- Six Ponds Improvement Association

    - Six Ponds and Water Quality
    - Testing Overview and Time Periods
    - 1970s, 1980s and Early 1990s • 1997 to 2001
    - 2002 to 2006
    - 2008 to 2013
    - 2014 to Present
    - Other Environmental Matters

Re-exam Halfway Pond

Halfway Pond

WATERSHED MANAGEMENT FOR HALFWAY POND PLYMOUTH, MASSACHUSETTS

A Discussion and Recommendations Based on a
Critical Review of a 1980 Study and the Analysis of More Recent Data

Richard A. Stabile and Leighton A. Price

December 2004

Introduction: Halfway Pond is a 232 acre kettle pond located in the south-central portion of Plymouth, Massachusetts. This large pond is relatively shallow, with an average depth of 9 feet, and a maximum depth of 15 feet. The pond is located in a rural residential zone. The upper half of its western perimeter and some of its eastern perimeter abuts conservation land owned by the Wildlands Trust of Southeastern Massachusetts. The island in the pond is owned by The Nature Conservancy. The pond serves as the headwaters of the Agawam River and as core aquatic habitat for rare species including freshwater mussels. Halfway Pond has the largest surface area of the ponds in the Six Ponds watershed. The pond has been showing serious nutrient stress for many years, and it has been the focus of several water quality studies. The cranberry bogs on the west and south sides of the pond are special concerns as is the long shoreline road along the west side.

Lyons and Skwarto Study: In 1979 and 1980, the environmental firm of Lyons and Skwarto performed a comprehensive water quality study of the pond, and they also performed water quality studies of 40 other ponds in Plymouth. The Halfway Pond study showed that the pond had elevated levels of nitrate and

phosphorus at that time, and many readings were found to be at ultra-eutrophic levels. While a few of the nitrate readings were in the range of acceptable readings (0.10), the majority of the nitrate readings were well above a critical level of 0.25. Likewise, the large majority of the values for Kjeidahl nitrogen (KTN), organic nitrogen, were well above the critical value of 0.40. In addition, while a few of the phosphorus readings were below the permissible level of 0.025, the majority of the phosphorus readings were somewhat above a critical level of 0.04. While additional parameters were measured, these two were the focus of the study. The 41 pond study mentioned above showed that Halfway Pond was ranked 38st on a eutrophic index (with 1 being best and 41 being worst). The pond was described as phosphorus limited and ultra-eutrophic. The study also stated that agricultural activity (cranberry bogs) was not likely a major source of nutrients for the pond at that time; however, no data was offered to support this statement.

Six Ponds Improvement Association Studies: The Six Ponds Improvement Association, on its own and with financial assistance from the Town of Plymouth, has conducted water quality studies of Halfway Pond for several years. The association has found that phosphate levels were worse than in 1980. It is interesting, however, that nitrate levels have been far lower than they were in 1980.

Nitrate levels were 0.04 mg/l in 1997, 0.01 in 1998, 0.5 (eutrophic) in 1999, and 0.005 both in 2000 and 2001. Levels in several 2002 samples ranged from non-detectable to 0.32. Levels in several 2003 samples ranged from non-detectable to .04. In general, nitrate levels fell well below the permissible limit of 0.10. In this regard, the nitrate results have been much better and very different from those reported in the 1980 study by Lyons and Skwarto. Aside from a few recent upgrades to Title V systems, little has changed that might mitigate nitrate pollution problems. So, what has changed to yield such dramatically lower nitrate values? Have there been important changes in the fertilizers used on the cranberry bogs between 1980 and now?

The phosphorus levels, however, have caused more concern. The association recorded levels of 0.01 mg/l in 1997, 0.060 (eutrophic) in 1998, 0.01 in 1999, 0.01 in 2000, 0.052 (eutrophic) in 2001, In 2002, the average of several reading was about around 0.08 (highly eutrophic). In 2003, the average of several readings was about 0.04 (eutrophic). In 2004, the average of several readings was about 0.085 (highly eutrophic). No additional residences had been constructed on the pond since 1980 (until one was constructed in 2004 to replace an existing house), and agricultural activity has not increased in scale since 1980. Has phosphorus been accumulating in the pond sediments, and has more phosphorus continued to flow into the pond? Has phosphorus been stirred up by weather events or by human activity. Why is the phosphorus situation worse now than it was in 1980?

In a separate, more intensive, study of Halfway Pond funded primarily by The Nature Conservancy in 2003, it was found that nitrate and Kjeidahl Nitrogen (KTN) levels were generally lower than they had been in 1980. However, most of the highest KTN readings were obtained at the outlets from the cranberry bogs or from pond locations near bog outlets, and most of these readings were near or above the critical level of 0.40. Phosphorus levels within the pond were fairly consistent with the elevated range and average obtained in other studies done by the Six Ponds Association. Moreover, phosphorus levels obtained at the outlets from the cranberry bogs and from pond locations near bog outlets were generally the highest values, with some of these reaching 20 to 30 times the eutrophic level of 0.03.

Apparent Errors in the Lyons and Skwarto Report: The Lyons-Skwarto report showed that Halfway Pond had elevated nutrient levels in 1979 and 1980, but some figures appear to have been inaccurately recorded and/or plotted.

Nitrate figures collected at Station 1, the pondâ€™s inlet, in March and April of 1980, may have been recorded and plotted at 10 times their actual levels (2.4 and 1.6 mg/l, respectively; values of 1/10th this amount would have been the expected norm). Nearly all other values obtained in the study were much lower. No apparent cause for these high figures was identified. Nitrate levels at Station 2, in the pondâ€™s southern

half, were mostly in the range of 0.35 to 0.55 mg/l, except for the last 4 months of the study when figures ranged from 0.09 to 0.16 mg/l. The values at this station show a less wide variation, and they appear more credible. Nitrate data from the pondâ€™s outlet at Station 3 show nitrate levels ranging from 0.05 to 0.95 mg/l with several in the 0.40 to 0.50 mg/l range. Some of these figures seem excessively high when compared to the months immediately before and after them. If the high nitrate values were actually correct, results above a critical value of 0.25 mg/l should have been cause for alarm at the time.

The phosphorus figures for all stations show much greater consistency, and, with one possible exception, they do not seem to suggest recording errors. Throughout the pond, most phosphorus levels ranged from 0.02 to 0.10 mg/l during the whole study period (nearly all at eutrophic or ultra-eutrophic levels).

At Station 1, the phosphorus figures were approximately 0.21 mg/l in August, 0.18 mg/l in September, and 0.15 mg/l in October of 1979. It is possible that these figures were entered into the table and plotted at 10 times their actual levels. The data for the following August and September were approximately 1/10th this magnitude. The value of 0.90 in June is also highly suspect since it is so far out of line with all other values from this or other stations. Such figures do not seem wholly credible without a causal agent of some kind, and there is no mention of major disturbance at the time. The other monthly figures obtained in the study seem far more consistent with long term trends.

Assessment of the Lyons and Skwarto Recommendations: Lyons and Skwarto recognized that Halfway Pond needed rehabilitation, and they listed several management strategies designed to reduce nutrient loading.The strategies were presented as boiler plate discussions of corrective actions that could reduce and possibly reverse the nutrient loading in almost any pond. But, since the report did not clearly state what the major source(s) of nutrients might be, it did not list any specific recommendations for mitigation of problems in Halfway Pond. Instead, they just presented the strategies as a list of options that might be employed individually or collectively to alleviate problems.

The whole watershed approach discussed uses two different tracksâ€”structural and non-structural controls. The structural controls are designed to reduce the volumes of wastewater and nutrients being discharged into the watershed. The actions discussed included diversion of stormwater runoff, installation of reduced flow devices on faucets, showers, and toilets in area homes, locating faulty septic systems, installation of soil erosion controls, removal and disposal of sanitary landfill leachate, and connections to town water and sewage services.

The non-structural controls are designed to reduce the total number of potential point and non-point sources of pollution that would affect the pond. These controls included zoning regulations that increase minimum lot size requirements and building setbacks (thus reducing the number of lots), development controls that limit the subdivisions of land and new construction in sensitive areas, and bans on detergents and fertilizers containing phosphorus. The town would have to manage the regional development, but the area residents and stakeholders would have to manage the phosphorus and other nutrients.

Lyons and Skwarto also discussed several in-pond management techniques to reverse some of the damage. They listed the options of chemical treatments, biological controls, dredging, drawdown, pond bottom sealing, dilution, aeration and mixing of pond water, harvesting aquatic plants, and reducing motor boat use.

Interpretation and Recommendations Based on This Review of the Lyons and Skwarto Study: As mentioned above, most of the Lyons and Skwarto recommendations were largely boilerplate which might apply to almost any pond, but, in the case of Halfway Pond, all but the simplest of their recommendations were either already in place or were totally impractical in this setting. On the other hand, there are a number of measures which should be considered.

Considerable area is already conservation land, and it would be best if even more of the shore could be preserved as open space. If any development takes place, zoning ordinances must be strictly enforced and possibly even tightened. Long setbacks should be required for any new residences, and new residences must have modern and efficient septic systems.

There must be as little buffer zone disturbance as possible, and water withdrawals should not exceed recharge rates. New and existing homeowners should consider reduced flow devices and should use erosion and runoff controls.

The few existing residences on the pond may not contribute much to the total nutrients going into the pond; however, residents should not use phosphorus-based detergents and fertilizers. Residents should also take care to maintain their vegetated buffer zones and not let untreated wastewater or stormwater reach the pond. Residents should maintain their septic systems in accordance with Title 5 regulations.

In the near future, the Town of Plymouth will be installing BMPs to eliminate road runoff into the Agawam River from Mast Road. Some types of BMPs should also be given serious consideration as a way to eliminate road runoff from the long shoreline section of Mast Road.

The several cranberry bogs around the pond should be fertilized as little as possible, and some of vegetated buffer zone which has been destroyed should be replanted. Tailing and settling ponds should be considered as additional means of reducing the quantities of nutrients which flow into the pond when bogs are irrigated or drained after they are flooded.

Motor boat use can be reduced by town and state decree, but other in-pond management techniques would require extensive review and may not be either prudent or practical.

Final Comments: Since the Lyons_Skwarto report was issued, it appears that no corrective action has ever been taken. There are many who do not believe that such a large pond in a (relatively) pristine area can be this degraded, especially when it is so far away from population centers. Yet, the 1980 study and recent data confirm its status as a highly eutrophic pond. This pond and its environs may be core habitat, but it is not a pristine one!

Through the efforts of the Six Ponds Improvement Association and resident who live on Halfway Pond, this pond is being closely monitored. However, all area stakeholders and town residents should have an interest in the health of this pond and its biota. Strong protective action must be taken to keep it from degrading further. It must be protected so it can heal.

Authors

Richard A. Stabileâ€" Plymouth resident, Plymouth Town Forest Committee (chairman), a masters candidate in environmental studies, formerly a member of the Plymouth Conservation Commission, and formerly a National Park Service Ranger.

Leighton A. Priceâ€" Plymouth resident, Six Ponds Improvement Association (board member), a founder of the Plymouth Water Quality Task Force, retired professor, data analyst and computer professional.

Sources

A Study of Halfway Pond With Guidelines for Rehabilitation. Lyons

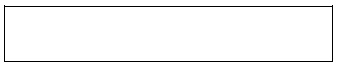
and Skwarto Associates, Westwood, MA, 1979. (Commissioned by the Town of Plymouth, MA and on file in the Conservation Office).

A Study of Halfway Pond which Replicates Portions of the Lyons and Skarto Study. Sponsored by The Nature Conservancy, Plymouth, MA, 2003 (unpublished).

Six Ponds Improvement Association web site (www.sixponds.org)

Plymouth Water Quality Task Force web site (www.plymouthwaterquality.org)

-
-
-



The Six Ponds Improvement Association
P.O. Box 1580
Plymouth, MA 02360
Contact Us

Site by Leighton A. Price
570 Mast Road, Plymouth, MA 02360