Hershberger managed the preparation of the response to the OTC and coordinated with MassDEP on the permit renewal.

**Club Motorsports, Inc – Potable Water Supply Investigation and Permitting, Valley Motorsports Park, Tamworth, NH.** Project Manger for the development of the potable water supply source(s) for proposed road course on 230 acres. Responsible for obtaining the necessary permit approvals from the New Hampshire Department of Environmental Services and design and implementation of technical and field assessments. Prepared for and represented project information at public meetings and hearings before the Tamworth Conservation Commission and Planning Board.

**Confidential Client – Cooling Water Source Investigation, Independent Power Project, Barre, MA.** Senior Hydrogeologist for the evaluation and investigation of potential sources of cooling water and potable water for a proposed power generation facility. Performed site reconnaissance and evaluated existing hydrogeologic information to assess and develop alternatives for water sources. Scoped and managed the implementation of subsurface drilling and testing programs to assess Site conditions, including baseline water quality. Developed planning-level cost estimates for the client for the permitting and development of potential water sources.

**MassDEP SARSS Program – New Source Approval of a Replacement Municipal Water Supply Source, Holbrook, MA.** Project Manager/Field Manager for New Source Approval. The reactivation of the Donna Road aquifer under Operable Unit 4 of the Record of Decision for the Baird and McGuire Superfund site is anticipated to replace the 0.31 million gallons per day of municipal water lost due to the contamination of the South Street Wellfield. Field activities included extensive surveying of surrounding land uses; installation of numerous exploration, observation, and monitoring wells; geophysical and bedrock fracture trace and fracture fabric analyses; installation of pilot production well(s); discharge water and groundwater sampling; and performance of a long-term aquifer pumping test. Project work also included temporary road design; preparation of draft bylaws and wellhead protection district documents; delineation of the zone of contribution (Zone II) of the proposed supply well; and preparation of documents to satisfy Massachusetts Division of Water Supply guidelines and regulations. Division of Water Supply approval of the source and the Zone II delineation was received in May 1994.

**Winchester Country Club – Irrigation Supply Project, Winchester, MA.** Assistant Project Manager and Hydrogeologist responsible for permitting and construction of the water supply component of an irrigation supply project that involved construction of a gravel pack water supply well adjacent to Upper Mystic Lake and associated appurtenances, dredging and lining of an existing on-site pond to provide adequate storage for irrigation water, installation of approximately 2,500 feet of piping and electrical feeds, and installation of a pump station. Permitting activities included Water Management Act permitting and reporting, associated wetland and biological monitoring, Wetland Protection Act permitting in Arlington and Winchester and subsequent water quality testing and reporting as required under the Order of Conditions for the project. In 2020, Mr. Hershberger coordinated the flow testing and redevelopment of this supply well and also evaluated the need to replace the well to ensure adequate capacity to meet the irrigation needs of the golf course.

**Winchester Country Club – Lake Sediment Assessment in Support of Wetlands Protection Act Permitting, Winchester, MA.** Task Manager and Hydrogeologist for an evaluation of sediment quality in the Upper Mystic Lake with regard to its potential impact on the quality of groundwater withdrawn from a proposed irrigation well located adjacent to the lake. Assisted in the design of the field sampling program, performed analytical modeling of the projected capture zone of the proposed pumping well and coordinated a contaminant fate and transport and risk evaluation of the potential for groundwater withdrawn through sediments of Upper Mystic Lake to mobilize metals contained in the sediments from upstream industrial properties and state- and federally listed disposal sites. All of the predicted groundwater concentrations were found to be less than the applicable MassDEP standards and other applicable risk thresholds. The predictions have been confirmed by the results of ongoing groundwater sampling from the existing supply well.

**Town of Littleton – Zone II Delineation, Littleton, MA.** Task Manager and hydrogeologist for the delineation of the Zone II area for the Spectacle Pond municipal supply well. The Zone II delineation was approved by the MassDEP.

**Rhode Island Water Resources Board – Water Supply System Management Plan database, RI.** Project Manager for the development of components of the database to facilitate data population and querying. The initial phase of the project included the development of a user interface to enable a user to query certain water supply information. The second phase of the project included the design of a comprehensive user-friendly data import tool to be distributed to Rhode Island's major water suppliers. This data entry tool was designed to assist the RIWRB with their proposed enhanced annual reporting goals.

## Professional Training

NGWA, 1991, Analysis and Design of Aquifer Tests

NGWA, 1994, Groundwater Flow and Mass Transport Modeling

NGWA, 1996, Natural Attenuation for Remediation of Contaminated Sites

NEWWA, 2000, Integrated Water Resource Management and Conservation

LSP Association, 2002, Principles and Field Techniques for Characterizing Contaminant Migration in Fractured Rock

NEWMOA, 2004, What Regulators Want: The Conceptual Site Model Approach

NGWA, 2005, Focus Conference on Eastern Regional Ground Water Issues

Fractured Rock Educational Services, 2007, Hydrogeology of Fractured Rock – Characterization, Monitoring, Assessment and Remediation

NEWMOA, 2008, Remediation of Chlorinated Solvent Sites

U.S. EPA/TIO, 2008, A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems

ITRC, 2010, Use and Measurement of Mass Flux and Mass Discharge

Microbial Insights, 2013, Case Studies Using Environmental Molecular Diagnostics

NGWA, 2013, BayState Groundwater Forum

EPA, 2014, Why Are So Many Groundwater Contaminant Plumes Persistent? Insight from Modeling and Characterization

EPA, 2014, Borehole Geophysics Applied to Bedrock Hydrogeologic Evaluations

SERDP/ESTCP, 2015, DNAPL Source Zone Management Approaches

Microbial Insights, 2015, An Integrated Approach for Deducing Degradation Pathways at Sites Contaminated with Chlorinated Ethylenes

NEWMOA, 2015, 1,4-Dioxane Assessment and Remediation

NEWMOA, 2017, Combining Technologies to Improve Remedial Outcomes

XDD Environmental, 2018, PFAS Properties, Remedial Options and Case Studies (2 Parts)

ITRC, 2018, Characterization and Remediation of Fractured Rock

EPA, 2019, PFAS Emerging Characterization and Remedial Technologies

Regenesis, 2020, PFAS Contamination in Minnesota: Lessons Learned, Fate and Transport and Reducing Exposure

Eurofin TestAmerica, 2020, PFAS: Advanced Discussion of Site Investigation Challenges and Best Practices

ITRC, 2020, Characterization and Remediation of Fractured Rock

EBC, 2021, EBC Annual Emerging Contaminants Seminar: PFAS – The Forever Chemical

NGWA, 2021, Applied PFAS Forensics: Beyond the Basics

### Publications and Presentations

"Hydrogeology and Water Resources of Shelburne and Colrain, Massachusetts", Masters Thesis, University of Massachusetts, 1992.

Finney, D.F., Hershberger, J.G., and Nangeroni, P.E., *Use of Angled Drilling Techniques to Characterize Fractured Crystalline Bedrock and Minimize Migration of Suspected Non-Aqueous Phase Liquids (NAPL)*, Proceedings - 2004 U.S. EPA/NGWA Fractured Rock Conference: State of the Science and Measuring Success in Remediation, September 13-15, 2004.

"Maximizing Water Use Potential Through Cost Efficient Hydrogeologic Studies", 8<sup>th</sup> Annual Regional Turfgrass Conference & Show, Providence, Rhode Island, March 9, 2005.

Bartos, Hershberger, Goulding and Breza, *Groundwater Flux Modeling of Chlorinated Compounds Through Metamorphic Fractured Bedrock in Rhode Island*, Poster Session, 2018 Battelle Chlorinated Conference.

Harms, Hershberger, *The Latest Info on 1,4-Dioxane*, EBC Emerging Contaminants Webinar, January 26, 2021.





## SCOTT DEHAINAUT SPATIAL DATA MANAGEMENT DIRECTOR

### Experience

ESS Group: 2016 to present

Years of Prior Related  
Experience: 30

### Education

BS, Geography, Southern  
Illinois University

### Applications & Software

ArcMap  
ArcCatalog  
3D/Spatial Analyst  
AutoCAD  
SQL Server  
Google (Earth, Maps, API)  
Javascript  
Access, Oracle, SQL Server  
HTML  
Python  
VBA

### Qualifications

Scott DeHainaut is a recognized expert in Geographic Information Systems (GIS) with more than 30 years of diverse training and experience in geospatial data management, analysis, and system design. This includes more than a decade developing GIS and data management systems at the municipal and county levels, and almost 2 decades supporting the use of GIS for environmental restoration and management. Mr. DeHainaut's expertise has an emphasis on ESRI applications and includes advanced spatial analysis, database management, GIS/CAD integration, visual impact assessments and simulations, and multimedia graphics presentations. Additionally, he brings experience in the development of client web portals and data collection using mobile platforms, as well as fluency in several programming languages which he leverages for data automation, integration, and analyses. At ESS, Mr. DeHainaut leads the company's technology advancement initiatives related to collecting and sharing georeferenced data, customized programming for analysis of complex multidimensional data sets, and the integration of data with graphics and visual presentations.

### Representative Project Experience

**Providence Water Supply Board – Limnological Assessment of Scituate Reservoir:** At 5.3 square miles in size Scituate Reservoir is the largest inland body of water in the State of Rhode Island and provides water to nearly 60% of the state's residents. Mr. DeHainaut helped develop the numerous GIS products and supporting datasets used in the assessment including detailed watershed analysis and a complex bathymetric analysis that incorporated both historic and current depth data.

**Clear River Energy, LLC – Burrillville, Rhode Island:** His involvement on this project included a variety of applications of GIS technology associated with environmental impacts and mitigation. He developed and performed numerous complex spatial analysis of wetland and riverine environments, and also introduced and supported the use of tablet-based technology that brought GIS into the field and significantly improved the options and efficiency of data capture.

**Davis Liquid Waste Superfund Site, Smithfield Rhode Island:** After acquiring and organizing a large collection of geology, hydrology, environmental, and infrastructure data he used GIS, CAD, and data management processes to develop a complex interactive 3-dimensional model to visualize the site's surface and subsurface environments.

**Winthrop Beach, MA:** For this dune vegetation mapping project he developed a unique integration of technologies that included form-based data collection on field tablets, and automated validation and report generation of the field data in almost real time. The results of this effort were significantly improved efficiency, quality, and turnaround time of the project's final products.

**US Wind – Maryland Offshore Wind Energy Project – Outer Continental Shelf, MD & Indian River Bay, DE:** Providing GIS support for a navigational risk assessment for the proposed development of a 750 MW offshore wind farm with an electrical interconnection at the Indian River Substation in Delaware. Additionally, providing services to support compliance with environmental conditions of the proposed Construction and Operation Plan (COP) and OCS lease during project construction and operations.

**North Bergen Liberty Generating Interconnection – North Bergen, NJ and New York City, NY:** Providing GIS support for the proposed 6.5-mile 345 kV submarine electric transmission line across the Hudson River.

**Poseidon Transmission Company, LLC - Poseidon Transmission Project, Licensing and Permitting – New York to New Jersey:** Provided GIS support for the proposed 80-mile transmission line project from Huntington, NY to South Brunswick, NJ, that involves both upland and submarine project segments. Responsible for GIS mapping associated with Topography, Local Streets, Alternative Cable Routes, Land Cover Designations, Soils, Potential Areas of Contamination, Wetlands, Critical Habitats, FEMA Flood Hazard Areas, Benthic and Shellfish Resources and Navigation.

**Silver Run Electric, LLC – Silver Run Project – Odessa, DE to Lower Alloways Creek Township, NJ:** Provided GIS support for the proposed Submarine Cable crossing of the Delaware River approximately 3-miles in length and an overland segment in Delaware approximately two miles in length.

**Nature Conservancy – Nasketucket Bay Oyster Reef Restoration – Fairhaven, MA:** Providing 3D analysis and visualization of the oyster reef restoration in Nasketucket Bay. ESS is preparing annual reports for 2016 and 2017 that portray reef distribution and depth, as well as summarizes and analyzes oyster distribution, growth rate, and survival data. The oyster reef restoration project is creating a permanent placement of eastern oysters on approximately one acre of sub-tidal sea floor. This will create a complex benthic habitat, improve water quality, and enhance the harvestable population of oysters for the public fishery in this embayment.

**AFCEC Joint Base Cape Cod – Environmental Remediation Program – MA:** GIS Manager and Functional Lead GIS/CAD/Graphics responsible for developing, maintaining, and extending GIS in support of the environmental remediation effort of the Air Force JBCC Program. Developed 3D terrain and subsurface models, as well as worked with engineers and other scientists to produce animations and unique graphic products to visualize the JBCC remediation effort. As the Group Functional Lead, he managed job efforts and established consistent standards between disciplines. He also developed numerous database and automation systems used on the JBCC and numerous other programs.

#### **Honors and Awards**

- Recognized as “Exceptional: in the Air Force’s 2011 Evaluation of Contractor Performance on the JBCC Program
- Air Force/Department of Energy Medallion for the JBCC Program
- Northeast Arc User’s Conference, First Prize, “Tree Screening and Wind Turbine Visibility”
- Northeast Arc User’s Conference, First Prize, “Air Force Groundwater Cleanup Progress”
- Northeast Arc User’s Conference, First Prize, “3D Visualization of Fuel Spill 28” Poster
- American Academy of Environmental Engineers, Grand Prize – Operations/Management



## Anna Chase Environmental Scientist & Taxonomist

### Experience

ESS Group: 2016 to present

Years of Prior Related Experience: 5

### Education

MS, Zoology, University of New Hampshire, 2015

BA, Biology and Environmental Studies, *Magna Cum Laude*, Honors in Biology, Bowdoin College, 2013

### Certifications

Society for Freshwater Science – Certified Taxonomist: Eastern Ephemeroptera, Plecoptera, and Trichoptera,

NAUI Certified Basic and Master SCUBA Diver

NASBLA Massachusetts Boating Safety Training

### Software

PC-ORD  
PRIMER-E  
IBM SPSS  
GraphPad Prism  
JMP  
Microsoft Excel

### Qualifications

Anna Chase holds an MS in Zoology and a BA in Biology and Environmental Studies with more than six years of professional experience. Ms. Chase performs and oversees field work, assists with experimental design, conducts data analysis, visualization, and research, prepares technical reports, and assists with permitting actions. She is also an experience freshwater and marine taxonomist. In addition to developing and presenting training sessions to lake associations and homeowners, Ms. Chase also provides internal training of field crews at ESS. She has supported a variety of projects, including numerous lake and pond restoration projects, hydrologic and water quality monitoring, and marine surveys.

### Representative Experience

**Massachusetts Water Resources Authority (MWRA) - Aquatic Invasive Macrophyte Surveys – Statewide, MA:** Task manager and field scientist for annual surveys of water quality and the aquatic plant community in several drinking water reservoirs throughout the state of Massachusetts. Provides internal training to ESS staff regarding implementation of the project's standard operating protocols and vessel decontamination and deployment. Also developed protocols for use of EXO 2 sonde, and coordinated fieldwork and data delivery to client. Analyzes results, creates figures, and prepares final report narrative on an annual basis.

**Hickory Hills Landowners, Inc. – Hickory Hills Lake Strategic Management Plan – Lunenburg, MA:** Developed monitoring and training program to improve the precision and accuracy of data collected by citizen science volunteers. Also planned and oversaw the collection of field data by ESS to support the development of a five-year strategic management plan. Assisting with the preparation of a final project report.

**Providence Water Supply Board – Limnological Studies of Five Reservoirs – Scituate, RI:** Assisted with development of survey plans. Conducted field work. Developed data and field work tracking spreadsheets and maintained databases of results from water quality sampling. Co-developed tablet-based field data acquisition forms to increase efficiency. Analyzed data (calculated discharge), created figures and tables for report.

**Town of Plymouth - Bartlett Pond Watershed Assessment – Plymouth, MA:** Planned and implemented collection of field data to support this major assessment of Bartlett Pond and its watershed. This included the deployment of multiple dataloggers in the pond and its tributary and outlet streams. Also supported project with data analysis and reporting.

**Town of Needham – Walker Pond Lake Management Planning Services – Needham, MA:** Collected water and surficial sediment samples for laboratory analysis and measured water quality parameters in the field. Conducted bathymetry and sediment depth surveys and mapped aquatic plants. Completed a habitat assessment, and wildlife surveys, including macroinvertebrate sampling and observations of vertebrates (birds and amphibians). Analyzed data and prepared final report for the client.

**Lake Quinsigamond Commission – Lake Quinsigamond Long-term Vegetation Management Plan Permitting – Shrewsbury, Worcester, and Grafton, MA:** Assisted with the preparation and filing of Notice of Intent applications to the Shrewsbury, Worcester, and Grafton conservation commissions seeking approval of the long-term vegetation management plan for Lake Quinsigamond. Conducted plant mapping and water quality sampling.

**MA DCR - Ware's Cove Aquatic Plant Management – Newton, MA:** Conducted post-treatment aquatic plant mapping in the Ware's Cove area of the Charles River to document the effectiveness of Sonar treatment for invasive fanwort and Eurasian Milfoil. Compiled results and prepared year-end report for MA DCR.

**Providence Water Supply Board – Scituate Reservoir Limnological Study – Scituate, RI:** Conducted regular water quality sampling within the Scituate Reservoir. Mapped the occurrence of aquatic plants throughout the reservoir, participated in sediment sample collection, and identified zooplankton. Deployed and monitored a NexSens cellular data water quality buoy, validated the calibration of dissolved oxygen, turbidity, and chlorophyll meters (RDOs, YSI EXO2). Conducted quarterly water quality sampling and stream discharge measurements at six tributaries within the Scituate Reservoir watershed. Managed the field and lab datasets for the project. Played a large role in preparation of the final report for the client, including data analysis, figure and table creation, and write-ups of methods and results.

**Providence Water Supply Board – Moswansicut Reservoir Monitoring and Alum Treatment Oversight – Scituate, RI:** Helped develop water quality monitoring protocol and conducted water quality sampling (field measurements and laboratory sample collection). Also deployed and monitored a NexSens cellular data water quality buoy and assisted with final reports on an annual basis.

**MA DCR – Walden Pond Stormwater and Erosion Control Project – Concord and Lincoln, MA:** Assisted with the preparation and filing of a Notice of Intent Application to the Concord Conservation Commission and a Request for Determination of Applicability application to the Lincoln Conservation Commission.

**NRRC, Inc. – Neponset Reservoir Access and Stormwater Management – Foxborough, MA:** Assisted with the preparation of a Notice of Intent application to the Foxborough conservation commission seeking approval of the Neponset Reservoir access and stormwater management plan.

**MA DCR - White Hall Pond Aquatic Plant Management Program – Rutland, MA:** Conducted post-treatment aquatic plant mapping to assess the effectiveness of endothall and triclopyr treatments of curly-leaf pondweed (*Potamogeton crispus*) and variable-leaf milfoil (*Myriophyllum heterophyllum*).

**Sand Dam Reservoir Association - Plant Mapping – Chepachet, RI:** Conducted an aquatic plant mapping survey in Smith and Sayles Reservoir, focused on delineating the extent of invasive variable-leaf milfoil beds within the pond.

**Town of Norton – Aquatic Plant and Wildlife Safe Zone Mapping – Norton Ponds, MA:** Conducted aquatic plant mapping and surveyed for wildlife habitat at multiple lakes and reservoirs both before and after application of herbicide to control invasive fanwort and milfoil.

**Town of Barrington – Brickyard Pond – Barrington, RI:** Assisted in the assessment of Barrington Pond, a small waterbody identified as eutrophic by the EPA. Field tasks included water quality sampling, sediment sampling, visual assessment of stormwater outfall locations and possible erosion sites, and waterfowl surveys.

**Nabnasset Lake Preservation Association – Nabnasset Lake Drawdown Monitoring – Westford, MA:** Conducted water quality monitoring and field surveys to determine the possible effects of a proposed winter lake water level drawdown on aquatic plants, freshwater mussels, and macroinvertebrates.

**Musketaquid Sportsmen's Club – Musketaquid Pond Aquatic Plant Monitoring – Concord, MA:** Conducted pre- and post-treatment surveys of aquatic vegetation in Musketaquid Pond to evaluate the effectiveness of herbicide treatments aimed at reducing the abundance of aquatic invasive plants.

**Town of Stoughton – Ames Long Pond Aquatic Plant Monitoring – Stoughton, MA:** Conducted a post-treatment survey of aquatic plants in Ames Long Pond to evaluate the effectiveness of herbicide treatments at reducing the abundance of invasive milfoil and fanwort.

**Massachusetts Department of Conservation and Recreation – Marshfield Ponds *Hydrilla* management survey – Marshfield, MA:** Conducted pre- and post-treatment aquatic vegetation surveys

at Magoun, Oakman, Hatch, and Mounce ponds to evaluate the effectiveness of herbicide treatments in decreasing the abundance of the invasive water weed *Hydrilla*.

**Massachusetts Department of Conservation and Recreation – Harold Parker Field Pond Plant Mapping – Andover, MA:** Mapped the occurrence of aquatic plants at Field Pond to evaluate the extent of invasive milfoil and fanwort growth prior to herbicide application. Also updated the five-year management plan, obtaining an extension to the OOC.

**Hatherly Country Club – Irrigation Improvement Project – Scituate, MA:** Conducted sediment depth mapping and collected sediment core samples in an irrigation pond at Hatherly Country Club as part of an irrigation improvement plan. The data collected will be used to inform dredging operations to deepen the irrigation pond, and site an adjacent desalination plant. Revisited site and conducted habitat assessment and water quality sampling of tidal creek and collected water quality samples.

**Lake Attitash Alum Treatment – Amesbury and Merrimac, MA.** Collected water quality samples and monitored contractor activities on site during an alum treatment at Lake Attitash. This was done to ensure compliance with permit conditions and provide the client with data regarding the effectiveness of the treatment.

**Providence Water Supply Board – Watershed Field Sampling and Analysis – Scituate, RI:** Quarterly sampling of seven surface waterbodies within the Scituate Reservoir watershed and two sources at the P.J. Holton Water Purification Plant for the presence of *Giardia* and *Cryptosporidium*. Assisted with processing and filtration of water samples.

**Narragansett Bay Commission - Bishop Cove Midge Monitoring – East Providence, RI:** Surveyed Bishop Cove, an area adjacent to the Bucklin Point water treatment plant, for the presence of larval life stages of nuisance midges after treatment of the area with a targeted larvicide. Prepared a report detailing study findings as part of ongoing monitoring to assess midge levels and recommend future actions to prevent midge population growth.

**New Hampshire Department of Environmental Services (NHDES) – Wetland Macroinvertebrate Sample Analysis – Statewide, NH:** Provided sorting, taxonomic identification, and enumeration of macroinvertebrate samples collected from multiple wetlands in New Hampshire in 2016 and 2017. These samples were collected and evaluated in support of New Hampshire's Wetlands Monitoring Strategy.

**Wilcox and Barton – Guilford Commons Stream Monitoring – Guilford, CT:** Provided sorting, taxonomic identification, and enumeration of benthic invertebrates collected from nine rock basket samplers deployed within Spinning Mill Brook each year. Created figures, calculated macroinvertebrate community metrics, and prepared report providing habitat monitoring information after construction of a retail property adjacent to the brook.

**Massachusetts Department of Conservation and Recreation – Flowering Pond Dredging Environmental Monitoring – Maudslay State Park, MA:** Provided sorting, taxonomic identification, and enumeration of freshwater macroinvertebrates from samples obtained through sediment grabs and net sweeps in 2016 and 2017. The results of this project were used to inform plans for restoration dredging to remove excessive sediment within Flowering Pond.

**US Environmental Protection Agency (EPA), Streamflow Duration Assessment Methods (SDAM), Great Plains and Eastern US:** Supports field visits to stream sites in the Great Plains and Eastern US as part of EPA's SDAM program. Also provides identification of aquatic invertebrates collected from stream locations. This is part of EPA's program to develop a rapid protocol for the assessment and classification of streamflow duration (e.g., ephemeral, intermittent or perennial). The protocol calls for the analysis of a number of different factors, including hydrologic, biological, and geomorphic.

**Multiple Towns – Connecticut MS4 and Industrial Stormwater Sampling and Reporting – Various Towns, CT:** Conducted MS4 and industrial stormwater field sampling for towns including Rocky Hill, Enfield, Windsor, Simsbury, and Vernon in 2016, 2017 and 2018. Gathered field observations and reported laboratory results in required formats.



- Experience** Keith Pilgrim has 23 years of experience on projects involving surface water quality, including monitoring and analysis of a wide range of systems. Examples of Keith's relevant experience include:
- Invention of a stormwater treatment method that uses spent lime to remove phosphorus and metals. Study was completed as part of a US EPA Section 319-10 Nonpoint Source Grant (project ID #7132). Study included bench scale testing, full scale system design and construction, and monitoring. Full scale system is still in operation in St. Paul, Minnesota and has high rates of phosphorus removal.
  - Part of the team that developed a sand filter that is augmented with elemental iron to remove dissolved phosphorus from stormwater. This system has proven to be effective at phosphorus as well as metals removal.
  - As part of a National Academies Sciences National Cooperative Highway Research Program, Keith is currently investigating the use of iron-sand filters to remove metals from highway runoff. This study includes a bench-scale laboratory investigation and a field component that includes storm event monitoring, flow monitoring, in-situ pH and dissolved oxygen monitoring (continuous), and water level monitoring. Data are still being collected and analyzed, however, the intended outcome is a determination if ferric oxide can be used to effectively treat metals in highway runoff and to develop design guidance.
  - Sediment sampling of dozens of Minnesota lakes to identify the phosphorus content and speciation of lake sediment.
  - Extensive experimental design experience: Have developed numerous experiments for a wide range of studies involving wetland sediments (e.g., for Douglas County Soil and Water District), lake sediments to examine the phosphorus binding capacity of a lake sediment treated with alum (e.g., Three Rivers Park District), aquatic toxicity of industrial dischargers (several industrial clients), and media for stormwater treatment (for the Ramsey Washington Metro Watershed District).
  - Developing one-dimensional lake models for approximately a dozen lakes to determine the source and sinks on nutrients in water bodies and the effect of nutrients on algal blooms. An example of these projects includes:
    - Performing one-dimensional water-quality modeling and conducting lake and runoff monitoring to evaluate the causes of high phosphorus and frequent algal blooms in Long Lake in Oakdale, Minnesota. Treated lake sediments with alum to inhibit internal loading and will use mechanical mixing to improve oxygen in the water column. Tools used in the study include the chemical-speciation program MINEQL+ and the water-quality model DYRESM-CAEDYM.
  - Developing a three-dimensional model to evaluate needed treatment for an artificial water body in Dubai. Modeled nutrients, salinity, temperature, and phytoplankton.
  - Developing three-dimensional hydraulic and complete ecological model of Ford Lake in Michigan to evaluate the potential benefits of artificial aeration on dissolved oxygen levels and phytoplankton growth in the reservoir.



**Education**      PhD, Water Resources Science, University of Minnesota, 2002  
Masters of Environmental Management, Duke School of Environment, 1995  
BA, Biology, Gustavus Adolphus College, 1992  
BA, Financial Economics, Gustavus Adolphus College, 1991

**Publications**

Hockett, D.; D.J. Lober; and K. Pilgrim. 1995. Determinants of per capita municipal solid waste generation in the Southeastern United States. *J. Env. Manag.* Vol. 45: 205-217.

Pilgrim, K. and P. Brezonik. 2005. Treatment of lake inflows with alum for phosphorus removal. *Lake and Res. Manag.* Vol. 21(1):1-9.

Pilgrim, K. and P. Brezonik. 2005. Evaluation of the potential adverse effects of lake inflow treatment with alum. *Lake and Res. Manag.* Vol. 21(1):78-89.

Pilgrim, K.; Huser, B.; and P. Brezonik. 2007. A method for comparative evaluation of whole-lake and inflow alum treatment. *Wat. Res.* Vol. 41: 1215-1224.

Huser, B. and K. Pilgrim. 2014. A simple model for predicting aluminum bound phosphorus formation and internal loading reduction in lakes after aluminum addition to lake sediment. *Wat. Res.* Vol. 53: 378-385.

Bartodziej, W., Blood, S., and K. Pilgrim. 2017. Aquatic plant harvesting: an economical phosphorus removal tool in an urban shallow lake. *J. Aquat. Plant Manage.* 55: 26-34.

**Attachment D**

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**Organizational Chart**



**ESS TEAM ORGANIZATIONAL CHART  
KEY PERSONNEL**

