Community Preservation Funding Application — Fiscal Year 2026

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1. Basic Project Information

Submission Date:	January 9, 2026
Project Name:	Forge Pond drawdown improvement study
CPA Funds Requested:	$20,000
Applicant Information:	
Name:	David Barr and Matt Salem
Address:	49 Matawanakee Trl, Littleton MA
Phone:	978-201-9524
Email:	barrdt@gmail.com
Sponsoring Board/Committee(s):	Westford Healthy Lakes & Ponds Collaborative
Additional Responsible Parties (if applicable):	Friends of Forge Pond
Project Manager/Contact Person:	David Barr

2. Project Purpose

Select all that apply:
☑ Open Space ☐ Affordable Housing ☐ Historic Preservation ☐ Recreation

3. Project Description and Goals

Provide a comprehensive project summary using the space at the top of page two or attach additional pages as necessary. Include the following information:

- **Project Purpose and Scope:** Clearly describe the objectives and scope of the project.
- **Community Benefits:** Explain how the project will benefit the residents of Westford and how those outcomes will be measured.
- **Preservation Impact:** Describe how the project preserves the town's character and aligns with the goals of the Community Preservation Act.
- **Timing Considerations:** If submitting outside the standard funding cycle, provide an explanation (example Special Town Meeting vs Annual Town Meeting). If project could be completed in multiple phases, please describe.
- **Long Term Impact:** What are the long-term maintenance or stewardship plans.

Project Description: (attach additional pages as necessary)

Project Purpose and Scope

This project will evaluate the extent to which possible changes near the Forge Pond outlet could improve the effectiveness of Forge Pond's winter lake level drawdowns. Making the drawdowns more effective would better limit the invasive plant growth in the lake, reducing the rate of eutrophication of Forge Pond and helping to preserve the ecology of Forge Pond, in line with the CPC mission of open space preservation.

Background

The Westford Healthy Lakes and Ponds Collaborative and the Friends of Forge Pond request funding to help preserve the quality of Forge Pond in the face of accelerating eutrophication. This aligns with the CPC mission of the preservation of open space.

- Forge Pond is increasingly infested by several invasive (non-native) aquatic plant species.
  - These include fanwort, Eurasian milfoil, variable milfoil, curly-leaf pondweed, and European naiad.
  - The invasive species impair recreational uses of the lake and degrade the habitat value of the lake areas where rooted plants grow, by out-competing beneficial native species. This plant growth also represents the accelerating eutrophication of Forge Pond, in which it slowly ceases to be a lake.
- In the last several years, the invasive plant growth in Forge Pond has accelerated significantly.
  - Life-long lake residents report that they have never seen this level of plants in the lake in all their years. We are concerned that this trend is the "new normal" and are working to address the issue.
- For more than a decade, the growth of invasive plants in Forge Pond has been countered by winter drawdowns of the lake. This has been moderately successful in limiting the growth of invasive plants by lowering the water level in the winter, which exposes shallow lakebed areas and when the winter is cold enough will kill the exposed invasive plants.
- Flow constraints in the area of the lake outlet limit flow for lowering the level, especially at levels that approach the target lake level, preventing the drawdowns from reaching the target level.
- In addition, recent winters have been warmer, which has significantly reduced the effectiveness of the drawdowns as precipitation falls as rain which flows directly into the lake, rather than snow that stays on the surrounding land until spring. This brings the lake level up quickly and outlet constraints result in slow lowering of the level again. As the winters continue to warm, these conditions will continue to reduce the effectiveness of the Forge Pond drawdowns.

Proposed work

The project seeks to improve the effectiveness of Forge Pond's winter lake level drawdowns by determining the extent to which possible changes near the Forge Pond outlet could:

1) Increase the outflow capacity from the lake over the course of the winter drawdowns, to better maintain consistent lake levels during the drawdown, even at levels near the target level, and
2) Allow a lower target elevation for the drawdown lake level while still satisfying the first objective. Different feasible lower targets may be identifiable for various valid changes that meet the first objective.

Several possible structural changes near the lake outlet will be investigated, using computer modeling of the flow through outlet structures and the overall drawdown process, to assess the extent to which the possible changes could improve drawdown performance.

The outlet changes to be evaluated are:

- Option 1: Reconfigure the current outlet control structure
  The structure used to implement the Forge Pond drawdowns is a concrete culvert which bypasses the Abbot Mill dam and allows flow into Stony Brook. If the inlet opening of this outlet control structure were lowered and the pipe inlet was converted from a round pipe to a rectangular shape, the outflow capacity through the outlet control structure would increase.
- Option 2: Create an additional auxiliary outlet structure
  A second auxiliary outlet structure would certainly increase the outflow during drawdowns. While constructing a second outlet would be more expensive than altering the inlet of the current one, if the increase in outflow is large enough, it could be worthwhile.
- Option 3: Lower the outlet channel streambed to eliminate flow bottlenecks
  A limited deepening of a portion of the Forge Pond outlet channel was carried out in 2022 to increase flow through the lake's outlet during drawdowns. While this increased the outflow from the lake during subsequent drawdowns, the stream depth is still shallow over a significant length of the channel, for lake levels near the drawdown target of 199.9 ft, restricting the flow and the drawdown. It would be useful to examine the extent to which further lowering of the outlet channel would improve the ability to reach the drawdown target level.

This project will consist of computer modeling of drawdown behavior using Hydrologic and Hydraulic Modeling (H&H modeling) of the conditions in Forge Pond and the flows in the outlet channel and outlet structures involved in the drawdown.

- Modeling the flows through the various proposed outlet structures, over a range of various drawdown conditions, will allow the improvements in flow for the different configurations to be compared.
- This will be followed by modeling of the full drawdown cycle, incorporating representative historical data from a previous year, allowing the effects of the different outlet configurations on the overall drawdown process to be evaluated. The datasets will also be adjusted to simulate wetter and drier winters.

See the attached section "Complete Project Purposes and Scope" below for further information.

Community Benefits

The improved effectiveness of winter drawdowns for Forge Pond will benefit the community through:

- **Improved recreational experience**
  Reducing the invasive plant growth in Forge Pond will provide better recreational, sporting, and leisure-time activities on Forge Pond. High levels of invasive plant growth make swimming, fishing and boating less enjoyable and, in some cases, less feasible. Some areas of the lake have become unavailable for these activities because the thick stands of invasive plants are unpleasant or hard to swim and paddle through, can preclude casting for fishing, and can choke the propulsion systems of motorized boats, sometimes requiring repair. Crew boats must avoid these areas of the lake because they are not passable. Heavy, though less thick, plant growth in other areas of Forge Pond have similar limiting effects.
- **Reducing lake eutrophication**
  See discussion under Preservation Impact
- **Restored natural ecology**
  See discussion under Preservation Impact

These benefits will be observed through reduced growth of invasive plants, the increase in recreational uses of the lake and a returning to more a sustainable, natural ecology of Forge Pond.

Preservation Impact

This project will evaluate the extent to which possible changes near the Forge Pond outlet could improve the effectiveness of Forge Pond's winter lake level drawdowns. Making the drawdowns more effective would better limit the invasive plant growth in the lake, reducing the rate of eutrophication of Forge Pond.

As such, this project is one of several being undertaken on Forge Pond with the overall goal of preserving the quality of our local lakes in the face of accelerating eutrophication. This aligns with the CPC mission of open space preservation.

Westford's lakes are a treasured natural resource, but when lakes are surrounded by developed communities, they are prone to accelerated eutrophication and deterioration. If we fail to halt the spread of invasive plants, the ecology of Forge Pond will continue to deteriorate and the lake will fill in, eventually becoming a wetland and, later, a meadow.

The eutrophication process takes thousands of years under natural conditions. But it occurs in hundreds of years or even decades when stimulated by human habitation. Intensive human activity has been fostering eutrophication in Forge Pond for nearly 100 years now, and the process is advancing rapidly. This accelerated eutrophication has been exemplified locally at Mill Pond in Littleton, which over just a few decades changed from being a vibrant lake with a 12-foot depth to a degraded pond with a 3-foot depth. Managing the ecology of the lakes is important for preserving their vitality.

Also, the ecology of our lakes declines as invasive plant species – which grow more aggressively than native plants – increasingly crowd out the native plants. The originally-diverse ecology becomes a near-monoculture of just a few plant types, which provide less support for the diversity of other life in the lake. Fish, turtles, frogs, mussels, and the entire array of life in the lake narrows to the few that can survive in the limited environment.

Community Preservation funds aim to preserve open space; that is our primary goal here. Lakes are unique resources which cannot be replaced if they deteriorate.

Timing Considerations

This project is submitted within the standard funding cycle.

This request represents the first phase of a process of evaluating, planning, permitting, and constructing potential changes in the Forge Pond outlet configuration to improve winter drawdowns. This project will evaluate possible changes to determine the effectiveness of contemplated changes. The next phase would assess the results, together with potential costs of implementing changes, to determine if changes are warranted and identify which would be appropriate. The owner of Abbot Mill would continue to be engaged in this phase as the owner of the dam and adjoining relevant property. Subsequent phases would be the Design and Construction of the selected modifications to the outlet structures. Permitting and raising of funds will be needed for the later work. CPA funds might be sought, as well as Massachusetts state grants. If outlet changes are determined to make a lower target level possible for the winter drawdown, the appropriate amendments for the current drawdown permit would be sought.

Long Term Impact

The long-term maintenance or stewardship plans would depend on what outlet changes are identified as being most appropriate, based on this study. Structural modifications or additions in the area of the dam are not likely to need maintenance with any significant costs.

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4. Project Location and Ownership

Project Address: Forge Pond

Assessor Information (Map/Block/Lot ID): N/A -- Assessor Location ID: F_659586_3035034

Ownership/Care and Custody Information: Forge Pond is owned by Commonwealth of Massachusetts

Most CPA-funded projects require legal protections to ensure long-term preservation:

Open Space / Conservation: Land or conservation restrictions must remain permanently protected (e.g., Conservation Restriction under M.G.L. Chapter 184).

Historic Preservation: Properties must include a preservation restriction or covenant to maintain historical integrity.

Affordable Housing: Long-term affordability must be secured through a restriction or covenant.

Recreation: Restrictions may be required if the project secures permanent public recreational access.

Applicants should check all that apply and attach supporting documentation or proof of restriction. The Community Preservation Committee/Town of Westford may require deed restrictions or covenants to be obtained as a condition of funding, if not already in place.

All activities in pursuit of preserving the ecology of Forge Pond have been and will continue to be permitted under the Wetlands Protection Act, working through the Westford and Littleton Conservation Commissions.

Deed Restrictions Required (check all that apply):

☐ Conservation ☐ Housing ☐ Historic Preservation

5. Budget

Attach a complete project budget, including estimates or quotes as needed.

Percent of Total Budget Requested from CPA Funds: 50%

Other Funding Sources (committed/applied/planned): $20,000 approved by Littleton CPC in 2026 cycle

Anticipated Annual Income/Expenses: _____

Recurring Expenses (maintenance, etc.): _____

Taxpayer Impact: _____

Total project cost: $40,000

Forge Pond is in both Westford and Littleton. The Littleton Community Preservation Committee has already approved matching funding for this project.

Planned cost breakdown:

Westford Community Preservation Committee: $20,000

Littleton Community Preservation Committee: $20,000

The matching funding for this project from the Littleton Community Preservation Committee was approved as part of their 2026 funding cycle. This funding requires approval from the Littleton Town Meeting this spring.

Basis for the budget:

This project was previously scheduled to be performed in FY2025 with matching funding provided by the Littleton Water Department and the Friends of Forge Pond, with a total project cost of $30,000. For that project, Friends of Forge Pond worked with an environmental engineering firm which had previously provided Hydrologic and Hydraulic Modeling (H&H modeling) of flow through the outlet from Forge Pond. With this experience and their existing computer models, they were a good choice to do the work. Due to concerns about scheduling, the Littleton Water Department funds were withheld and we were asked to seek CPC funding for the work in the 2026 funding cycle. The anticipated total cost of the project was increased to $40,000 for the 2026 work partly because of likely inflation escalation and partly to allow for some additional computations to be made which were not included in the previous contract.

6. Procurement

Projects exceeding $10,000 must comply with applicable public procurement laws.

- **Town Departments:** Follow MGL Chapter 30B procedures.
- **Non-Town Department applicants:** Describe your proposed compliance plan to ensure procurement procedures are followed. Applicants may be directed to the Town Manager's office for additional follow-up and guidance.

Note: Non-Town Department applicants must sign a grant agreement before CPA funds are released. The Town Manager's office will assist with this process as needed.

Procurement Plan: Westford Healthy Lakes and Ponds Collaborative, in conjunction with the Town of Littleton, will coordinate the contracting for this project.

7. Project Timeline

Proposed Start Date: June 2026

Expected Completion Date: October 2026

Include key milestones or phases of the project if applicable: _____

Expected Milestones

June 2026 – Contract with engineering firm for the work to be done

Early July 2026 – Collaborate with the contractor on the modeling and data sets to be used

Late July – August 2026 – Perform the Hydrologic and Hydraulic Modeling (H&H modeling)

September 2026 – Review results with contractor prior to preparation of final report.

October 2026 -- Receive final report

8. Endorsements by Applicable Boards/Commissions

Check all that apply and attach letters of support to the application:

- ☐ Affordable Housing Committee and/or Housing Authority
- ☐ Cemetery Commission
- ☑ Conservation Commission – Possible (Discussions underway for endorsement)
- ☐ Historic Commission
- ☑ Parks and Recreation Commission – Possible (Discussions underway for endorsement)
- ☐ Planning Board
- ☐ Water Commission
- ☑ Other: Westford Healthy Lakes and Ponds Collaborative

9. List of Attachments

Include all supporting materials relevant to your application:

- Site maps, photographs, or plans
- Cost estimates or contractor quotes
- Letters of support or endorsements
- Ownership documentation or legal agreements
- Deed restrictions

See attached “Complete Project Purposes and Scope”

10. Applicant Signatures

Signature: David Barr Date: January 9, 2026

Printed Name: David Barr Title: Member, Westford Healthy Lakes and Ponds Collaborative

President, Friends of Forge Pond

Signature: Matthew Salem Date: January 9, 2026

Printed Name: Matthew Salem Title: Co-chair, Westford Healthy Lakes and Ponds Collaborative

Conservation Resource Planner

For Community Preservation Committee Use Only

Date Received:

Year:

Is Sufficient Data/Detail Provided?

Is Timeliness an Issue?

Is Additional Information Required?

Project Interview Date:

Public Hearing Date:

Committee Vote: ☐ Yes ☐ No ☐ Abstain

Date:

Recommendation for Town Meeting Consideration: ☐ Spring ☐ Fall ☐ Special

Attachment 1:

Complete Project Purposes and Scope

Central Focus

Control of invasive plants in Forge Pond in Westford and Littleton, Massachusetts has focused for over a decade on winter drawdowns. While this method has been moderately successful in the past, methods are needed to make the drawdowns more effective.

Several structural changes near the lake outlet will be investigated, using computer modeling of the water flow and the drawdown process, to assess the extent to which they could improve drawdown performance.

Background

Forge Pond / Lake Matawanakee, located in Westford and Littleton, Massachusetts is a 203-acre lake with a watershed area of approximately 15,000 acres. The lake, hereinafter referred to as "Forge Pond", has two primary inflows: Beaver Brook (from Mill Pond) and Gilson Brook (from Spectacle Pond). The lake has only one outlet, on the north side, which flows into Stony Brook.

Invasive plant growth

Forge Pond has experienced the growth of non-native, invasive aquatic plants for more than a century. The invasive species include Eurasian milfoil, variable milfoil, fanwort, curly-leaf pondweed, and spiny naiad. These species degrade the habitat value of the lake's littoral zone (the area of rooted plant growth) by out-competing beneficial native species, and degrade the recreational uses of the lake. Native species that have in some cases become abundant in areas where swimming and boating occur include coontail, common bladderwart, wild celery, lesser duckweed, ribbonleaf pondweed, thin-leaf pondweed, white water lily, yellow water lily, and musk grass. During the summer of 2025, nearly one-third of the surface of Forge Pond had aquatic plant cover and significant growth of invasive plants.

Plant control techniques

The Westford Healthy Lakes and Pond Collaborative, the Littleton Clean Lakes Committee, and the Friends of Forge Pond have been active in trying to control invasive plant growth in Forge Pond. Various available methods to limit the growth of invasive plants in the lake have been considered. These include winter drawdowns of the lake level, physical removal of the plants by manual or mechanical harvesting, benthic mats, and chemical herbicide treatments.

Chemical treatments can be very effective in the short term, although they can have adverse environmental consequences when used consistently over the long term.

Physical removal of the plants by the Eco-Harvesting process has been tried in the summers of 2023 and 2024. These treatments were both of very limited extent, because of limited funding (2023) and a 99-cubic-yard cap on the amount of material to be removed (2024). It is expected that a more extensive Eco-Harvesting treatment will be performed, once a permit is obtained to exceed the current 99-cubic-yard limit on material removed. Funding for this has been allocated by the Littleton Community Preservation Committee. If Eco-Harvesting is shown to be successful, ways to lower the cost of the such treatments will be pursued, since the current contracted cost of these treatments is quite high.

Benthic mats have been shown to be very successful in repressing plant growth, but they are suited only to small areas because of the costs and the labor needed to install and remove them.

Winter drawdowns are a very cost-effective way to help control invasive aquatic plants in the lake. Winter drawdowns of Forge Pond have been used to control plant proliferation for over 10 years. Prior to that, drawdowns were apparently carried out on-and-off going back to the early twentieth century. Drawdowns reduce invasive plant growth in shallow areas and provide safe and clean swimming and boating areas. Drawdowns are environmentally favorable, freezing and drying plants in the exposed lakebed to inhibit plant growth. Drawdowns are particularly effective in controlling plants that rely on fragmentation and vegetative propagules for overwintering and expansion, such as the invasive species present in Forge Pond do. About two weeks of sustained below-freezing air temperatures, with low water, are needed to accomplish this. (Note: Although pure water freezes at 32 degrees, the composition of the fluid in plants results in a lower freezing point – into the mid-20s. So, full effectiveness would require an extended period of this lower temperature).

Results from drawdowns in Forge Pond vary from year to year due to variations in precipitation, temperature, tributary inflows, and other conditions such as the presence or absence of beaver dams in Beaver Brook upstream of the lake. A series of annual drawdowns helps decrease invasive plant growth, improving both the wildlife habitat and the recreational quality of the lake. If drawdown effectiveness can be increased sufficiently, this method is seen to be the most cost-effective way to control invasive plants in the parts of the lake that can be exposed during the drawdown.

Outlet dam and nearby structures

Water flows out of Forge Pond through a 900-ft outlet channel on the north side of the lake, which ends at the Abbot Mill dam. The dam is constructed of stone blocks with a spillway weir height that can be adjusted somewhat by inserting or removing a row of vertical wooden flashboards. Immediately south of the dam spillway are three timber sluice gates which control water flow from the outlet channel into a sluiceway leading to the Abbot Mill. An “auxiliary outlet”, or secondary outlet, was constructed in the 1990s, downstream of the sluice gates, to facilitate winter lake drawdowns. The “auxiliary outlet structure” consists of a 3-ft-diameter pipe that diverts flow from the sluiceway down into the Stony Brook channel downstream of the dam spillway. Flow through the auxiliary outlet is controlled by the “auxiliary outlet control structure,” consisting of a concrete weir with eight removable aluminum stop logs at the upstream end of the auxiliary outlet structure. The layout of the outlet area is shown in Figure 1.

Drawdown process and results

The winter drawdowns of Forge Pond are performed under the Orders of Conditions (OOC) issued by the Conservation Commissions of Westford and Littleton. The drawdown is accomplished by adjusting the structures in and around the Abbot Mill dam. Specifically, the drawdown is started on October 15 by a sequence of actions over a period of several weeks: removing the wooden flashboards on the main spillway, opening the three sluice gates to allow free flow to the sluiceway, and incrementally removing stop logs from the auxiliary outlet control structure to allow flow from the sluiceway through the auxiliary outlet and into Stony Brook. These actions are coordinated to meet the OOC requirements that downstream flow in Stony Brook must not exceed 70 cubic feet per second and the drawdown rate must be less than 3 inches per day. In the spring, the process is reversed to replace the stop logs in the auxiliary outlet control structure, close down the three sluice gates to some extent, and replace the flashboards on the main spillway. These operations must maintain the downstream flow in Stony Brook to be above 11.5 cubic feet per second as the lake refills for the summer. The lake level must reach “summer level” by April 1.

The drawdowns have been moderately successful in reducing the level of invasive plants, but a more consistent drawdown performance would better control the invasive plant growth. In addition, invasive plant growth continues to be an issue in areas where the water is deeper than the lowest level of the drawdown. The minimum allowed lake level during drawdowns is 199.9 feet elevation (NAVD88) [Note: all elevations in this document refer to NAVD88 values.]. This target lake level has never been achieved during any of the drawdowns for which Friends of Forge Pond and Littleton Clean Lakes Committee have been responsible. The minimum, maximum, and approximate average lake levels during drawdowns over the years 2019 to 2025 are shown in Table 1.

Drawdown limitations

Elevated average level

Drawdowns are most successful when the lake level is at its target (lowest allowed) level during the periods of extended sub-freezing air temperatures. This maximizes the area of the lakebed over which the invasive plants are controlled. The hypsographic curve for Forge Pond (Figure 2) shows that over the range of lake levels experienced during the drawdown (i.e., with the lake level being reduced by 2 to 5 feet), each additional foot of drawdown during extended sub-freezing weather provides plant control over an additional 4.3% of the lake area, or 9 acres. Assuming that plant growth occurs in areas of the lakebed that have depths up to 10 ft, the hypsographic curve shows that 55% of the lake's area would support plant growth. So, each additional foot of drawdown affects an additional 9% of the lake's area in which plants grow.

Unfortunately, the configurations of the structures at the outlet of Forge Pond are such that the rate at which water can flow out of the lake slows dramatically when the level is within a foot of the target level. Therefore, the ability to reach the target level becomes limited as the drawdown nears that level. As a result, historically, the lowest lake level achieved is half a foot above the target level and the average lake level during drawdowns is about 2 ft above the target level. So, bringing the average lake level during drawdowns down close to the current target would impair plant growth over almost an additional 20% of the lake's area in which plants are growing.

Lake level fluctuations

Equally troublesome is the lake level fluctuation over the course of the winter, which is very evident from the graphs of the drawdown histories. The level increases when water enters the lake faster than it can leave through the outlet. This typically occurs after a precipitation event adds water to the lake and the surrounding watershed. The effect of these events is more pronounced when, as has often been the case in the past few years, winter temperatures are warmer than the historic levels. The warm weather delays ice formation on the lake. During the winters of 2022-2023 and 2023-2024, much of the lake had open water for most of the winter. The warm temperatures also cause precipitation to fall as rain rather than snow. As a result, the rain flows quickly into the waterways – being added directly into the lake and open upstream wetlands, added as runoff from the surrounding upland, and added as groundwater – instead of remaining as snow on the ground or on the ice covering the lake until melting in the spring. Such events result in high water flows into the lake. At such times, the drawdown outflow through the auxiliary outlet is insufficient to match the inflows and the lake level rises, sometimes dramatically. The level then drops slowly as the flow bottleneck in the outlet area eventually releases the additional water.

Unfortunately, the sub-freezing temperatures needed to control the exposed plants can often occur during these times of higher lake levels, with the result that the amount of lakebed affected by the drawdown is often much less than it would be if it was possible to keep the lake level near the target level. While significant fluctuations in drawdown lake level are seen even during cold

winters, the issue is more prominent during winters with warm weather intervals, as described above, which will become more common as the effects of climate change continue to be felt.

Current drawdown limit
The current target elevation of 199.9 ft for the winter drawdown was established by regulatory authorities to protect wildlife (especially the endangered Blanding's turtle) in the Beaver Brook wetlands upstream of the lake. The downstream end of Beaver Brook enters Forge Pond as it crosses under Beaver Brook Road. When a new bridge was constructed for Beaver Brook Road at this location in 2023, the elevation of the streambed under the bridge was set to 200 ft. Because of this, lowering the lake level below the current target level of 199.9 ft will not lower the water level in the Beaver Brook wetland any further than is the case with the current target. It is therefore conceivable that it may be possible to get approval to revise the Orders of Conditions for the winter drawdown to set a lower target level.

If a lower target level of the lake elevation were to be allowed and achievable, a greater area of the lakebed would be exposed during the drawdown. The drawdown would then affect more of the invasive plants and be more effective at reducing plant growth in the lake.

Study objectives
The project seeks to improve the effectiveness of Forge Pond's winter lake level drawdowns by determining the extent to which possible changes near the Forge Pond outlet could:

1) Increase the outflow capacity from the lake over the course of the winter drawdowns, to better maintain consistent lake levels during the drawdown, even at levels near the target level, and

2) Allow a lower target elevation for the drawdown lake level while still satisfying the first objective. Different feasible lower targets may be identifiable for various valid changes that meet the first objective.

Possible improvements to increase drawdown effectiveness
The following changes near the lake's outlet will be evaluated to assess the extent to which they can achieve the objectives and improve the effectiveness of the winter drawdowns of Forge Pond.

Option 1: Reconfigure the auxiliary outlet control structure
The auxiliary outlet structure is a 3-ft-diameter round pipe with an invert elevation at the inlet of approximately 198 ft. The base elevation of the auxiliary outlet control structure supporting the stoplogs used in the drawdown is 199.0 ft. As the lake level approaches the target level of 199.9 ft, the flow area through which the outlet flow exits the sluiceway is reduced and outflow is consequently reduced also. If the elevations of these structures at the opening of the outlet control structure were lowered and the pipe inlet was converted from a round pipe to a rectangular shape, the outflow capacity through the outlet control structure would increase.

Option 2: Create an additional auxiliary outlet structure
A second auxiliary outlet structure would certainly increase the outflow during drawdowns. While constructing a second outlet would be more expensive than altering the inlet of the current one, if the increase in outflow is large enough, it could be worthwhile.

Option 3: Lower the outlet channel streambed to eliminate flow bottlenecks
A limited deepening of a portion of the Forge Pond outlet channel was carried out in 2022 to increase flow through the lake's outlet during drawdowns. Over an approximately 250-foot-long section near the mouth of the channel, the channel bottom was adjusted to bring the streambed elevation to 199 ft in areas where it was higher than that. This resulted in the lowering of the

streambed in this section by up to 9 inches in certain places. While this increased the outflow from the lake during subsequent drawdowns, the stream depth is still shallow over a significant length of the channel, for lake levels near the drawdown target of 199.9 ft, restricting the flow and the drawdown. It would be useful to examine the extent to which further lowering of the outlet channel would improve the ability to reach the drawdown target level.

Methodology

This project will consist of computer modeling of drawdown behavior using Hydrologic and Hydraulic Modeling (H&H modeling) of Forge Pond volume and the flows in the outlet channel and outlet structures involved in the drawdown.

Hydrologic and Hydraulic (H&H) computer modeling uses software to simulate water movement. Hydrologic models predict water generation (runoff from rain/snow) and water migration (between lakes, streams, and groundwater) in watersheds. Hydraulic models simulate water flow in rivers, pipes, or control systems. These tools can combine terrain data, rainfall/flow inputs, and land characteristics (e.g., roughness) to design drainage, manage water resources, analyze flood risk, and assess climate change impacts, offering insights for engineers, planners, and managers.

Modeling the flows through the various proposed outlet structures, over a range of various water depths, will allow the improvements in flow for the different configurations to be compared.

Modeling the full drawdown cycle, incorporating representative historical data from a previous year, will allow the effects of the different outlet configurations on the overall drawdown process to be evaluated. The datasets will also be adjusted to simulate wetter and drier winters.

Assessment

The extent to which the possible structure changes improve the drawdown effectiveness over a range of winter conditions will be reviewed. Expected relative costs of each change will factor into the evaluation of which, if any, should be pursued.

Table 1. Lake levels during winter drawdowns

Lake Surface Elevation (Feet above mean sea level (NAVD88))			
Winter Season	Minimum level	Maximum level	Approximate average level
2019 – 2020	200.4	202.9	201.0
2020 – 2021	200.7	203.4	201.5
2021 – 2022	201.5	204.2	202.3
2022 – 2023	200.8	204.3	202.5
2023 – 2024	201.2	205.0	203.0
2024 – 2025	200.4	202.3	201.5

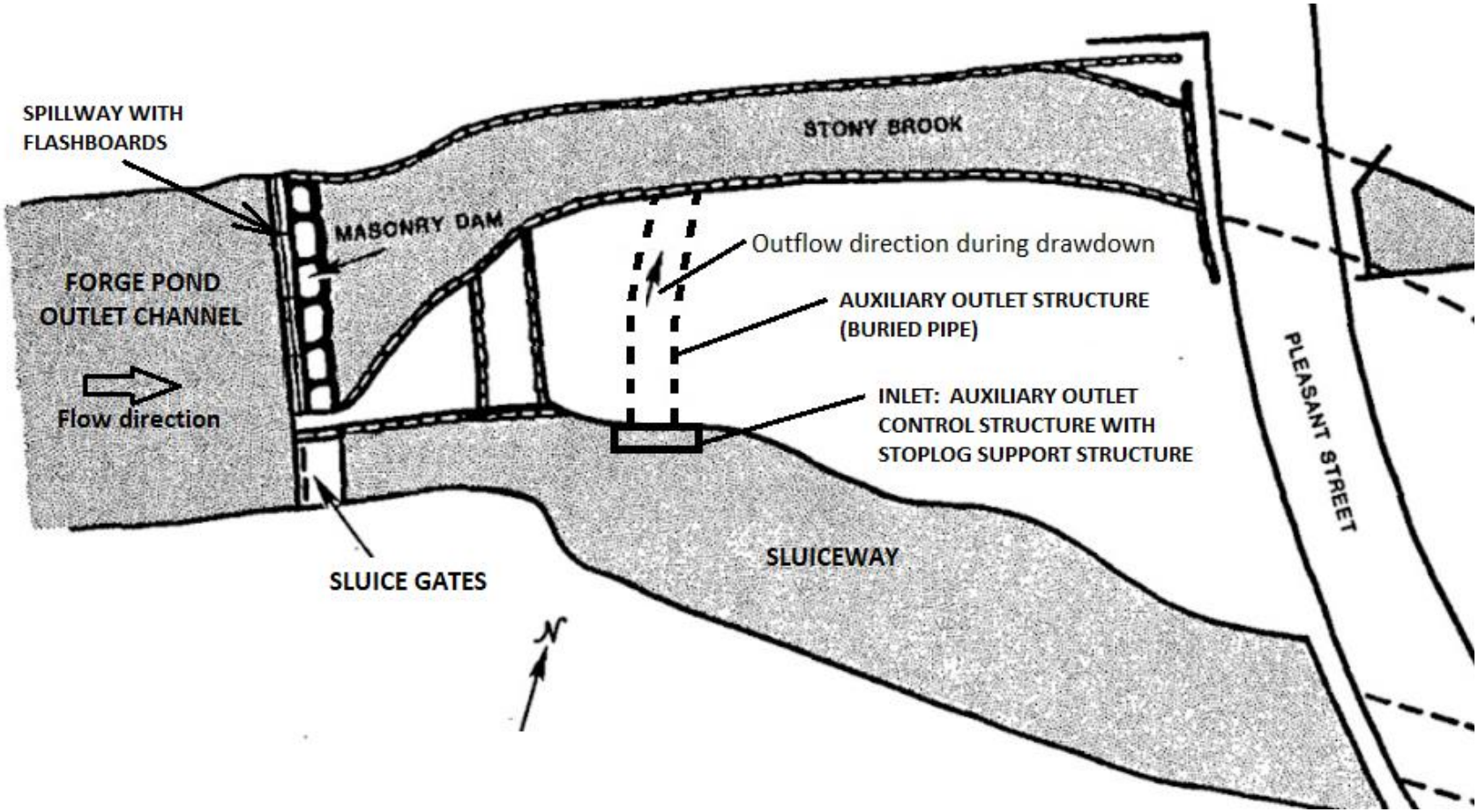

Figure 1 – Outlet channels and structures downstream of Forge Pond

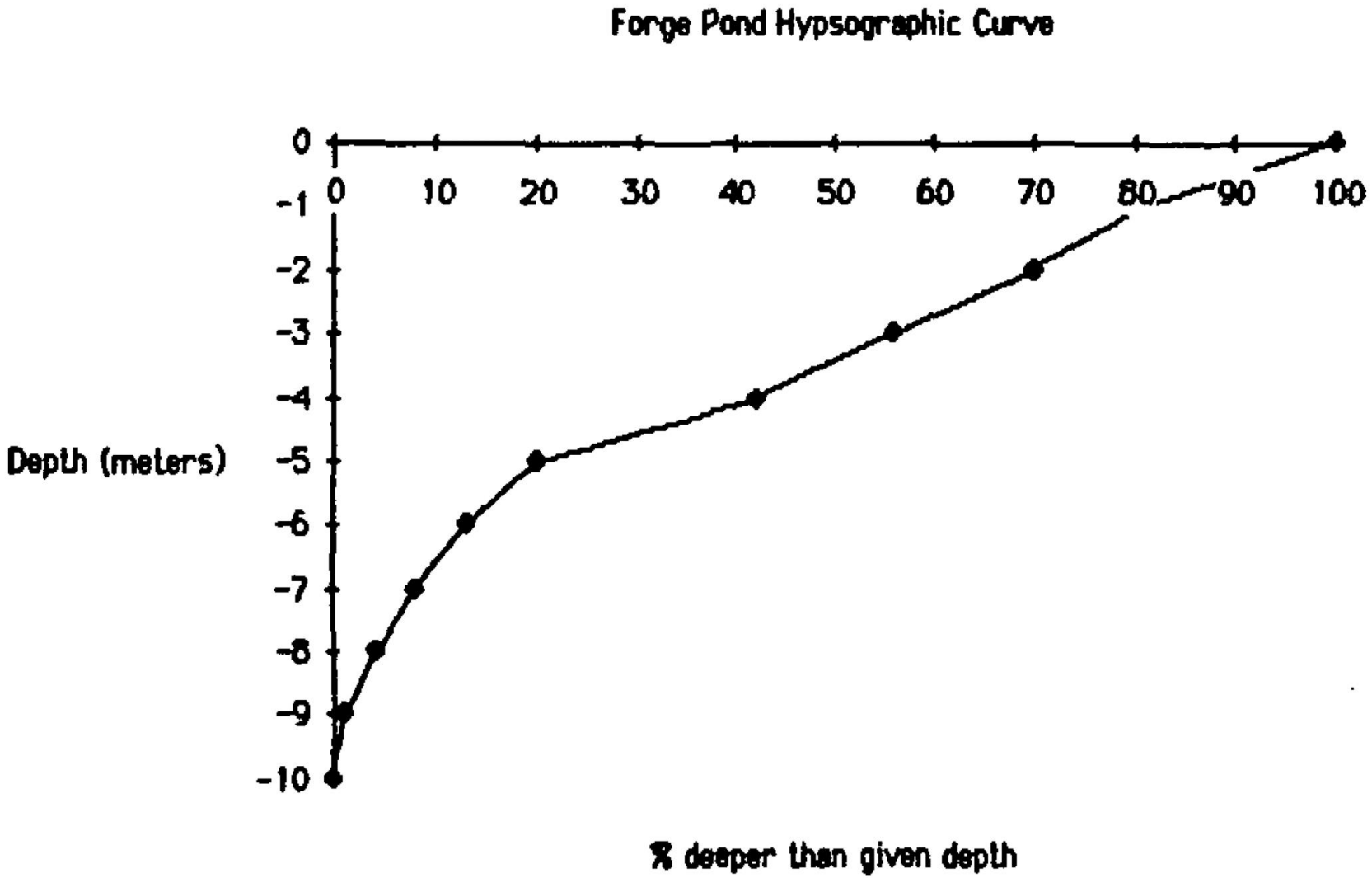

Figure 2 – Hypsographic curve for Forge Pond