Stony Brook Streamflow Restoration Plan: Final Report

Stony Brook Flow Restoration Project

Water Management Act Grant Fiscal Year 2020

June 2020

Submitted by

Littleton Water Department
Westford Water Department
Geosyntec Consultants

With technical support from

Comprehensive Environmental Inc.

Prepared for (and with support from)

Massachusetts Department of Environmental Protection

Table of Contents

Appendices

List of Tables

List of Figures

1. Introduction

1.1 Background

The Massachusetts Department of Environmental Protection (MA DEP) has identified Westford Water Department (WWD) and Littleton Water Department (LWD) water supply source sub-basins in the Merrimack Basin as highly impacted by groundwater withdrawals; specifically, as Groundwater Withdrawal Category 5, Biological Category 5, and August Net Groundwater Depletion greater than 25 percent. As such, WWD and LWD will need to minimize the impact of existing withdrawals to "the greatest extent feasible" to meet groundwater regulations through development of a minimization plan. These impacted sub-basins are primarily located in northern Littleton and Westford, within the Stony Brook watershed, which contain water bodies frequently experiencing periods of low flow.

In fiscal year 2018 (FY2018), WWD, LWD, Geosyntec Consultants, and Comprehensive Environmental, Inc. (CEI) were awarded a grant under the Water Management Act (WMA) entitled the "Stony Brook Flow Restoration Project" to develop a Streamflow Restoration Plan (SRP) to assess opportunities for improvement of streamflow in Stony Brook. These efforts to restore streamflow in the Stony Brook watershed aim to mitigate impacts of groundwater withdrawals, consistent with goals of a minimization plan required as part of the MA DEP regulations. Specifically, the SRP evaluated if coordinated low flow releases from a series of impoundments along Stony Brook could be made to improve the timing, magnitude, and duration of streamflow to mimic natural conditions without compromising in-lake uses (e.g. recreation, ecology, and other uses). The SRP included the development of a regional surface water model and the installation of two continuous streamflow monitoring stations (in addition to four existing streamflow monitoring stations installed in 2017 as part of the DAM Dashboard Pilot Project[1]) to collect data in real-time and make the data accessible via online dashboards. Based on the modeling results, recommended operational strategies (e.g., open or close a sluice gate or remove or replace a stop-log) were developed for the flow control infrastructure (e.g., dams) at each impoundment and email alerts were setup from the online dashboard tool, DAM Dashboard, to inform stakeholders when to initiate such strategies.

WWD and LWD, in partnership with Geosyntec, then prepared another successful WMA grant application to secure funding needed to further refine and improve the recommended operational strategies and evaluate additional strategies to reduce groundwater withdrawals in the watershed. Addendum 1 to the SRP was prepared to document the approach and results of these additional analyses included as part of the FY2019 Stony Brook Flow Restoration Project. In FY2020, the Project Team was awarded funding from the Massachusetts Division of Ecological Restoration (DER) to continue this project by implementing and quantifying the benefits of operational strategies and planning additional strategies to mimic natural hydrology in the watershed. The scope of work of the FY2020 Stony Brook Flow Restoration Project (the "Project") included implementation of the SRP through continuous monitoring and evaluation of low flow releases at Forge and Spectacle Ponds, revision of preliminary rating curves after collection of additional stream gaging data, and planning for future project expansion and potential equipment automation. Addendum 2 to the SRP was prepared to document the approach and results of these additional analyses included as part of the FY2020 Stony Brook Flow Restoration Project.

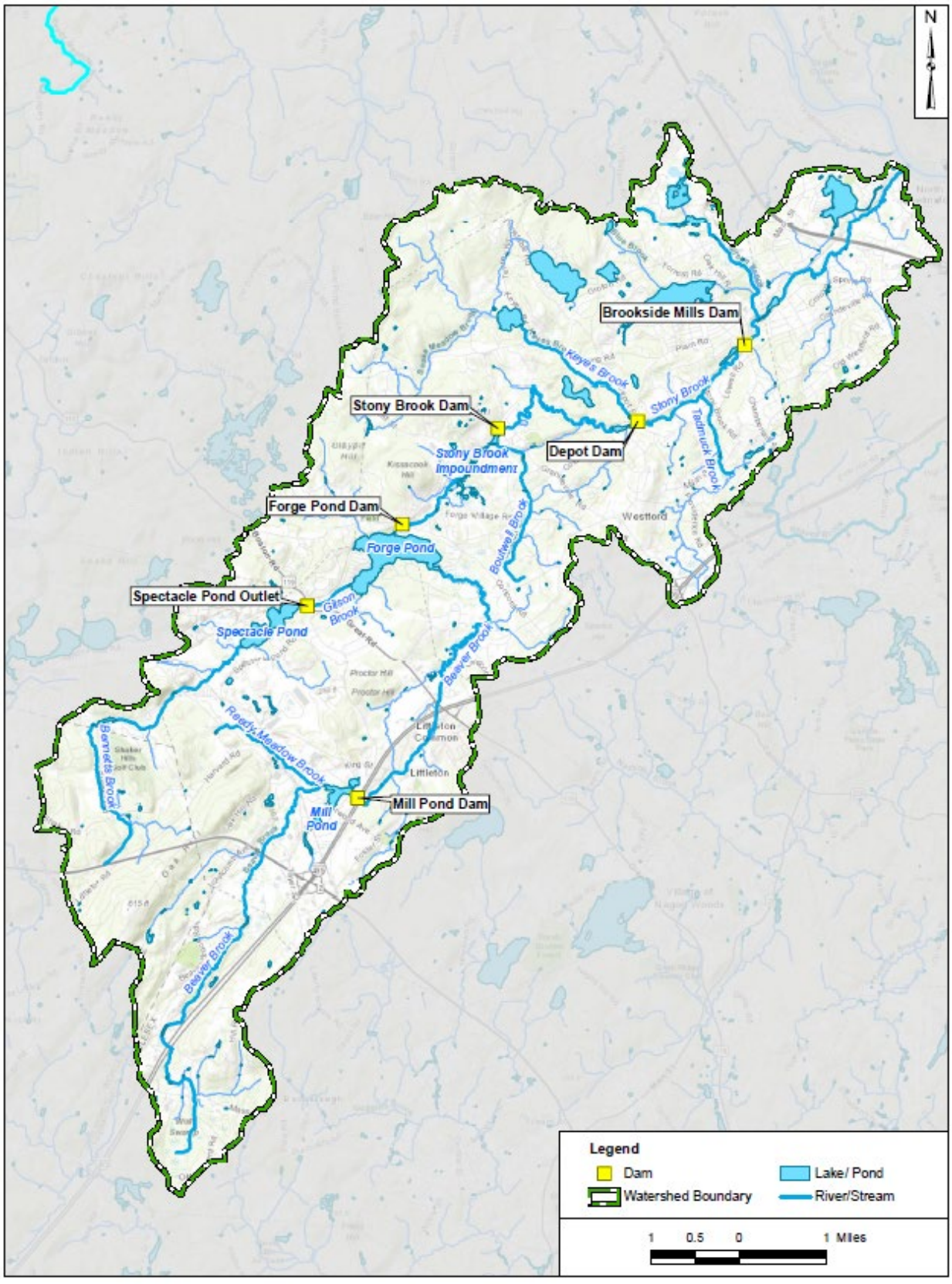
1.2 Current Project

In FY2020, WWD, LWD, Geosyntec, and CEI were awarded another grant under the WMA to continue the development and implementation of the Stony Brook SRP. Two of the previous study impoundment areas remain the primary study areas in this phase of work including: Spectacle Pond Outlet and Forge Pond Dam (also referred to as Abbot Mill Dam). See **Figure 1** for a map of the study area. This report has been prepared to summarize the results of this Project, including the following sections:

[1] The DAM Dashboard Pilot Project was a previous study conducted in 2017 by LWD and Geosyntec Consultants where continuous streamflow monitoring equipment was installed at Forge Pond and Spectacle Pond. Decision support dashboards were created for stakeholders to view data collected in real-time, but the dashboards did not feature the email notifications developed in the FY2018 Stony Brook Flow Restoration Project. The data collected at the monitoring stations over the time between the DAM Dashboard Pilot Project and the FY2018 Stony Brook Flow Restoration Project was used to calibrate model results for the FY2018 Stony Brook Flow Restoration Project.

- Creation of a Low Flow Release Protocol and Stakeholder Engagement Plan to provide a framework for conducting low flow releases at Spectacle and Forge Ponds, including how to provide notifications to the public and interested stakeholders (**Section 2**);
- The feasibility of extending the study area from the towns of Westford and Littleton into the town of Chelmsford (**Section 3**);
- The feasibility of several retrofit options for the existing outlet controls at the Forge Pond Dam to more reliably manage streamflow and upstream impoundment levels (**Section 4**);
- Submission of permit applications to obtain authorization of low flow releases (Spectacle Pond and Forge Pond) and Seasonal Drawdown (Spectacle Pond) (**Section 5**); and
- A summary of the two stakeholder meetings held to solicit feedback on the current project activities (**Section 6**).

Figure 1: Study Area



2. Low Flow Release Protocol and Stakeholder Engagement Plan

To plan for future releases at Spectacle Pond and Forge Pond, Geosyntec developed a Low Flow Release Protocol and Stakeholder Engagement Plan (see **Appendix A**), which provides a framework for conducting the releases at each location, including how to provide notifications to the public and interested stakeholders. The outline of the Stakeholder Engagement Plan was presented to Stakeholders on April 21, 2020, to give stakeholders an opportunity to provide feedback on what to include in the plan, which has been incorporated into the final document. The low flow release protocol generally includes the following information, noting that the individual details may be adjusted in the future to optimize low flow releases as data from releases are collected:

- Requirements to be met prior to initiating a low flow release;
- Instructions on how to perform the releases at both Spectacle and Forge Ponds (e.g., open valve, remove stop logs); and
- The monthly target flow rates established downstream of both Spectacle Pond and Forge Pond.

The low flow release protocol flow charts for Spectacle Pond and Forge Pond are shown in **Figures 2** and **3**, respectively.

Figure 2: Spectacle Pond Outlet Low Flow Release Protocol

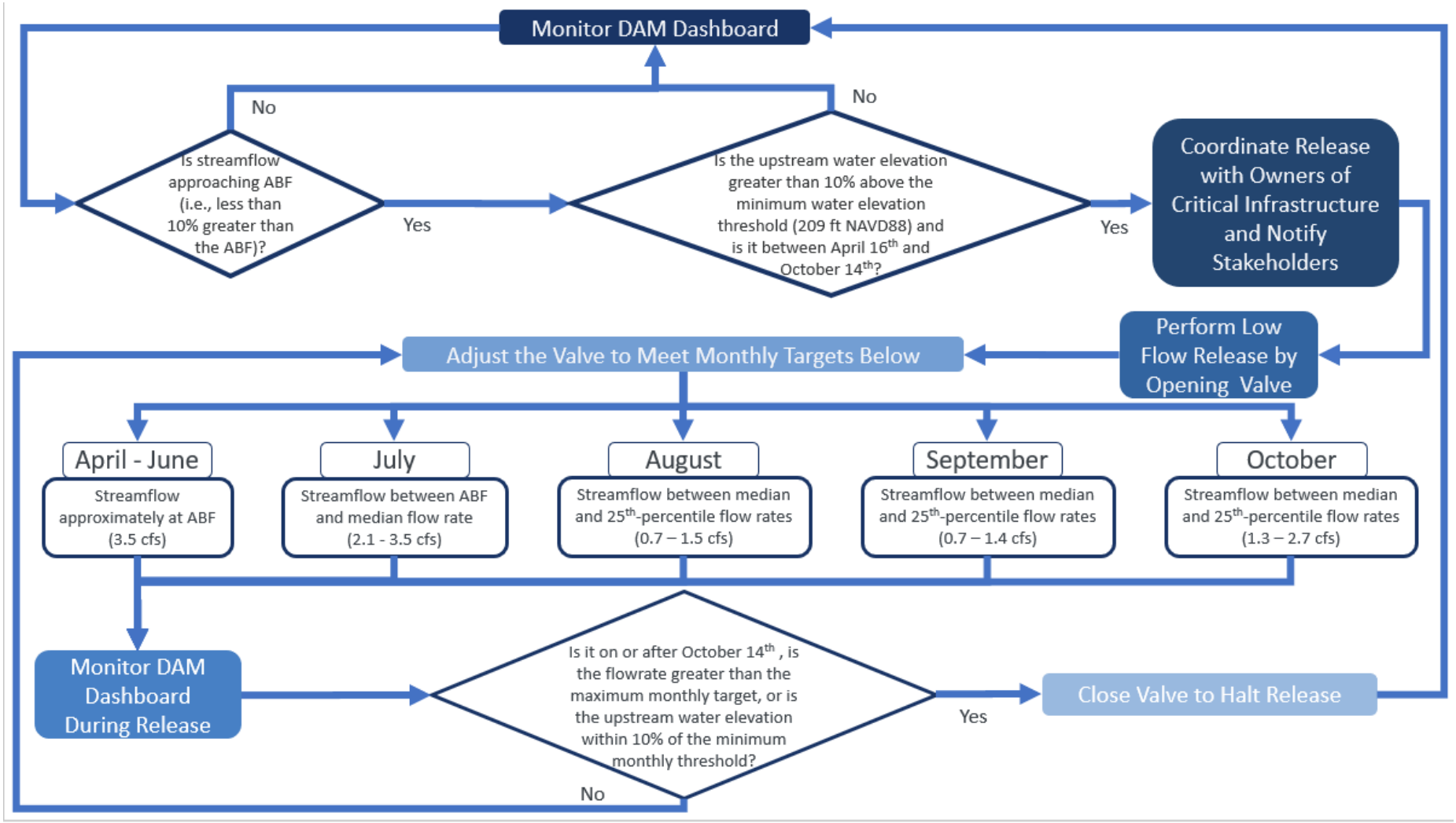
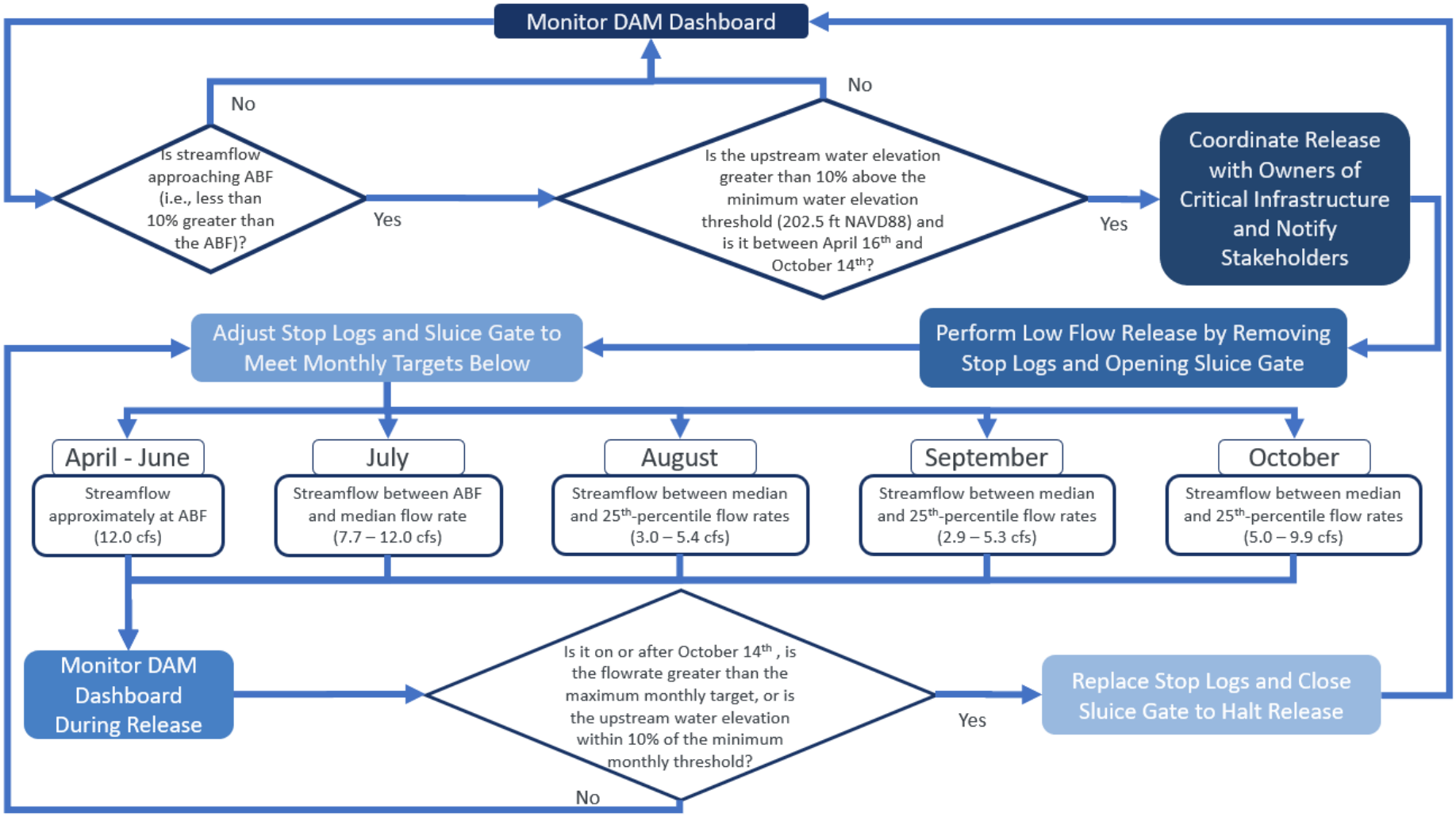


Figure 3: Forge Pond Dam Low Flow Release Protocol



Additionally, the stakeholder engagement section of the document includes the following information:

- Who to notify prior to planned low flow releases, such as owners of critical infrastructure, town management, and residential abutters of the ponds;
- How to notify each group of stakeholders (e.g., emails, letters, Project website);
- What information will be provided to stakeholders in original notifications and Project updates (see below), including potential impacts to the ponds during low flow releases and the expected duration of releases;
- The roles and responsibilities for notification of stakeholders and performing the low flow releases; and
- The plan for continual stakeholder engagement, including outreach through lake association annual meetings and email distribution lists, a Project website, and/or social media posts.

The information that will be included in the original notifications (e.g., emails or letters to abutters of Spectacle and Forge Ponds, Town Conservation Commissions, Town Management) to stakeholders will include:

- The anticipated period that low flow releases will be performed from April 16th to October 14th;
- The potential impacts of low flow releases, including the upstream pond level decreasing and the downstream flow increasing;
- The benefits of the low flow releases, including the improvement of aquatic life habitat, the focus on minimizing impacts to recreational uses, and improved water management; and
- A reference to the Stony Brook Flow Restoration website for individual release information, an opportunity to provide feedback, and points of contact.

The information that will be provided on the Stony Brook Streamflow Restoration Project website will include:

- All of the information detailed above that is included in the original notification;
- Release-specific information, including when a low flow release is expected to begin and end and the expected depth to which the upstream pond level may decrease, if available; and
- Contact information to submit comments and feedback.

The deliverable for this task included a Low Flow Release Protocol and Stakeholder Engagement Plan report that is provided in **Appendix A**.

3. Study Area Expansion

During previous phases of this project, two dams along Stony Brook were investigated within the town of Chelmsford to determine whether they could be retrofitted for future low flow releases as part of this Project. Based on this assessment, one of the dams was deemed potentially feasible for this use and preliminary discussions with the Chelmsford Water District (CWD) were initiated. Under this current scope of work, additional time was included to prepare materials and meet with CWD, Chelmsford management, and stakeholders to provide an overview of the Project, discuss the potential benefits to Chelmsford, and outline a strategy for retrofitting the Chelmsford dam for inclusion into the project. However, due to the coronavirus (COVID-19) pandemic and because Chelmsford staff are deciding internally whether they are interested in participating in this project, these meetings could not be held. Instead, Geosyntec prepared preliminary slides that can be used for future discussions with Chelmsford if they are interested in participating (see **Appendix B**).

The deliverable for this task was intended to be meeting minutes from the planned meetings with Chelmsford staff and stakeholders (up to three meetings). As mentioned above, these meetings could not be held and therefore the deliverable has been modified to only include the preliminary slides developed for future conversations (**Appendix B**).

4. Forge Pond Automated Controls Evaluation

CEI performed an evaluation of potential options to retrofit the existing outlet controls at the Forge Pond Dam. Retrofit goals are to make it easier for Project stakeholders to reliably manage streamflow and upstream impoundment levels. This evaluation included a discussion with the owner of the Abbot Mill, a review of historical information, and an assessment of the following factors:

- Constructability;
- Power availability;
- Permitting; and
- Potential costs.

Based on this evaluation, it was determined that retrofit of both control structures (i.e., sluice gate control structure and auxiliary outlet structure, see **Figures 4** and **5**, respectively) is feasible. The auxiliary outlet structure could be replaced with a new aluminum sluice gate. One timber sluice gate from the sluice gate control structure could be replaced with a new aluminum sluice gate. Aluminum sluice gates could be controlled by the following options:

- A manually operated handwheel;
- A locally controlled electric actuator; or
- A remotely controlled and automated electric actuator.

Figure 4: Forge Pond Dam and Sluice Gate Control Structure

Figure 5: Downstream of Forge Pond Dam and Auxiliary Outlet

The deliverable for this task included a summary memorandum of the evaluation (see **Appendix C**). The potential planning level cost estimate for each option ranges from $60,000 to $150,000. Given the relatively high implementation costs for all options, it is likely only feasible to retrofit one of the outlet control structures. The summary memorandum therefore recommends that future efforts consider implementation of an electric actuator paired with installation of a new sluice gate at the sluice gate control structure. If additional funding is available, these efforts may also consider automation through OptiRTC or SCADA.

5. Long-Term Low Flow Release Permitting

The purpose of the permitting task was to obtain authorization of seasonal low flow releases (Spectacle Pond and Forge Pond) and Seasonal Drawdown (Spectacle Pond). Spectacle Pond and Forge Pond both span multiple towns. Approvals were therefore required in the Towns of Westford (, Forge Pond), Littleton (Spectacle Pond, Forge Pond), and Ayer (Spectacle Pond). Massachusetts Wetland Protection Act (WPA) notice of intent (NOI) approvals were required for each Town. Additionally, a Massachusetts Endangered Species Act (MESA) review and Massachusetts Division of Fisheries and Wildlife (DFW) review were performed relative to potential impacts to rare species habitat (i.e., Blanding's Turtle) and fish habitat.

Note that the original grant scope of work assumed that approvals for Spectacle Pond would only be required in the Town of Littleton. After completion of MassDEP review, it was determined that a separate NOI would be required for the Town of Ayer, as a small portion of Spectacle Pond is located in Ayer. Additionally, the original scope of work included preparation of permitting applications for the Chelmsford Dams; however, Chelmsford staff are still deciding internally whether they are interested in participating in the project. Chelmsford permitting activities were therefore shifted to prepare a NOI for Ayer. The Ayer NOI was submitted on June 25, 2020. Future efforts will involve attendance at a public hearing to obtain approval.

Refer to **Table 1** for a summary of permitting activities performed for the Project, including a description of actions performed, status, and required steps to maintain authorizations. Refer to **Appendix D** for copies of all submittals and approvals.

Table 1: Summary of Permitting Activities

Required Approval	Description	Actions Performed	Status	Key Thresholds
MESA Review	Massachusetts Endangered Species Act (MESA) review through Natural Heritage & Endangered Species Program (NHESP) for rare species habitat (i.e., Blanding's Turtle) within Forge Pond and Spectacle Pond.	Application submitted on May 11, 2020	Approved. Letter of "No Take" obtained on June 4, 2020. NHESP File No. 19-38594.	Must perform drawdown (Spectacle Pond) and low flow releases during Blanding's Turtle active season (**April 16 - October 14**)
DFW Review	Massachusetts Division of Fisheries and Wildlife Review (DFW) relative to protection of fisheries for seasonal drawdown at Spectacle Pond. *(Does not apply to low flow releases given minor water level fluctuation range and previous authorization of Forge Pond drawdown per an Order of Conditions in October 2018).*	Letter submitted April 23, 2020	Approved. Letter of "No Objection" obtained on May 1, 2020	Must follow timing guidelines required by NHESP and guidelines from the Final Generic Environmental Impact Report[2] (GEIR) on Eutrophication and Aquatic Plant Management in Massachusetts (e.g., drawdown range, timing, downstream flow thresholds). GEIR guidelines are addressed in all Notice of Intent Submittals (per below).
WPA Review, Littleton	Massachusetts Wetland Protection Act (WPA) Notice of Intent (NOI) for low flow releases (Spectacle Pond, Forge Pond) and seasonal drawdown (Spectacle Pond).	• NOI submitted May 12, 2020 • Public Hearings attended June 1, 2020 and June 15, 2020	Approved. Order of Conditions (OOC) Obtained June 19, 2020. MassDEP File No. CE 204-0912.	OOC expires five years from issuance. Actions must be performed in accordance with NOI project description and OOC Conditions.
WPA Review, Westford	Massachusetts Wetland Protection Act (WPA) Notice of Intent (NOI) for low flow releases (Forge Pond).	• NOI submitted May 11, 2020 • Public Hearing attended June 10, 2020	Approved. Order of Conditions (OOC) Obtained June 25, 2020. MassDEP File No. 334-1747.	OOC expires three years from issuance. Actions must be performed in accordance with NOI project description and OOC Conditions. Note: Permission was asked for a five-year period. As of June 26, 2020, the Commission is considering amending the OOC for a five-year period.
WPA Review, Ayer	Massachusetts Wetland Protection Act (WPA) Notice of Intent (NOI) for seasonal drawdown (Spectacle Pond).	• NOI submitted June 26, 2020 • Public Hearing **TBA**	Pending attendance at future public hearing. MassDEP File No. CE 100-0447.	Pending attendance at future public hearing.

[2] Generic Environmental Impact Report on Eutrophication and Aquatic Plant Management in Massachusetts (GEIR): https://www.mass.gov/doc/final-generic-environmental-impact-report-main-document/download

6. Meetings and Reporting

The first stakeholder meeting was held virtually on April 21, 2020. The purpose of the first stakeholder meeting was to share the results of the previous Project evaluation (i.e., rating curve updates, release data evaluations, Spectacle Pond automation controls), to review the current Project tasks, and to gain insight from stakeholders on what to include in the Stakeholder Engagement Protocol, which was used in the development of this plan. The second stakeholder meeting was held virtually on June 23, 2020. The purpose of the second stakeholder meeting was to share updates and results of the current Project tasks, as well as to provide an opportunity for discussion with stakeholders. Both presentations are included in **Appendix E**.

The results of the tasks above are summarized in this report to satisfy this task's final report deliverable requirement.

7. Next Steps

After completion of the tasks above, the Project Team recommends the following tasks to be completed in the future to continue the development and implementation of the Stony Brook Flow Restoration Project:

- Collect elevation measurements or survey the installed monitoring equipment relative to adjacent infrastructure (e.g., spillway) to calibrate the DAM Dashboard readings;
- Perform low flow releases and collect and analyze data to modify the release protocol in the future;
- Develop the Project website according to the information provided in the stakeholder engagement plan;
- Continue discussions with Chelmsford to discuss incorporating their dam in the Project in the future;
- Calibrate the Project hydrologic model (using USEPA Storm Water Management Model [SWMM]) based on the additional stream gaging and release testing data collected in order to refine the overall predicted benefits of the Project to the Stony Brook watershed;
- Use additional stream gaging data collected by DER to revise rating curves in the DAM Dashboard;
- Update the DAM Dashboard to include the recently installed monitoring equipment downstream of Spectacle Pond, including providing a stage-discharge curve to inform future releases;
- Continue discussions with Abbot Mill operations to understand anticipated future uses of the Forge Pond diverted water, and potential for automation of the impoundment structures; and
- Discuss the results of this Project with other watersheds in the region to understand whether implementation of similar real-time controls could add similar benefits elsewhere.

Appendix A

Low Flow Release Protocol and Stakeholder Engagement Plan

Appendix B

Study Area Expansion Presentation Slides

Appendix C

Forge Pond Automated Controls Evaluation Memorandum

Appendix D

Permit Submittals and Approvals Memorandum

Appendix E

Stakeholder Presentations