

**TOWN OF PLYMOUTH CAPITAL IMPROVEMENT PLAN REQUEST  
FY24 FALL ANNUAL TOWN MEETING**

<b>Department:</b> Marine and Environmental Affairs	<b>Priority #:</b>	2
<b>Project Title and Description:</b> Savery Pond Groundwater Flow Model	<b>Total Project Cost:</b>	\$32,800

**Department/Division Head:** David Gould

**Check if project is:**    New ☒    Resubmitted ☐      **Cost estimate was developed:**    Internally ☐    Externally ☒

**For project re-submittals, list prior year(s):**

**List any funding sources and amounts already granted:** Environmental Affairs Fund

Basis of Estimated Costs (attach additional information if available)			If project has impact on 5 Year Plan and future operating budgets, insert estimated amounts.		
Capital:	Cost	Comments	Fiscal Year:	Capital	Operations & Maintenance
<i>Planning and Design</i>	\$32,800		FY23		
<i>Labor and Materials</i>			FY24		
<i>Administration</i>			FY25		
<i>Land Acquisition</i>			FY26		
<i>Equipment</i>			FY27		
<i>Other</i>					
<i>Contingency</i>					
<b>Total Capital</b>	\$32,800				

**Project Justification and Objective:** \_\_\_\_\_

Employ UMASS Amherst's Plymouth groundwater flow model (recently developed as part of the Plymouth saltwater intrusion study) to simulate surface-water/groundwater interactions in the Savery Pond System. The goal of this effort would be to develop a tool to allow the predictive investigation of alternative management scenarios and their effect on pond and groundwater levels.

**For Capital Project Requests:**

Will this project be phased over more than one fiscal year? If yes, enter it on the 5 Year Plan      Yes ☐      No ☒  
Can this project be phased over more than one fiscal year?      Yes ☐      No ☒

**For Capital Equipment Requests:**

☐ Check if equipment requested is replacement and enter the year, make & model, VIN and present condition of existing equipment

**What is the expected lifespan of this new/replacement equipment:** \_\_\_\_\_

**Attach backup information, estimates, or justification to support this request.**

# Savery Pond Conservancy

August 2, 2023

David Gould, Department Head  
Department of Marine and Environmental Affairs  
Town of Plymouth  
26 Court Street  
Plymouth, MA 02360

## **Re: Letter of Support for Savery Pond Management Plan Implementation - Groundwater Flow Modeling**

Dear Mr. Gould,

The Savery Pond Conservancy (SPC), a Plymouth-based 501(c)(3) nonprofit corporation that has been engaged in addressing harmful algal blooms and revitalizing Savery Pond over many years, strongly supports the proposal to apply the Plymouth Groundwater Flow Model to improve understanding of hydrologic interaction between groundwater and Savery Pond and assess water resource management strategies. As many are aware, Savery Pond has proven quite vulnerable to changes in groundwater flushing and nutrient inflows. The balance between clean groundwater flushing through the pond vs. nutrient (phosphorus) loading to the pond dictates the potential for algal blooms. While we have made recent advances in addressing the problem of algal blooms, the pond is still vulnerable and understanding this balance plays a key role towards identifying management alternatives geared towards keeping the pond healthy and safe. In addition, the proposed modeling project will serve as a case study as to how the Plymouth Groundwater Flow Model can be applied to other Plymouth ponds to develop management alternatives.

SPC supports Town funding of this proposal and we intend to contribute to the project. We commit to \$2,000 in cash donation along with \$3,000 of in-kind hydrologic services to support the modeling effort. Our in-kind support will include compilation and provision of hydrologic data collected on the pond over the last decade, technical input during model refinement and application, and (if requested) running the updated model to perform simulations of interest to the Town. SPC president Peter Schwartzman is a licensed hydrogeologist who has led the data collection, published Savery Pond technical reports (see our website: [www.saverypond.org](http://www.saverypond.org)), and is an experienced groundwater modeler capable of working with the refined model.

Thank you for the opportunity to support development of this important tool for managing Plymouth ponds and our precious water resources.

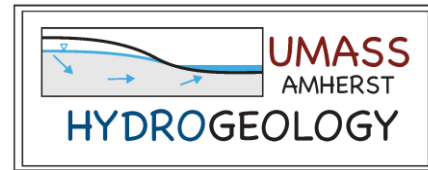
Sincerely,  
**Savery Pond Conservancy Board of Directors**



**Peter Schwartzman**  
SPC President



**Application of the Plymouth Groundwater Flow Model to Improve Understanding of Hydrologic Interaction Between Groundwater and Savery Pond and Assess Water Resource Management Strategies**



**Revised August 1, 2023**

**Dr. David Boutt, Professor, University of Massachusetts-Amherst**

**Detailed Savery Pond Scope - 1:**

**Objective:** Employ UMASS Amherst's Plymouth groundwater flow model (recently developed as part of the Plymouth saltwater intrusion study) to simulate surface-water/groundwater interactions in the Savery Pond System. The goal of this effort would be to develop a tool to allow the predictive investigation of alternative management scenarios and their effect on pond and groundwater levels. A calibrated model would update elements of any watershed plans, such as estimated groundwater flushing (i.e. dilution of nutrient loading and impacts on pond temperature) and "zone of contribution" of groundwater to ponds. Similar methodology developed for the Savery Pond modeling study could be applied to other ponds of interest in the Town of Plymouth

**Deliverables:**

A technical report describing objectives, methods, and results including digital files from the calibrated model and predictive scenarios and related metadata.

**Scope:**

1. Review existing information about Savery Pond groundwater, surface water, and water quality including:
  - a) Hydrologic data compiled by Savery Pond Conservancy (SPC), including surveyed groundwater elevations, outlet stream elevation, time-series streamflow measurements and time-series pond level measurements
  - b) Water-quality data compiled by SPC and Town of Plymouth Department of Marine and Environmental Affairs (DMEA) to better understand nutrient loading issues
  - c) Information from neighboring Town wells (construction, geologic logs, pumping history, predicted future withdrawals)
  - d) Hydrologic interpretation presented in SPC technical reports, including water levels & streamflow" (2019), "East Bog" characterization (2020), and bathymetric survey (2017)
  - e) Savery Pond Watershed Plan (TMDL Solutions, 2022) and other relevant documents
2. In-person tour/kickoff meeting and Scope Refinement
  - a) Pond tour presented by SPC and DMEA to observe key hydrologic features
  - b) Kickoff meeting with DMEA and SPC to:

- i. Ensure that all available data have been identified
    - ii. Understand stakeholder concerns
    - iii. Discuss realistic predictive modeling scenarios
  - c) Scope revision as needed
- 3. Refine the model grid locally to obtain increased resolution
  - a) Increase resolution of grid
  - b) Update model representations of pond and streams using U.S. Geological Survey “MODFLOW” modeling packages, such as “streamflow routing” and “lake” packages
  - c) Update modeled local aquifer occurrence and properties
- 4. Calibration to documented conditions
  - a) Adjust model parameters using PEST to improve model fit to local conditions and define sensitivity of model results to reasonable ranges of model parameters
- 5. Predictive model scenarios
  - a) Investigate influence of nearby pumping on pond flushing and stream outflow
  - b) Evaluate how lowering the outlet elevation of the stream would affect pond flushing and stream outflow (short term and long term)
  - c) Preliminary exploration on how changes in groundwater flushing of the pond could affect the nutrient (phosphorus) balance and pond temperatures
- 6. Technical memorandum
  - a) Draft technical memorandum
  - b) Web meeting to receive comments
  - c) Document finalization
- 7. Project Management
  - a) Contracting and invoicing
  - b) Model progress check-in web meetings (2)
  - c) Provision of digital deliverables with metadata

#### **Costs for Savery Pond Scope:**

##### **A. Direct costs (\$34,800)**

- Postdoctoral Groundwater Modeler: \$27,000
- Research Technician: \$5,000
- Model License: \$2,000
- Travel to field site: \$800

*Direct costs to be split by DMEA (\$32,800) and SPC (\$2,000)*

##### **B. In-Kind Contributions (\$6,500)**

- Dr. Boutt: \$3,500
- SPC (data compilation and applied model simulations performed by licensed hydrogeologist [Peter Schwartzman]): \$3,000