

Bare Hill Pond Invasive Weed Management Strategy

The Nature of the Problem and the Studies

Eutrophication of ponds (the filling of ponds through excessive plant growth) is a natural and inevitable process, and is the primary challenge to the way we currently think about and use Bare Hill Pond. The Pond was a former sheep meadow, and with its now extensive peat bottom and shallow depths it is a prime candidate for plant growth. Studies of the Pond (Whitman and Howard, 1987; Mass. TMDL 1999; ENSR 1998 and 2002) all conclude that eutrophication is accelerating due to natural and development-related nutrient enrichment from the pond's watershed as well as from septic systems. The prime culprit is phosphorous, a potent fertilizer. The 1999 TMDL Study resulted in Bare Hill Pond being listed as an endangered lake and pond and made us eligible for federal EPA funding for our proposed drawdown project for invasive weed control.

The primary recommendation of the ENSR reports were to begin systematic, managed drawdowns of Bare Hill Pond, to deepen the drawdowns beyond 3.5 feet to enable them to be more effective in deeper and wetter areas of the Pond, to continue harvesting, and to consider dredging. All of these studies are accessible on the Pond Committee Page of the Town Website [http://www.harvard.ma.us/Bare Hill Pond Studies.doc](http://www.harvard.ma.us/Bare_Hill_Pond_Studies.doc).

The Alternatives Considered

The options for controlling eutrophication include: watershed management, drawdowns, harvesting and weed pulls, dredging, herbicides, dyes, and sterile grass carp. All of these options were carefully considered by the Pond Committee in light of the studies, published research, their cost, their politics and their likely efficacy. Many of them have been adopted and are underway. In addition, members of the Pond Committee have been active participants in annual educational programs sponsored by the Congress of Lakes and Ponds (COLAP), where studies and case reports are presented annually and one can keep abreast of these various techniques at other lakes and ponds throughout Massachusetts and the country.

Watershed management is the primary recommendation of the original Whitman and Howard report as well as the State TMDL report. This approach treats the problem at its source by working to remove the nutrients that feed weed growth and the filling of the Pond with sediment. Watershed management tends to restore the ecosystem and can help over the long term to slow, but not stop, eutrophication. The downside of this approach is that if used alone it has limited short-term impact. The level of phosphorous already in the sediment of the Pond is so high that while watershed management may help prevent the nutrient load from worsening, it is not likely, when used alone, to restore the Pond. For this reason, we are using watershed management in parallel with other control techniques. Volunteers and students are central to our watershed management activities, which include a survey of the watershed to identify inflows to the Pond that could benefit from retention basins, and efforts to educate watershed residents on actions they can take to reduce "fertilization" of the Pond. We are also working with the ZBA and Planning

Board to ensure that watershed friendly approaches are adopted when land is developed in the watershed.

Drawdowns are a primary means for controlling invasive aquatic species. A good summary of how drawdowns work and some Massachusetts case studies on their relative effectiveness can be found on the Pond Committee website http://www.harvard.ma.us/Drawdown_Facts_and_Case_Studies.doc. The studies recommend their use, and a Chronology prepared by Gene Marsh corrects a common misconception that there have been numerous drawdowns of the Pond and that they have failed. Prior to 2002, there were 5 drawdowns since the Dam was constructed in 1837 (1978-79, 1988-89, 1998-99, 1999-2000, 2001-02). The Marsh report indicates that four of these drawdowns had a significant impact at depths of 4 feet or less (the limits of the current gravity drawdown). The 2001-02 drawdown had limited impact due to a mild winter. In each year where the drawdown was successful, algae growth on the milfoil appeared to impair the milfoil's growth during the next year. This suggests that even when drawdowns do not kill a plant, they may still weaken it and subject it to natural biological control. The results in 2003-04 were consistent with these results.

Studies of other lakes show that while any single drawdown may not kill all weeds, drawdowns are effective incrementally over time if they are conducted on a regular basis. Killing of the weeds is *greatest* when the areas of invasive weed growth are dried and exposed to cold freezing weather. This does not occur every winter. This is consistent with the results of the sporadic drawdowns to date on Bare Hill Pond. It is also why deeper drawdowns are necessary to dry out the areas behind the beach and to address depths greater than 4 feet.

Drawdowns also help to manage weeds by other indirect factors. The extra flushing of the Pond is believed to help reduce the level of phosphorous and other nutrients, which reduces the rate of weed growth. The exposure of the shoreline's rocks and glacial till results in the washing of the exposed peat sediment into deeper areas of the Pond. This is believed to have several beneficial effects, including: (1) a decline in sediment in shallow areas that would otherwise fertilize and promote weed growth, and (2) a reduction in phosphorous loading in the water column. We have a very active Pond from both wind and recreational use. In the early morning hours the Pond is calm, but as wind and activity pick up, wave action and turbidity mixes with the shoreline silt and adds nutrients to the water column. By moving the sediment to deeper water, fertilization and the rate of weed growth may be slowed. With this in mind, we adopted a strategy of first demonstrating the environmental safety and efficacy of drawdowns at the 4 foot level, and now proceeding, through the pumping project, to increase the depth incrementally to achieve optimal control.

Weed Pulls and Harvesting have been and remain a key part of the strategy for controlling invasive species. Hand pulling of water chestnut plants has been quite effective in containing growth in the inner part of the Clapp's Brook area; however, their seeds spread and continuous vigilance is required to pull plants outside that area.

Harvesting of milfoil and fanwort does not eliminate those species but, like mowing a lawn, removes weeds from the beach, shore lines and other areas to facilitate recreational use. Harvesting can also help at certain times of the year to remove seed-bearing water chestnut plants. Harvesting is an excellent supportive activity but is not a solution by itself.

Dredging or Excavating could be the most definitive solution. If we removed the 2-5 feet of peat from the bottom of the Pond, the invasive plants would probably not survive. The principal obstacle is cost. Current in-lake dredging estimates are in the tens of millions of dollars, which the town cannot afford. We are testing the sediments and exploring alternative dredging options. Deeper drawdowns will expose significant areas where sediments might be removed by excavation (which is far less expensive), might be useable at the beach, might result in saleable topsoil, and ultimately might help to provide a more durable solution.

Herbicides have not been a primary focus for the Pond Committee following the most recent negative vote at Town Meeting. There is a diversity of views on the Pond Committee regarding their use.

There are several facts on which we agree. First, their use is highly controversial within the Town. This has made any discussion extremely time-consuming and prevented us in the past from taking other positive steps. Second, the herbicides used in the Pond in the 1960s are no longer considered safe and are no longer available. Silvex, for example, is now banned for health and environmental reasons. Few herbicides in fact, are currently available, and their efficacy is more limited. Repetitive annual treatments would be required to achieve desired results, and elsewhere have resulted in the replacement of one invasive weed species for another, rather than weed reduction. Finally, and perhaps most compelling, are the regulatory and financial considerations. The use of herbicides would require extensive environmental monitoring and permitting from the Conservation Commission, which would be costly, and the outcome uncertain. The Town of Stow attempted to license the use of herbicides on Lake Boon two years ago, and after two years in court, and significant expense, dropped the project. Even if we could get through the process, a ballpark estimate from Lee Lyman, a leading contractor in this field, was \$2 million over 3 years. In light of our other options, these cost estimates, as well as the highly controversial politics regarding the safety of herbicides, we concluded that they should only be considered after other options are exhausted, lest we do nothing but debate for the foreseeable future.

Dyes are a management technique used in many Ponds to curtail sunlight and reduce weed growth. Water clarity of the Pond already approaches that which would be achieved by dyes, and ENSR advised it would not be an appropriate method.

Grass Carp are used in other states to control invasive species. They consume large volumes of weeds (native and non-native) and in theory are a viable control methodology. Sterilized fish are used so that they cannot reproduce, and statistics exist for how many fish per acre are required. The downside is that they grow quite large (up

to four feet) and can be quite frightening to swimmers. The other downside is that Massachusetts prohibited their use several years ago and it would take a reversal of policy to adopt this approach. It was not recommended by ENSR.

The Cost to the Town

Financial cost to the town has been at the forefront of every decision we have made and caused us to expend substantial effort to recruit volunteers and to obtain federal matching funds of \$195,000 under a DEP/EPA grant to help finance our expansion of activities. We also received \$145,000 of CPC funds at Town meeting to cover the remaining costs of the pumped drawdown project. The Town contribution to the DEP/EPA grant is not new funding, but the existing level Pond Committee funding of \$11,000, plus money already budgeted by the DPW for harvesting operations. More importantly, we make up the match portion our federal grant through a credit for our volunteer time (at a rate of \$15 per hour). We consider this to be a model of frugality for funding town projects.

The Strategy

To summarize, our strategy for the protection of Bare Hill Pond assumes an integrated approach. Bare Hill Pond is lucky to have a dam than enables drawdowns and is unlucky that gravity limits the drawdowns to 3.5 feet. The results from this year's drawdown and four previous drawdowns are consistent and show that they are effective in areas that dry and freeze. Based on the research to date we have embarked on an environmentally responsible path to conduct regular drawdowns, and to engineer and construct the capability to conduct deeper drawdowns. At the same time, we will continue to harvest and conduct weed pulls, while also conducting outreach and education to improve our collective behavior within the watershed. We believe this is a sound and fiscally prudent approach.