



University of Massachusetts Dartmouth
The School for Marine Science and Technology



Scope of Work

Technical Support for the Town of Falmouth

Mill Pond/Green Pond Nutrient Management Testing

May 1, 2021

I. Overview

The Coastal Systems Program at SMAST is pleased to submit the following scope of work to the Town of Falmouth to add PRB Piloting to the Water Quality Monitoring and Restoration Assessment of Mill Pond (East Falmouth). Multiple removable surface water PRB's will be installed in cranberry bog creeks up-gradient from Mill Pond and tested for nutrient removal efficacy. The Town of Falmouth Water Quality Committee and CSP-SMAST scientists are working together to formulate a cost-effective restoration plan for Mill Pond. The Town of Falmouth Water Quality Committee has taken steps toward restoration, during summer 2020, through the completion of a macrophyte harvest and deployment and monitoring of a pond-aeration system. One other project being considered to lower nutrient levels for the restoration of the Mill Pond ecosystem is the implementation of a horizontal, submerged, permeable reactive barriers (PRB) in the upstream bog system connected to Mill Pond by Backus Brook. However, data from a PRB Pilot installation is needed first.

As part of the decision and restoration process, CSP-SMAST was asked by the Town of Falmouth to provide this Scope of Work detailing the monitoring activities, which need to be conducted to determine the effectiveness of horizontal PRBs for improving ecosystem health by reducing high levels of eutrophying nutrients travelling from Backus brook into Mill Pond. Initially two PRB's (~20 ft in length) will be deployed horizontally on removable frames in the lower cranberry bog discharging to Mill Pond. The system is modular and will be expanded based upon initial results. The PRB's allow flow over and under but do not impede stream flow but allow nitrate+nitrite and orthophosphate movement into the PRB matrix. CSP-SMAST will monitor the water flow volume and N and P load moving into and out of the PRB deployment area to determine removals and also nutrient loading into Mill Pond from Backus Brook and water quality of the pond itself, to maintain the baseline monitoring of the multiple nutrient management actions being tried by the Town. Water quality monitoring data will provide information to the Town of Falmouth Water Quality Committee as to the effectiveness of the restoration solutions implemented and guide restoration solutions.

This diagnostic assessment project will be under the direction of Dr. Brian L. Howes, Director of the Coastal Systems Program at SMAST-UMD and Elizabeth Ells, Ph.D. Candidate.

II. TECHNICAL SCOPE

Task 1 – Pilot Testing of N & P Removal by Surface Water PRB's from Cranberry Bog Waters Discharging to Mill Pond and the Green Pond Estuary

In order to quantify the effects of a new PRB approach to nutrient removal from Backus Brook into Mill Pond, water quality sampling of surface water inflows to Mill Pond will be conducted biweekly for the duration of implementation of the horizontal PRB. Water samples will be assayed by the Coastal Systems Analytical Facility to be consistent with prior Mill Pond monitoring and PondWatch data. Volumetric flow will be measured weekly with an electromagnetic flow meter and also monitored using autonomous gauges. Periodic water sample both up-gradient and down-gradient of the PRB will be used to assess N and P removal, while discharge to Mill Pond and Mill Pond itself will also be monitored, although Mill Pond will only be sampled monthly, and Mill Pond inlet and outlet sampled biweekly. PRB specific assays will be sampled at least biweekly, but more frequently depending on results.

Nutrient samples will be analyzed for nitrate+nitrite, ammonium, dissolved organic and inorganic nitrogen, particulate nitrogen and carbon, total phosphorus, ortho-phosphate, and chlorophyll-a. The PRB should be most effective in removing Nitrate+nitrite and ortho-phosphate. This task focuses on collecting water samples and flow volumes (flow meter and stage record) for determining the N and P loads into Mill Pond throughout the Mill Pond restoration project area and to determine the effectiveness of the horizontal PRB in lowering N and P loads to the pond.

Results will be synthesized as to PRB effectiveness in a brief Technical Memorandum and a presentation to the WQMC if requested. Data will be transferred to the Town of Falmouth in EXCEL format.

Project duration 1 year from contract amendment.

Task 1. Total Cost = \$7,000