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The State of Webber Pond: Understanding the Factors Affecting Water Quality in the Webber Pond Watershed

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Problems in Environmental Science course (Biology 493), Colby College

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The State of Webber Pond

Understanding the Factors
Affecting Water Quality in the
Webber Pond Watershed

PART 1

Colby Environmental Assessment Team

Colby College Biology Dept.

December 5, 2002

Vassalboro Town Office



The State of Webber Pond

Summary & Recommendations

Problems in Environmental Science Class
Colby College

This summary is provided at the time of the public presentation given at the Vassalboro town office December 5, 2002. A full report of the study will be published and distributed in the spring of 2003.

Executive Summary

The Colby Environmental Assessment Team (CEAT) investigated the water quality of Webber Pond in Vassalboro, Maine from June through December 2002. CEAT analyzed several factors that contribute to water quality, including physical and chemical measurements, land use patterns, and the impact of residential and commercial development. All of these measurements were compared and used to compute models, which enabled CEAT to discover the sources of pollution most threatening to the current and future water quality of Webber Pond. These data were also compared to those collected in previous years to gain a historical perspective. Water quality is affected by the accumulation of nutrients, particularly phosphorus, due to surface runoff, erosion, and internal nutrient loading. When concentrations of phosphorus reach threshold levels, a lake can experience algal blooms that decrease the aesthetic, recreational, ecological, and economic value of the lake.

A brief summary of CEAT findings in the Webber Pond watershed:

- Webber Pond is a eutrophic pond with a mean phosphorus level of 23 ppb, which is well above the threshold for algal blooms (12 ppb to 15 ppb).
- Phosphorus concentrations in the hypolimnion (lake bottom) are becoming increasingly higher, with a mean of 353.76 ± 33.93 ppb. Internal nutrient loading is a significant problem in Webber Pond, contributing about 26 percent of total phosphorus load to Webber Pond.
- Transparency and dissolved oxygen measurements at Webber Pond correspond to characteristics found in a eutrophic pond. The mean transparency is consistently lower than 6.0 m limit for eutrophic ponds, with a mean reading of 1.24 ± 0.14 m in September. There is a sharp decline in dissolved oxygen below 6 m in depth. Anoxic conditions increase internal nutrient loading and impact the recreational fishery at Webber Pond.
- A water budget indicates the flushing rate and was 1.58 flushes per year. This value indicates that the water in Webber Pond is theoretically replaced 1.58 times a year. This value is higher than expected for a pond that has the algae bloom problems that Webber Pond exhibits.
- A comparison of land usage from 1956 to 1997 shows a significant decrease in land used for agriculture. In 1956, 35.9 percent of the land in the Webber Pond watershed was used for agriculture, while in 1997 only 13.8 percent of the land was used for agriculture. Agriculture still contributes 27 percent of the total phosphorus load from external sources to Webber Pond.

- There has been an increase in commercial and municipal land use, including the Green Valley Campground, Natanis Golf Course, and the Vassalboro Middle School. This increase in development has led to increased erosion and nutrient run-off of phosphorus and nitrogen. The golf course contributes 11 percent of the total phosphorus load from external sources to Webber Pond.
- Data from the CEAT buffer survey indicates that many of the shoreline residences do not meet the minimum setback requirement and lack an appropriate buffer strip. The buffer survey indicated that 21.6 percent of buffers were poor, 50.3 percent were partial, while only 28.1 percent were considered adequate. There are significantly fewer adequate buffer strips around Webber Pond compared with many other lakes in the region.
- Roads also disproportionately contribute to the total sediment and nutrient loading rates of surface waters, contributing 7 percent of the phosphorus in Webber Pond. This is a substantial amount from relatively small sources that can be readily improved. There are 43 roads that cover 41.6 acres of the Webber Pond watershed.
- Data from the CEAT road survey indicate that the condition of fourteen roads are good, 13 acceptable, 10 fair, and six poor. Several roads need crowning, ditch repair, and removal of berms.
- Currently, there are no introduced aquatic plant species in Webber Pond. The threat of such invasive plants being introduced to Webber Pond is high because Webber Pond has a public boat ramp and a shallow, sandy bottom.

Reducing the amount of nutrients entering Webber Pond is necessary for successful remediation. Properly maintaining roads, preventing shoreline erosion, and modifying or banning products containing phosphorus will help reduce the amount of nutrients entering Webber Pond. The reduction of internal loading of phosphorus is also important. Presently, this is addressed through the yearly drawdown. However, there are several other possible techniques, including phosphorus inactivation and hypolimnetic withdrawal that should be considered. Additional action must be taken to improve water quality for the residents who recreationally use Webber Pond and to protect the native flora and fauna within Webber Pond.

RECOMMENDATIONS

The primary problem facing Webber Pond is cultural eutrophication. Increased development along the shore accelerates the loading of phosphorus and nitrogen into Webber Pond. Additionally, the excess phosphorus in the sediment of Webber Pond is recycled through the water column and made available for plant growth by internal loading. Remediation efforts aimed to limit the quantities of available nutrients must address both of these nutrient sources. The Maine DEP classifies Webber Pond as eutrophic. Although water quality has not seen a serious decline in recent years, it remains relatively poor. The implementation of preventative measures is essential to improve the water quality of Webber Pond. CEAT has developed several recommendations relevant to this improvement.

MONITORING SUGGESTIONS

Periodic water monitoring is necessary in developing an overview of the water quality at Webber Pond and in locating specific problem sites. We recommend:

- Performing transparency, total phosphorus, and DO/temperature profile readings bi-weekly from May through August as suggested by Roy Bouchard in his plan for monitoring water level drawdown.
- Testing surface and epicore samples for phosphorus and transparency at the following sites yearly:
 - Maine DEP testing site and deepest location (site 1)
 - Offshore from the Webber Pond dam (site 10)
 - Offshore from the Green Valley Campground (site 6)
 - Offshore from the Natanis Golf Course (site 9)
- Measuring phosphorus input from the Threemile Pond tributary to determine how much phosphorus loading the stream contributes at various points along the year and to assure that point-source diversion is not crucial remediation of Webber Pond.

This study reviewed several remediation techniques used in other watersheds and the feasibility of implementing these in Webber Pond. We recommend:

REMEDICATION SUGGESTIONS

Development Control

We believe that Webber Pond's water quality is largely impacted by the development occurring along its shores. Residences contribute to a deteriorated lake health due to their proximity to the main body of water. The construction of roads and driveways elevates the proportion of impermeable surfaces that surround the lake, and poorly maintained roads can contribute even higher levels of nutrients. The problems of development and roads are confounded when they are not separated from the lake by a sufficient buffer, and in areas that lack sufficient riprap. Changes in each of these areas would greatly improve Webber Pond's health, and can occur through regulatory measures, community measures, and residential measures. We recommend the following measures:

Regulatory Measures

Agriculture

- Increasing the number of farms that implement Best Management Practices (BMPs) with the Maine Department of Agriculture (MDA).
- The MDA monitoring these farms more closely.

Forestry

- Restricting future timber harvest, especially near the tributaries and the shoreline of Webber Pond
- Observing town-zoning regulations, particularly in areas with elevated erosion potential such as steep slopes.

Roads

- Conducting road surveys frequently and consistently in order to identify trouble spots, as well as addressing the trouble spots identified in this report.
- Removing berms along the road's edges, to prevent water retention on the surface of the road and reducing the formation of potholes and rills.
- Keeping culverts clear of debris and functional and their drainage areas should be well vegetated and not flowing directly into the lake.
- Encouraging the use of funds raised by the China Regional Lake Alliance, Webber Pond Association, and Webber Pond residents to improve the quality of the roads, including annual crown construction and grading.

Residential

- Observing the zoning laws outlined for residential development around the lake.
- The Town of Vassalboro or the Webber Pond Association should encourage the addition and enhancement of vegetated buffers and riprap by Webber Pond residents in areas with minimal buffering and eroding shoreline. Where possible, approaching the ideal of 75 ft of native vegetation between their home and the lakeshore should be done.
- Retaining areas of naturally vegetated buffer as well as planting native trees and shrubs around the periphery of the lake where vegetated buffer is lacking or insufficient enforced by the Town of Vassalboro.
- Limiting the usage of lawn fertilizers near the shoreline, especially those with high phosphate content.
- Reducing shoreline alteration, including the installation of docks and piers, and encouraging residents to retain large naturally occurring shoreline rocks and to install riprap where necessary.
- Educating residents about the importance of installing diversions and enhancing the surface quality of their driveways, which can often lead to even greater nutrient contributions to Webber Pond than roads due to their proximity to the lake.

Cleared Land

- Enclosing areas of newly exposed soil by silt or hay fences to reduce the amount of runoff flowing from them to the lake.

Nutrient Control

The phosphorus loading model predicted that at least 25 percent of the phosphorus in Webber Pond was due to internal nutrient recycling, making it the greatest contributor. Even if the amount of incoming phosphorus to Webber Pond is limited, phosphorus levels will remain high and still sustain algal blooms. To reduce internal phosphorus we recommend:

- Continuing the yearly gradual drawdown. The plan should follow the monitoring suggestions by Maine DEP. Gradual drawdown should commence before Labor Day, after a severe algal bloom. Boards should be removed every few days afterwards and all boards should be pulled after Labor Day.
- Investigating the possibility of using the nutrient rich water from hypolimnetic withdrawal for irrigation of Natanis Golf Course. The golf course could use a longer intake pipe, that would drain water even after drawdown occurred. Nutrients would be removed from Webber Pond, and the golf course would gain water and nutrients for the holes closest to Webber Pond.
- Investigating the possibility of phosphorus inactivation through the addition of alum.

Macrophyte Control

The introduction of invasive aquatic plants in lakes has become a serious problem throughout the United States. Although they have not yet been introduced to Webber Pond, residents should be engaged in vigilance and education efforts to ensure that they are not introduced in the future. Populations of invasive plants such as Eurasian Watermilfoil (*Myriophyllum spicatum*) can be transported by tiny plant fragments, which make their establishment difficult to prevent. In addition, the introduction of these non-natives is commonly the result of transfer from recreational boats. This is a problem for Webber Pond because it has a public boat ramp, which would allow boats carrying plant pieces from other lakes to introduce them into Webber Pond. Educating residents and others who use the boat ramp about the dangers of depositing plant fragments into the lake may reduce the risk that nuisance non-native plant infestations may occur in Webber Pond. Also, the implications of increased native macrophytic growth should also be described to and preventative measures should be taken by the Webber Pond Alliance as well as by Webber Pond residents. We recommend the following:

Non-natives

- Making clear to residents the threat of non-native plant invasion through a comprehensive public awareness campaign including distribution of pamphlets, and more posted signs. These should outline legislation concerning invasive plants and proactive measures that residents can take against them.

Excess Native Macrophytic Growth

- Encouraging residents to remove excess plant debris that washes onto their property before it decomposes and returns nutrients to the lake.
- Controlling areas of excess macrophytic growth with manual pulling by residents and other volunteers.

EDUCATION SUGGESTIONS

The residents around Webber Pond have the greatest ability to improve the water quality of Webber Pond. Many of the sources of nutrients, such as roads and runoff due to improper buffer strips, are under their private control. Residents must be educated regarding how their daily lifestyle affects the water quality of Webber Pond, and about the simple remediation projects they can undertake to benefit the future of Webber Pond. We recommend:

- Encouraging the availability of this report to the general public including providing copies of the report to Webber Pond Association and local libraries.
- Working closely with the China Regional Lake Alliance, volunteer lake monitors, and the Maine DEP to educate homeowners about improving road, buffer strip, and riprap construction. These volunteers go door-to-door distributing pamphlets and explaining simple techniques that could be used.
- Developing and distributing an educational pamphlet on how to avoid detergents high in phosphorus. Also discouraging residents from washing cars and boats with detergents near Webber Pond.
- Developing and distributing an educational pamphlet on the necessity and benefits of water level drawdowns.
- Incorporating the Vassalboro school system in educational initiatives. Provide information to teachers to involve schoolchildren in monitoring Webber Pond

Problem Roads

All of the specific problem areas were found on unpaved camp roads. These roads present the greatest risk in terms of erosion of sediment and leaching of nutrients from the road surface. With one exception, all

problem areas were found on roads leading directly to Webber Pond, areas where proper drainage and water diversion devices are crucial. These problem areas are concentrated in areas of residential development. Intensive use and problems of increased runoff from driveways and lawns can augment the normal rates of erosion and nutrient loading. Each problem area found has been listed alphabetically by road name. Descriptions of the problem and solutions are listed to aid in the remediation of the affected areas.

Alfred Road – culvert damage

Location: 0.1 miles off Town Farm Road

Problem: Culvert exposed to road surface, pipe is corroding and worn

Remediation: Need to rebuild road to cover culvert, possible need to replace culvert in future

Jones Road – severe erosion

Location: 0.5 miles off Cross Hill Road

Problem: Erosion evident down the center of road in the direction of Webber Pond

Remediation: Surface needs work – ruts need to be filled, and berm removed
Ditching necessary just before problem area
Crowning would also help to divert water flow

Jones Road – severe erosion

Location: 0.4 miles off Cross Hill Road

Problem: Erosion evident and the presence of a berm noted

Remediation: Surface needs work – ruts need to be filled and berm removed
Some ditching necessary
Crowning to divert water flow

McQuarrie Road – severe erosion

Location: 0.4 miles off Hannaford Hill Road

Problem: Portion of road washed out, water runs straight down the road

Remediation: Crowning to divert water flow
Proper ditch construction needed

No Name Road (off Fairway Drive) – culvert damage

Location: 0.1 miles off Fairway Drive

Problem: Plastic culvert is exposed and crushed

Remediation: New culvert pipe needed as well the rebuilding of road to cover culvert

Perley Road – culvert blockage

Location: 0.1 miles off Saucier Road

Problem: Culvert blocked by sediments and organic material

Remediation: Clearing of debris needed to restore water flow

Pleasant Point Road – diversion blockage, ditch required

Location: 0.1 miles off Cross Hill Road

Problem: Diversions present but full of sediments, no ditches present

Remediation: Clear diversions of debris
Proper ditch construction needed

Pleasant Point Road – culvert blockage

Location: 0.2 miles off Cross Hill Road

Problem: Culvert blocked by sediments and organic debris
Remediation: Clearing of debris needed to restore water flow

Pleasant Point Road – culvert blockage

Location: 0.2 miles off Cross Hill road

Problem: Culvert blocked by sediments and organic material
Remediation: Clearing of debris needed to restore water flow
Proper ditch construction needed on both sides of culvert

Pleasant Point Road – culvert blockage

Location: 0.25 miles off Cross Hill Road

Problem: Culvert damaged, blocked by sediments and organic material
Remediation: Clearing of debris needed to restore water flow
Repair culvert pipe

Pomerleau Road – berm present

Location: 0.1 miles off Cross Hill Road

Problem: Berms present along side of road
Remediation: Berm removal and the construction of proper ditches needed to divert water flow

Pooler Drive – severe erosion

Location: 0.1 miles off Taber Hill Road

Problem: Severe erosion present in combination with steep slopes
Remediation: Crowning would help to divert water flow

Saucier Road – culvert blockage

Location: 0.1 miles off Cross Hill Road

Problem: Ditch and culvert blocked by sediments and organic material
Remediation: Clearing of debris needed to restore water flow

Shaefer Lane – crown absent

Location: 0.1 miles off Pleasant Point Road

Problem: Surface needs work – road needs grading, proper crown construction
Remediation: Diversion needed to channel water from a 4X4 trail