PHOSPHORUS CONTROL ACTION PLAN

and Total Maximum Daily (Annual Phosphorus) Load Report

WEBBER POND

Kennebec County

Webber Pond PCAP-TMDL Report

Maine DEPLW 2002 - 0556

Maine Department of Environmental Protection

and Maine Association of Conservation Districts

Final EPA Review Document

July 3, 2003 (Revised September 2, 2003)

WEBBER POND Phosphorus Control Action Plan (PCAP)

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APPENDICES

WEBBER POND

Total Maximum Daily (Annual Phosphorus) Load

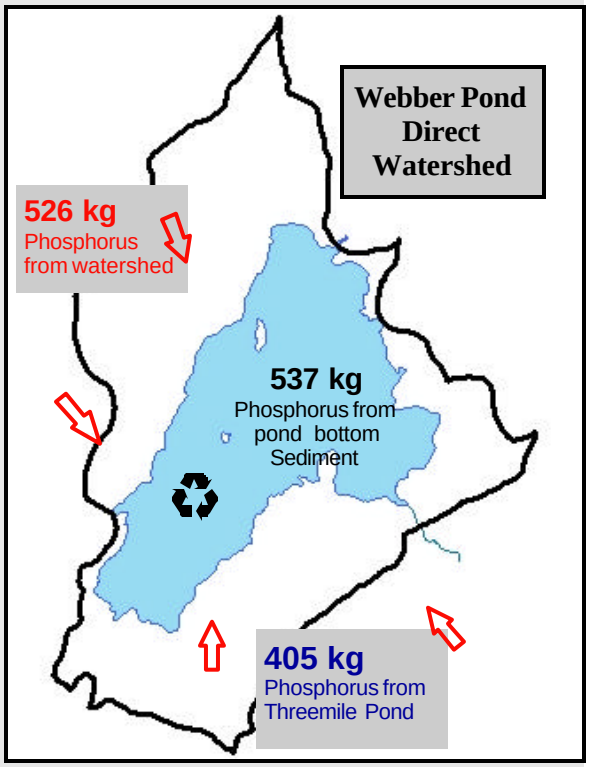
ACKNOWLEDGMENTS

In addition to Maine DEP and US-EPA New England Region I staff, the following individuals, groups and agencies were instrumental in the preparation of this combined Webber Pond Phosphorus Control Action Plan-Total Maximum Daily (Annual Phosphorus) Load report: MACD staff (Jodi Michaud Federle, Forrest Bell and Tim Bennett); China Region Lakes Alliance (Reb Manthey); Town of Vassalboro (Office staff); Kennebec County SWCD (Nate Sylvester and Dale Finseth); Webber Pond Association (Judy Moody and Frank Richards); Scott Pierz (former Vassalboro CEO); Maine Department of Marine Resources (Matthew O'Donnell and John Perry); Maine Department of Agriculture (David Rocque); Maine Forest Service (Morten Moesswilde); Maine Department of Inland Fisheries and Wildlife, Region B, Sidney (Jim Lucas); and special appreciation to Judy and Ike Moody (VLMP monitors) and Reb Manthey for the use of their boats to complete the TMDL-associated water quality monitoring during the 2002 season.

Webber Pond Phosphorus Control Action Plan
Summary Fact Sheet

Background

WEBBER POND is a 1,201 acre waterbody located in the Town of Vassalboro in Kennebec County, south central Maine. Webber Pond has a direct **watershed** (see map) area of 8 square miles; a maximum depth of 41 feet, a mean depth of 16 feet; and a **flushing rate** of 1.5 times per year. The total Webber Pond watershed drainage area, including upstream situated Threemile and Threecornered pond subwatersheds, is 22.5 square miles.



Webber Pond has a history of supporting excessive amounts of algae in the late summer, due in large part to the contribution of **phosphorus** that is prevalent in area soils and has accumulated in the pond bottom sediments. Soil erosion in the Webber Pond watershed can have far-reaching consequences, as soil particles effectively transport phosphorus, which serves to "fertilize" the lake and decreases water clarity (see photo of Webber Pond below). Excess phosphorus can also harm fish habitat and lead to nuisance algae blooms—floating mats of green scum—or dead and dying algae. Studies have shown that as water clarity decreases, lakeshore property values also decline.

Stakeholder Involveme nt

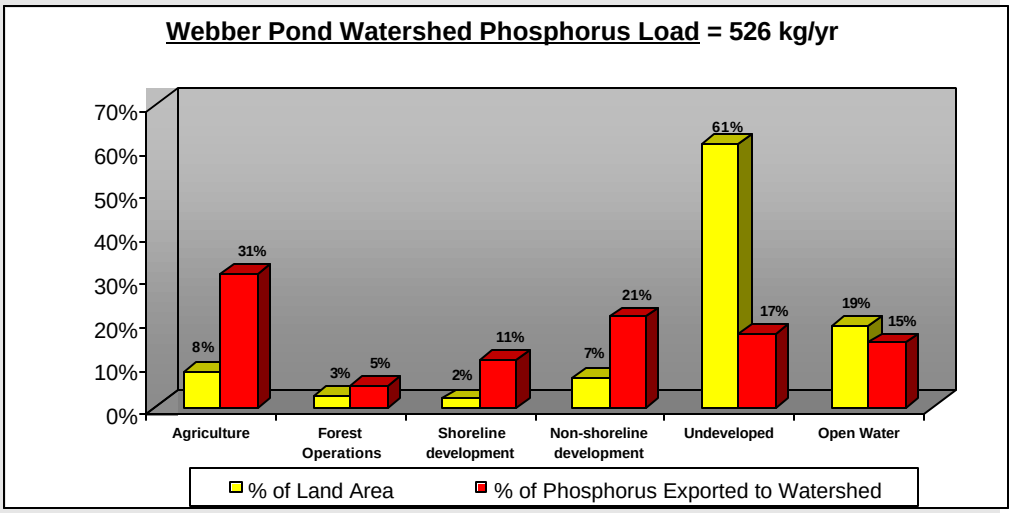
Federal, state, county, and local groups have been working together to effectively address this nonpoint source water pollution problem. In 2001, the Maine Department of Environmental Protection funded a project in cooperation with the Maine Association of Conservation Districts, Kennebec County Soil and Water Conservation District, China Region Lakes Alliance, and the Webber Pond Association to identify and quantify the potential sources of phosphorus and identify the **Best Management Practices** needed to be installed in the watershed. A final report, completed in the spring of 2003, is entitled "Webber Pond Phosphorus Control Action Plan" and doubles as a **TMDL** report, to be submitted to the U.S. Environmental Protection Agency, New England Region, for their final review and approval.

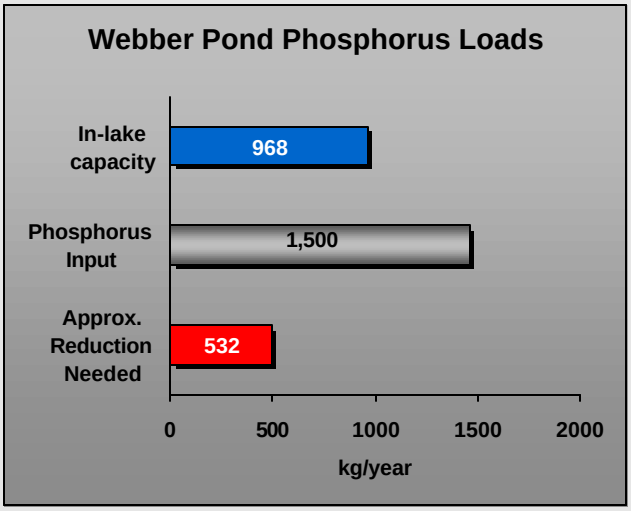
What We Learned

A land use assessment was conducted for the Webber Pond watershed to determine potential sources of phosphorus that may run off from land areas during storm events and springtime snow melting. This assessment utilized many resources, including generating and interpreting maps, inspecting aerial photos, and conducting field surveys. Similar land use assessments have been conducted for the two associated upstream situated Threemile and Threecornered ponds, located in the neighboring towns of China and Augusta, as well as Vassalboro.

An estimated 526 kilograms (kg) of phosphorus per year is exported to Webber Pond from the direct watershed. The bar chart illustrates the land area for each land use vs. its total phosphorus export load.

The total phosphorus contribution from up-stream Threemile Pond was estimated at 405 kg/yr. Over the past two decades the amount of phosphorus being recycled internally (537 kg/yr) from the bottom sediments of Webber Pond during the summertime has been fairly regular - nearly equaling one-half of Webber Pond's natural capacity (968 kg TP/year) for in-lake phosphorus assimilation.





The graph (left) and map (previous page) displays the estimate that the internal (537 kg) + external (526 kg) + indirect (405 kg) + future development (32 kg) = (1,500 kg) loading, which exceeds Webber Pond's capacity (968 kg) to effectively process phosphorus. The approximate amount needed to be reduced, on an annual basis, to ensure that Webber Pond is free of nuisance summertime algae blooms is 500+ kg/yr.

What You Can Do To Help!

As a watershed resident, there are many things you can do to protect the water quality of Webber Pond. Lakeshore owners can use phosphorus-free fertilizers and maintain natural vegetation adjacent to the lake. Agricultural and commercial land users can consult the Kennebec County Soil and Water Conservation District or Maine Department of Environmental Protection for information regarding Best Management Practices (BMPs) for reducing phosphorus loads. Watershed residents can always become involved by volunteering to help the Webber Pond Association and participating in events sponsored by the CRLA. All stakeholders and watershed residents can learn more about their lake and the many resources available, including review of the Webber Pond Phosphorus Control Action Plan. Following final EPA approval, copies of this detailed report, with recommendations for future NPS/BMP work, will be available online at www.state.me.us/dep/blwq/docmonitoring/tmdl2.htm, or can be viewed and/or copied (at cost) at Maine DEP offices in Augusta (Bureau of Land and Water Quality, Ray Building, AMHI Campus).

Key Terms

- ***Watershed*** *is a drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.*
- ***Flushing rate*** *refers to how often the water in the entire lake is replaced on an annual basis..*
- ***Phosphorus****: is one of the major nutrients needed for plant growth. It is naturally present in small amounts and limits the plant growth in lakes. Generally, as phosphorus increases, the amount of algae also increases.*
- ***Best Management Practices*** *are techniques to reduce sources of polluted runoff and their impacts. BMP's are low cost, common sense approaches to reduce storm runoff and velocity to keep soil out of lakes and tributaries.*
- ***TMDL*** *is an acronym for Total Maximum Daily Load which represents the total amount of a pollutant (e.g., phosphorus) that a waterbody can receive on an annual basis and still meet water quality standards.*

Project Premise

This project, funded through a 319-grant from the United States Environmental Protection Agency (EPA), was directed and administered by the Maine Department of Environmental Protection (Maine DEP) in partnership with the Maine Association of Conservation Districts (MACD), from the summer of 2001 through the late spring of 2003.

The objectives of this project were twofold: First, a comprehensive land use inventory was undertaken to assist Maine DEP in developing a Phosphorus Control Action Plan (PCAP) and a Total Maximum Daily Load (TMDL) report for the Webber Pond watershed. Simply stated, a TMDL is the total amount of phosphorus that a lake can receive without harming water quality. Maine DEP, with the assistance of the MACD Project Team, will address and incorporate public comments before final submission to the US EPA. *(For more specific information on the TMDL process and results, refer to the Appendices or contact Dave Halliwell at the Maine DEP Augusta Office at 287-7649 or at David.Halliwell@maine.gov*).

Secondly, watershed survey work, including a shoreline and septic survey evaluation, were conducted by the Maine DEP-MACD project team to help assess **total phosphorus** reduction techniques that would be beneficial for the Webber Pond watershed. Watershed survey work included assessing direct drainage **nonpoint source (NPS) pollution** sites that were not identified during the Webber Pond Watershed Nonpoint Source Pollution Survey previously conducted in 1997. The China Region Lakes Alliance (CRLA) — as part of its Watershed Management Plan (1998-2008) — intends to conduct a comprehensive follow-up watershed survey. The results of this 1997 assessment report includes recommendations for future conservation work in the watershed to help citizens, organizations, and agencies restore and protect Webber Pond. **Note:** *To protect the confidentiality of landowners in the Webber Pond watershed, site-specific information has generally not been provided as part of this report.*

Total Phosphorus (TP) *- is one of the major nutrients needed for plant growth. It is generally present in small amounts and limits the plant growth in lakes. Generally, as the amount of lake phosphorus increases, the amount of algae also increases.*

Nonpoint Source (NPS) Pollution *- is polluted runoff that cannot be traced to a specific origin or starting point, but appears to flow from many different sources.*

This Phosphorus Control Action Plan (PCAP) report compiles and refines land use data derived from various sources, including the municipality of Vassalboro, the Webber Pond Association, the Kennebec County Soil & Water Conservation District (SWCD), and the CRLA. Local citizens, watershed organizations, and conservation agencies should benefit from this compilation of data as well as the watershed assessment and the NPS Best Management Practice (BMP) recommendations. Above all, this document is intended to help Webber Pond stakeholder groups to effectively prioritize future BMP work in order to obtain the funding resources necessary for NPS pollution mitigation work in their watershed.

Study Methodology

Webber Pond background information was obtained using several methods, including a review of previous studies of the lake and watershed area, numerous phone conversations and personal interviews with municipal officials, regional organizations and state agencies, and several field tours of the watershed, including boat reconnaissance of the lake and shoreline.

Land use data were determined using several methods, including (1) **Geographic Information System (GIS)** map analysis, (2) analysis of topographic maps, (3) analysis of town property tax maps and tax data, (4) analysis of aerial photographs (USFSA 1992 & 1997) and (5) field visits. Much of the undeveloped land use area (i.e., forest, wetland, grassland) was determined using GIS maps utilizing data from the Penobscot Bay Land Cover 1995/96 for the Coastal Change Analysis Program. The developed land use areas were obtained using the best possible information available through analysis of methods 2 through 5 listed above. Necessary adjustments to the GIS data were made using best professional judgment.

> ***GIS**—or **geographic information system** combines layers of information about a place to give you a better understanding of that place. The information is often represented as computer generated maps.*

Roadway data were gathered by taking actual road width measurements of the various types of roads (state, town, private/camp) in the watershed. Roads were measured between the two outer edges of the roadside ditches or berms. An average width was used for each of the three road types. Final measurements for all roadways within the watershed were extrapolated using GIS (Penobscot Bay Land Cover 1995/96 Analysis for the Coastal Change Analysis Program), and USGS topographical maps. Finally, the roadway area was determined using linear distances and average widths for each of the three main road types.

Additional land use data (i.e. non-shoreline residential, institutional) were determined using GIS cover mapping, aerial photos, topographic and property tax maps as well as personal consultation and, when necessary, field visits.

Agricultural information within the Webber Pond watershed was provided by the Kennebec County Soil and Water Conservation District (SWCD). Information regarding forestry harvesting operations was provided by the Maine Forest Service, Department of Conservation.

Study Limitations

Land use data gathered for the Webber Pond watershed is as accurate as possible given available information and resources utilized. However, the final numbers for the land use analysis and phosphorus loading numbers are approximate at best, and should be viewed as carefully researched estimations only.

Figure 1. Map of Webber Pond Direct Watershed

Webber Pond Watershed: Kennebec County, Maine

WEBBER POND Phosphorus Control Action Plan

DESCRIPTION of WATERBODY and WATERSHED

WEBBER POND is a 1,201 acre single-basin waterbody, located within the Town of Vassalboro (DeLorme Atlas, Map13), in Kennebec County, located in south central Maine. Webber Pond has a **direct watershed** area (see Figure 1) of 6,373 acres (8.1 square miles), and is within the Sevenmile Stream drainage of the Lower Kennebec River watershed. Webber Pond has a maximum depth of 12 meters (41 feet), an overall mean depth of 5 meters (16 feet) and has a flushing rate of 1.5 times per year. The total Webber Pond watershed drainage area, including the upstream Threemile and Threecornered pond subwatersheds, is 14,226 acres (22.5 mi^2).

*The **direct watershed** refers to the land area that drains to the lake without first passing through another lake or pond.*

Drainage System – The entire Webber Pond watershed includes a chain of three larger (1,201 acre Webber, 1,132 acre Threemile, and 180 acre Threecornered) and two lesser ponds (Anderson and Mud). Threecornered Pond (to the south) drains into Threemile Pond (to the southeast), which drains directly into Webber Pond via Seaward Mills Brook. Webber Pond has a single outlet at the dam - non-303(d) listed Sevenmile Stream, a major tributary to the Kennebec River. A number of streams drain into Webber Pond, including Seaward Mills Brook which is the inlet from Threemile Pond and by far the largest tributary, contributing approximately 90% of the total tributary water input to Webber Pond (Maine DEP 1982).

Water Quality Information

Webber Pond is listed on the Maine DEP's 303(d) list of lakes that do not meet State water quality standards as well as the State's Nonpoint Source Priority Watersheds list. Hence, the preparation of an Action Plan for Phosphorus Control (and TMDL) was prepared, publicly reviewed, and completed in the late spring of 2003.

***Secchi Disk Transparency**—a measure of the transparency of water (the ability of light to penetrate water) obtained by lowering a black and white disk into water until it is no longer visible.*

Water quality data for Webber Pond has been collected from the deep hole station (01) since 1975. Based on continuous **Secchi disk transparencies,** measures of both TP and **chlorophyll-a**, the water quality of Webber Pond is considered to be poor and the potential for nuisance summertime algae blooms is moderate to high (Maine VLMP 2002). Together, these data document a trend of increasing **trophic state,** in direct violation of the Maine DEP Class GPA water quality criteria requiring a stable or decreasing trophic state.

***Chlorophyll-a** is a measurement of the green pigment found in all plants including microscopic plants such as algae. It is used as an estimate of algal biomass; the higher the Chl-a number, the higher the amount of algae in the lake.*

***Trophic state**—the degree of eutrophication of a lake. Transparency, chlorophyll a levels, phosphorus concentrations, amount of macrophytes, and quantity of dissolved oxygen in the hypolimnion can be used to assess trophic state.*

Nonpoint source pollution is the main reason for declining water quality in Webber Pond. During storm events, nutrients, such as phosphorus—naturally found in Maine soils– drain into the lake from the surrounding watershed by way of streams and overland flow.

Phosphorus is naturally limited in lakes and can be thought of as a fertilizer, a primary food for plants, including algae. When lakes receive excess phosphorus from NPS pollution, it "fertilizes" the lake by feeding the algae. Too much phosphorus can result in algae blooms, which can damage the ecology/aesthetics of a lake, as well as the economic well-being of the entire effected watershed community.

Principle Uses: The dominant human uses of the Webber Pond shoreline are residential (both seasonal and year-round occupancy) and recreational—boating, fishing and swimming/beach use. There is public access to the lake at the Town of Vassalboro boat launch and swim area, located off of Webber Pond Road at the southwest corner of the lake. There is a public campground located on the eastern shore of the lake.

Human Development: Webber Pond is a moderately developed lake with approximately 40 to 50 percent of the shoreline developed (MACD & CRLA 2001). There are 162 shoreline dwellings, of which an estimated 77% are seasonal cottages and 23% are year-round homes. There are, on an average, 1 to 2 seasonal to year-round conversions per year (Vassalboro planning board meeting minutes, 1997-2000).

The entire direct watershed of Webber Pond is located within the single town of Vassalboro, encompassing approximately 21% of the Town of Vassalboro (KC-SWCD). Vassalboro is a rural, residential suburb, located five miles north of Augusta and 15 miles south of Waterville in central Kennebec County. Augusta and Waterville are the major commercial and employment centers in this area.

Over a decade ago, Maine DEP found that increased development in the watershed had increased phosphorus loading to the lake and that loading will "grow substantially over the next decade as moderate development pressure continues to convert forest and farmland to new dwelling lots and as seasonal cottages are converted to year-round use" (Maine DEP 1991). Over the past two decades, the amount of forested land has decreased by at least 10% while the amount of developed land has increased (Maine DEP 1982, MACD 2001).

Webber Pond is on the State's **Nonpoint Source Priority Watersheds** list due primarily to algal blooms and other factors. In addition to NPS pollution, high population growth rates are a concern for the watershed. There are 4,047 people currently residing in Vassalboro, a 10% increase for the 1990s (US Census 2000). Prior decades experienced an 8% increase in the 1980s and a 30% increase for the 1970s (US Census). The estimated watershed population is 950 (Vassalboro tax records; US Census 2000).

*Waterbodies within designated **NPS priority watersheds** have significant value from a regional or statewide perspective and have water quality that is either impaired or threatened to some degree due to NPS water pollution. This list helps to identify watersheds where state and federal agency resources for NPS water pollution prevention or restoration should be targeted.*

Outlet Dam Management - The outlet dam is owned, operated and maintained by the Webber Pond Association. Work was completed on the dam in the fall of 1990 to facilitate limited enhanced annual drawdowns. One objective of the annual drawdown is to "provide for adequate and timely

flushing of surface water which is high in phosphorus and algal matter to aid in water quality restoration" (Maine DEP 1996). The dam has only 5.5 feet of drawdown potential; however, hydraulic forces prevent removal of the bottom boards (Frank Richards, WPA, personal communication).

In general, there has been a 3 to 4-foot draw right after Labor Day for about the past 10 years (1993-2002) (Frank Richards, WPA, personal communication). In recent years, the timing of the drawdown is determined at the Webber Pond Association's annual meeting and the exact dates of drawdown vary from year to year. In 2001, all boards were pulled immediately after Labor Day. In 2002, one dam board (one on each side) was removed on August 13 for a 6-inch draw in an effort to flush out the top algae-laden layer of water. A second 8-inch draw occurred on September 2 and a third draw of about 8 inches on September 8, with as many remaining boards as possible being pulled after September 15th (Frank Richards, WPA, personal communication).

Historically, few boards were replaced and much of the lake bottom was left exposed during the winter months. In recent years, some boards are replaced in October to allow the lake water level to rise before ice-in, with the remainder of boards replaced sometime in the spring, which allows for about 2 feet of draw to be left exposed at the control gate during the winter months (Frank Richards, WPA, personal communication).

View of the Webber Pond Outlet Dam during drawdown—September 2001

Fish Assemblage - Anadromous Fish Restoration

Based on records provided by the Maine Department of Inland Fisheries and Wildlife (Maine DIFW) and a recent conversation with fish biologist Jim Lucas (Region B, Sidney DIFW office), **Webber Pond** (Town of Vassalboro, Seven Mile Stream and Kennebec River drainage) is currently managed as a mixed warmwater and coldwater fishery and was last surveyed in 1993 (Maine RE-MAP Project). A total of **14** fish species are listed, including: **9** native indigenous fishes (American eel, Fallfish, White sucker, Brown bullhead, Chain pickerel, Banded killifish, Redbreast sunfish, Pumpkinseed, and Yellow perch); **3** introduced fishes of uncertain origin (White perch, Smallmouth bass and Largemouth bass); and **2** annually stocked managed fishes (sea-run Alewife - Maine DMF **anadromous** fish restoration program, and catchable-sized Brown trout - Maine DIFW). Golden shiner are not listed, but probably have been introduced as a commonly used bait fish. According to Maine DIFW, Webber Pond has been targeted for a new '**put-and-take-only**' Brook trout fishery program and will receive its first stocking in the spring of 2004. Similar to neighboring Threecornered Pond (1998), there have been recent (June 2002) unverified records of larger illegally introduced Northern pike being angled from Webber Pond. Kennebec River stray Sea lampreys have been historically reported from Webber Pond, as well as from the upstream situated Threemile Pond (Maine DIFW).

***Anadromous** fish are born in fresh water, migrate to the ocean to grow into adults, and then return to fresh water to spawn.*

***Put-and-take-only** is the process of stocking game fish that are intended to be harvested in a short period of time.*

The Maine Department of Marine Resources (Maine DMR) has been stocking Webber Pond with Alewives since 1997 as part of the Lower Kennebec River Anadromous Fish Restoration Plan (1986). This plan seeks to restore American Shad and Alewife to their historical habitat in the Kennebec River above Augusta. Stocking in Webber Pond was deferred in 1986 at the request of Maine DEP to establish a long-term water quality database for this lake. In 1987, Maine DMR, DEP and IFW began a 10-year cooperative study of the relationship between anadromous Alewives, resident freshwater species and the water quality of selected study lakes (Kircheis et al. 2002). This study suggested that study lakes were not noticeably affected by Alewife stocking at 6 fish/ acre (Maine DEP 1995). Table 1 outlines the extent of alewife stocking in Webber Pond by Maine DMR.

Table 1. *History of Alewife Stocking in Webber Pond*

YEAR	# ALEWIVES STOCKED	FISH/ACRE
1997	2,504	2
1998	5,008	4
1999	7,512	6
2000	7,512	6
2001	7,512	6
2002	7,619	approx. 6
TOTAL	**37,667**	

The stocking rate for Webber Pond will remain at 6 fish/acre until a proposed fishway is installed, at which time the rate will be increased to the full stocking rate of 35 fish/acre or 43,820 Alewives (Matthew O'Donnell, formerly of Maine DMR, personal communication). Plans for fishway installation that would allow for fish passage from the Kennebec River to Sevenmile Stream and into Webber Pond have yet to be finalized (Ibid). Webber Pond usually has sufficient water levels to allow for fish exit-passage from the lake over the spillway into Sevenmile Stream throughout the low-water summer season.

Improved water transparencies and overall acceptable water quality conditions in Webber Pond, including restoration of suitable **dissolved oxygen** conditions (greater than 5 parts per million) will serve to enhance and/or support the continued maintenance of both existing warmwater and marginally coldwater fisheries.

Dissolved Oxygen*—refers to the amount of oxygen measured in the water. It is used by aquatic organisms for respiration. The higher the temperature, the less oxygen the water can hold. Oxygen will naturally decline during the summer months as water temperatures rise.*

Watershed Topography and Characteristic Soils (Source: USDA SCS 1978): Soils dominating the Webber Pond drainage area are fine to medium textured and are easily erodible when vegetation is removed (CRLA 1999) and are described by the following three soil associations:

1. Hollis-Paxton-Charlton-Woodbridge (82%). Shallow and deep, somewhat excessively drained to moderately well-drained, gently sloping to moderately steep, moderately coarse textured soils, on hills and ridges.

2. Buxton-Scio-Scantic (12%). Deep, moderately well-drained to poorly drained, nearly level to sloping, medium textured soils, in flat areas near waterways.

3. Scantic-Ridgebury-Buxton (6%). Deep, poorly drained to moderately well-drained nearly level to sloping, medium textured soils in valleys and moderately coarse textured soil in flat areas or depressions on upland ridges.

Land Use Inventory

The results of the Webber Pond watershed land use inventory are depicted in Table 2 (following page). The various land uses are categorized by developed land vs. undeveloped land. The developed land area comprises approximately 20% of the watershed and the undeveloped land including the water surface area of Webber Pond, comprise the remaining 80% of the watershed. These numbers may be used to help make future planning and conservation decisions relating to the Webber Pond watershed. The information in Table 2 was also used as a basis for preparing the Total Maximum Daily (Annual Phosphorus) Load report (see Appendices).

Descriptive Land Use and Phosphorus Export Estimates

Agriculture: In 1981, Maine DEP conducted a Diagnostic Feasibility Study for the entire Webber Pond watershed, inclusive of both the Threemile and Threecornered pond watersheds. In this study, high external-watershed TP loading was attributed to poor manure handling techniques (winter spreading on grassland) and inappropriate nutrient management. In 1983, a watershed management plan, including a comprehensive listing of recommended agricultural conservation practices for the Webber, Threemile and Threecornered pond watersheds, was developed by the

Table 2. WEBBER Pond Direct Watershed - Land Use Inventory and P-Loads.

LAND USE CATEGORY	Total Land Area Acres		Total Land Area %	TP Export Total %
Agricultural & Forested Land		**Webber Pond**		
Cropland	121		1.9	13.9
Hayland (Manured)	175		2.7	8.8
Low-Intensity Hayland	149		2.3	4.0
Orchard	11		0.2	0.3
Pasture/Barnyard	61		1.0	3.9
Operated Forest Land	170		2.7	5.2
Sub-Totals	**687**		**11%**	**36%**
Shoreline Development		**Webber Pond**		
Low Impact Residential	28		0.4	0.5
Medium Impact Residential	44		0.7	1.7
High Impact Residential	10		0.2	0.5
Septic Systems	—		0.0	2.3
Camp and Private Roads	30		0.5	4.6
Recreational	49		0.8	1.9
Sub-Totals	**161**		**2%**	**11%**
Non-Shoreline Development		**Webber Pond**		
State Roads	2		0.0	0.3
Town Roads	51		0.8	6.0
Low Density Residential	254		4.0	4.9
Commercial Property	4		0.1	0.6
Institutional (Public)	25		0.4	2.8
Golf Course - Tees and Greens	3		0.0	0.9
Golf Course - Fairways	12		0.2	0.7
Golf Course - Other Areas	86		1.3	4.6
Sub-Totals	**437**		**7%**	**21%**
Total: DEVELOPED Land	**1,285**		**20%**	**68%**
Non-Developed Land		**Webber Pond**		
Inactive/Passively Managed Forest	3,035		47.6	9.5
Wetlands	208		3.3	0.3
Scrub Shrub	355		5.6	2.8
Reverting Fields	285		4.5	4.5
Open (Bare) Land	4		0.1	0.3
Total: NON-DEVELOPED Land	**3,887**	**Webber P.**	**61%**	**17%**
Total: Surface Water (Atmospheric)	**1,201**		**19%**	**15%**
TOTAL: DIRECT WATERSHED	**6,373**	**Webber P.**	**100%**	**100%**

Kennebec County Soil and Water Conservation District (SWCD) and the USDA Natural Resources Conservation Service (NRCS).

As a result of the extensive amount of conservation measures employed, in addition to less intensive farming practices and changes in land use patterns, a significant reduction in external loading from agricultural sources was suggested with probable 50% reductions of phosphorus loading to Webber Pond (Maine DEP 1991).

During the last decade (1991 to 2001), there have been fewer agricultural conservation practices installed by the Kennebec County NRCS office, with the exception of the development of nutrient management plans for two farms in the watershed, covering an estimated 150 acres of farmland (KC NRCS). More recent agricultural data were provided by the Kennebec County SWCD and confirmed by aerial photo analysis (1992 and 1997) and field verified with the assistance of Kennebec County SWCD staff.

The agricultural land area of the Webber Pond drainage area currently comprises 8.1% of the total watershed area and 30.9% of the external phosphorus load.

Forestry: Generally, poorly managed forestry operations have the potential to negatively impact a waterbody by erosion and sedimentation from logging sites. Local foresters within the Webber Pond watershed have worked with the CRLA to minimize potential impacts and many are Certified Logging Professionals trained to reduce potential environmental impacts associated with forest practices (CRLA 1999).

Maine landowners who harvest more than 2 acres of forest (or 5 acres if partially cut) are required to submit a Forest Operations Notification, including a location map, to the Maine Forest Service, Department of Conservation. After harvest, a Landowner Report of acres actually harvested in a given year is required. These reports provide a reasonable average annual estimate of those acres where some type of partial timber harvesting took place. The estimated "operated forestland" acres for Webber Pond, based on Landowner reports submitted for 1998 – 2001 average 170 acres per year.

Harvested forest acres in Maine typically regenerate as forest, whether or not they are under any type of planned forest management or under the supervision of a Licensed Forester. Forest areas without harvesting may be managed passively, or may be under an active management program with no commercial activity occurring in 1998-2001. Landowner Reports also reflect forest acres that which have been cleared with the intention of converting the land to another use, such as cropland, pasture, or residential use. There were a total of 2 acres of "forest conversion" reported during this four-year time period (All forestry data provided by Morten Moesswilde, Maine Forest Service). The operated forestland area within the watershed approximates 2.7% of the total land area and an estimated 5.2% of the total phosphorus load to Webber Pond.

Shoreline Residential (House and Camp Lots): A shoreline survey was completed in August of 2001 by Maine DEP-MACD project staff. The survey was conducted from a boat, approximately 50 feet from the shoreline. The survey results provide a complete shoreline structure tally as well as evaluative determinations of the impact of each lot in regard to phosphorus loading.

There are 162 homes and cottages on Webber Pond, which are comprised of 77% seasonal (125) and 23% year-round (37) dwellings.

To determine phosphorus loading estimates, each developed shoreline lot was assigned an NPS pollution impact rating using best professional judgment. The ratings range from 1 to 5, with 1 being very low impact (natural - best case scenario) and 5 being high impact (unnatural – worst case scenario). Table 3 (below) outlines the impact ratings assigned to each shoreline lot during the survey. Lots receiving a rating of 1 have a full naturally vegetated buffer. Conversely, a lot given a score of 5 would have little or no vegetative buffer and support bare (eroding) soil – a visible source of phosphorus input to the lake. A grass covered mowed lawn leading down to a rip-rapped shoreline or beach would receive a rating of 4 – but, only if there was no evidence of bare soil, in which case a rating of 5 would be assigned.

Table 3. Webber Pond Shoreline Survey Results (2002)

NPS Pollution Potential Severity Score	Impact rating characterized by one or more of the following:	Number of shoreline sites identified within each category	% of sites within each category
1 = very low impact	All natural vegetation—great buffer; good setback from lake	47	29%
2 = low impact	Good natural vegetation; good setback from lake	9	5%
3 = moderate impact	Lack of adequate buffer; close to lake	87	54%
4 = moderately high impact	Lack of buffer; steep slopes; close to lake	11	7%
5 = high impact	Lack of buffer; steep slopes; close to lake; bare soils	8	5%

Overall, 66% of the developed shoreline lots on Webber Pond have a moderate to high impact due to inadequate or nonexistent vegetative buffers and/or close proximity to the lake. Many of the shoreline areas have been adequately rip-rapped at the toe of the slopes, but lack vegetative plantings (other than mowed lawns) above the rip-rapped areas. Vegetative buffers help to decrease the amount and flow of run-off from the site. Many of the homes and cottages have mowed grass lawns that stretch down to the lake and do not serve as adequate vegetated buffers.

To estimate phosphorus loading from residential land use, the shoreline survey data were condensed into three categories - low, medium and high impact. Phosphorus loading coefficients were developed using information on residential lot stormwater export of algal available phosphorus (Dennis et al. 1992). Seasonal and year-round camp and home lots on Webber Pond comprise 1.3% of the land area and an average of 14 kg of total phosphorus annually, which approximates 2.7% of the estimated total phosphorus load.

- *To convert kg of total phosphorus to pounds—multiply by 2.2046*
- *To convert kg/hectare to lbs/acre—multiply by .892*

Shoreline Septic Systems: Currently, there are no public sewer services for the land areas within the Webber Pond watershed. Vassalboro's Shoreland Zoning Ordinance has a provision for septic waste disposal which required all landowners within the Shoreland Zone to provide documentation of system installation in compliance with Maine's Subsurface Wastewater Disposal Rules, or install a new system in accordance with this rule by December 31, 1995. Failure to comply constitutes a violation and is subject to enforcement action. As a result of this shoreland zoning ordinance, many old septic systems were replaced for an estimated 95% compliance rate (CRLA 1999; Scott Pierz, personal communication, 2001).

In order to estimate total phosphorus loading from shoreline septic systems, a simple model was used based on the following attributes: seasonal or year-round occupancy; estimated age of the system; estimated distance of the system to the lake; and an estimated 3 people per dwelling. These attribute values were determined by shoreline survey, town records and personal interviews with Town of Vassalboro officials.

Estimates of the loading from residential septic systems on Webber Pond range from a low of 10 to a high of 30 kg total phosphorus per year. Estimates of the phosphorus loading from the single commercial campground septic system ranged from a low of 2 to a high of 5 kg total phosphorus per year. Combined residential and commercial shoreline septic system loading approximates an average total watershed phosphorus export of 2.3% or 12 kg TP annually.

Recreational (Shoreline): Included in this category are the public boat launch/swim area (approximately 1 acre) and the commercial campground located on the eastern shore of Webber Pond. The campground facility has 84 campsites (9 tent sites and 75 RV sites). Campground use is characterized by recreational vehicles/campers that remain on site throughout the summer season (Reb Manthey, personal communication, 2002). Forty-five of the RV sites (60%) have sewer hook-up capability. The campground covers a total of 78 acres, of which approximately 30 acres are in Tree Growth (Vassalboro Tax Assessor). There is an office, store/laundry room and game room, a swimming area, volleyball-basketball court and playground area. There is also a

small marina operation with boat docking, boat rentals (canoes, paddleboats and small outboards) and a gas pump. Estimates of loading from recreational (shoreline) development approximates an average TP export of 1.9% or 10 kg of TP annually.

Shoreline Erosion: Undeveloped areas of the lake shoreline that may be eroding due to natural causes (i.e., wind, wave and ice action) are not included as a source of phosphorus due to the difficulty in quantifying impact area and assigning suitable coefficients. Areas of concern regarding shoreline erosion include Town Farm Island and areas at the northern end of the lake. The CRLA assessed these areas in August of 2002 for potential NPS-BMP implementation to be performed by the CRLA Conservation Corps during the 2003 field season (Reb Manthey, personal communication 2002).

Private/Camp Roadways: There are 19 private camp roads around Webber Pond comprising 8 miles (CLRA). As of December 2001, there were five formal road associations for the private camp roads around Webber Pond (Judy Moody, personal communication). Total phosphorus loading from private camp roads comprises only 0.5% of the land area and approximates 4.6% of the total watershed TP export annually.

Overall, shoreline development comprises only 2% of the total watershed area however it contributes an average of 60 kg of total phosphorus annually which approximates 11% of the estimated phosphorus load.

Other Development and Land Uses

Non-Shoreline Development - All lands outside the immediate shoreline area of Webber Pond, including state and town roadways, low-density non-shoreline residential areas, commercial, institutional (public) areas and the public golf course. These land use areas were calculated using GIS land use coverage provided by the Kennebec County Soil and Water Conservation District, as well as tax data, aerial photos and field visits (groundtruthing).

Public Roadways: There is less than one mile of state roadway and almost 11 miles of town roads within the Webber Pond watershed. Public roadways account for a much greater percentage of the phosphorus load (6.3%) versus its land area (0.8%) in the Webber Pond watershed.

Low-Density Residential Homes: The Town of Vassalboro tax records and property tax maps were used to determine the number of residential dwellings within the Webber Pond watershed. An average lot size of one acre was used to estimate the residential land area for a total of 254 acres. This land use is characterized by dispersed, low-density, single-family homes. Non-shoreline residential areas account for 4.9% of the total phosphorus load to Webber Pond.

Commercial: Commercial development within the watershed is limited to a small area – approximately 4 acres – consisting of a golf course clubhouse and paved parking lot, a used car lot, a small-engine repair shop, and a distribution center for Maine-made items**.** This land use accounts for less than 1% of the total phosphorus load to Webber Pond.

Institutional: There is an elementary school located at the corner of the Bog and Webber Pond roads in the northern portion of the watershed, encompassing approximately 25 acres. Built in the early 1990's, this project was reviewed under the Site Location of Development statute – the first application of a comprehensive site design for phosphorus control in Vassalboro (Michelle Jandreau, CEO, personal communication). There is also a church in Center Vassalboro that is located due east of Webber Pond. Institutional land areas account for less than 3% of the total phosphorus load to Webber Pond.

Golf Course: A popular golf course is located partly within the Webber Pond watershed and partly within the Sevenmile Stream watershed (that flows to the Kennebec River). The course lies on both sides of the Webber Pond Road within the Town of Vassalboro. The original 18-hole golf course was developed between 1965 and 1970, at which time no Site Location of Development permit was required. This portion of the course is irrigated with water from Webber Pond. The course was expanded from 18 to 27 holes after the applicant received site plan approval by Maine DEP in 1988. This expansion consisted of approximately 160 acres, with three of the nine holes located within the Webber Pond Watershed. Water for irrigating this section of the golf course is supplied by irrigation ponds located on the course (Maine DEP Order, 1988).

On-site detention for storm water runoff was deemed unnecessary for post-development runoff (Maine DEP 1998 Order of Conditions) at the golf course. Maine DEP granted approval on the condition that all fertilizers be quick solution fertilizers and "slow-release fertilizers containing phosphorus shall be limited to dry periods and shall be immediately followed by a light irrigation (to dissolve the phosphorus and tie it up in the soil)" (Maine DEP Findings of Fact and Order 1988). Several hundred feet of vegetation were to remain in place between the golf course and Webber Pond, with no formally designated buffer strips proposed.

Maine DEP granted approval to expand the golf course from 27 to 36 holes in 2000, approximately a 100-acre expansion, and to modify four already-existing holes. This expansion converted several hay fields, a large chicken barn and forestland to a golf course. The expansion is located on the west side of the Webber Pond Road, mostly within the Sevenmile Stream watershed. Only the northeast corner of the project is within the Webber Pond watershed. The applicant was required to mitigate phosphorus impacts by removing the existing chicken barn and improving the phosphorus removal capability of an existing pond which outlets via a 24" culvert under the Webber Pond Road by way of an intermittent stream (seasonal runoff), eventually flowing into Webber Pond. In addition, three retention ponds were constructed for storm water runoff and to further mitigate impact on wetlands.

During April of 2002, MACD project staff toured the golf course with the owner-manager in order to assess on-site NPS-BMPs. According to management, soil tests indicate adequate amounts of phosphorus in the soils so that very little, if any, phosphorus is used to fertilize the fairways, and very little is used on tees and greens. The "rough" areas of the course are not fertilized. Quick solution fertilizer containing phosphorus is generally applied when new turf is established.

The golf course is in close proximity to Webber Pond with a portion of the course (2 holes)

separated from the lake by sloping fields and varying widths of natural vegetation. Much of the golf course within the Webber Pond watershed drains into retention ponds or streams that traverse the course – all of which have direct flow to the lake, at least on a seasonal basis. Golf course area (100 acres) was determined by aerial photos, Vassalboro town records and field verification. To estimate phosphorus loading attributable to the golf course area, the limited use of fertilizer containing phosphorus, as well as the varying amounts of fertilizer applied to tees, greens and "rough" area were all taken into consideration. Total phosphorus loading estimates from the golf course area comprise only 1.5% of the total land area and 6.2% of the total phosphorus load.

Overall, non-shoreline development accounts for 7% of the total land area and contributes about 21% of the total phosphorus load to Webber Pond.

Phosphorus Loading from Non-Developed Lands

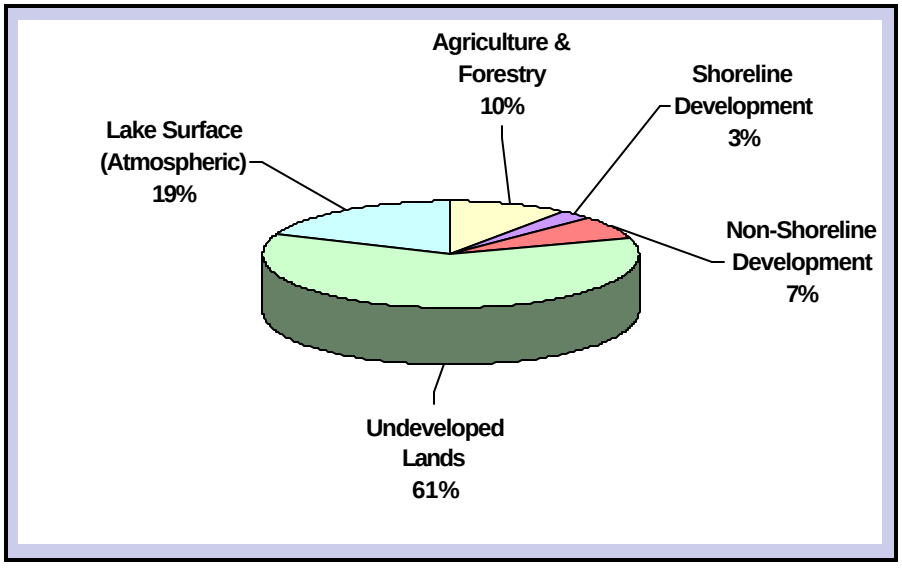
Forests: Of the total land area within the Webber Pond watershed, 47.6% (3,035 acres) is forested, characterized by privately-owned non-managed deciduous and mixed forest plots (KC-SWCD GIS, MACD 2002). About 9.5% of the phosphorus load is estimated to be derived from non-commercial forested areas within Webber Pond's direct drainage area.

Other Non-Developed Land Areas: Combined wetlands, reverting fields, old field scrub shrub and bare land account for the remaining 13.5% of the land area and 7.9% of the non-cultural total phosphorus export load.

Atmospheric Deposition (Open Water): Webber Pond surface waters (1,201 acres) comprise 19% of the total watershed area (6,373 acres), representing 15% of the total phosphorus load entering Webber Pond.

Figure 2 (below) depicts the percentage of total land area covered by each land use.

Figure 2. Webber Pond Direct Watershed - Total Land Area

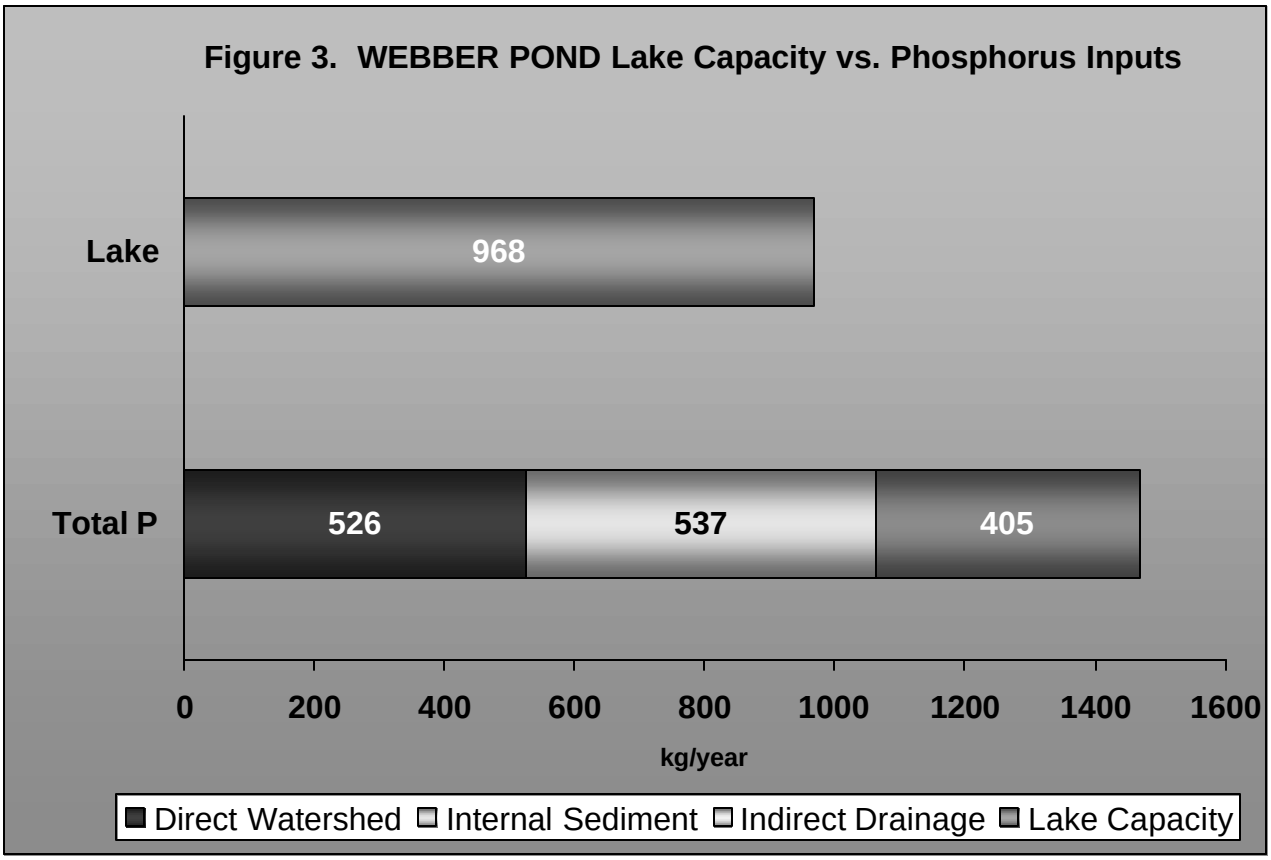


PHOSPHORUS LOADS – Watershed, Sediment and In-Lake Capacity

Supporting documentation for the phosphorus loading analysis includes the following: water quality monitoring data from Maine DEP and the Volunteer Lake Monitoring Program, and the development of a phosphorus retention model (see Appendices for detailed information).

- Total phosphorus loadings to Webber Pond originate from a combination of external (watershed) and internal (pond sediment) sources. External (direct) watershed TP sources, averaging 526 kg annually have been identified and accounted for by land use (see above).
- Total phosphorus loading from the associated upstream Threemile Pond accounts for external loading from the indirect watershed of 405 kg annually, determined on the basis of *flushing rate x volume x TP concentration,* and typical area gauged streamflow calculations (Jeff Dennis, Maine DEP, personal communication).
- The relative contribution of internal sources of total phosphorus within Webber Pond - in terms of pond sediment total phosphorus recycling - range from 210 to 759 kg with an average annual value approximating 537 kg.
- The annual contribution to account for future development for Webber Pond is an additional 32 kg, for a total phosphorus load (internal and external sources) of 1,500 kg per year.
- The load allocation (lake assimilative capacity) for all existing and future non-point pollution sources for Webber Pond is 968 kg of total phosphorus per year, based on a target goal of 15 ppb. Figure 3 (below) depicts these estimates.

Figure 3. WEBBER POND Lake Capacity vs. Phosphorus Inputs



WEBBER POND

PHOSPHORUS CONTROL ACTION PLAN

Recent and Current NPS/BMP Efforts

Maine DEP completed a Diagnostic Feasibility study (1981) for the Webber Pond watershed, inclusive of Threemile and Threecornered ponds. This study documented significant water quality impairment to the ponds as well as recommended steps for restoration. In 1983, KC-SWCD and USDA SCS (NRCS) produced the Webber Pond Watershed Plan. It included a listing of needed agricultural conservation practices in the watershed of Threemile, Threecornered and Webber ponds. Seven of 31 farms within the total Webber Pond watershed were designated as high priority for conservation measures. Notably, by 1991, four out of the seven farms had established soil and water conservation practices.

Substantial support was provided for the restoration of Webber and Threemile ponds under the Clean Lakes Program of EPA, under section 314 of the Clean Water Act. Maine DEP was awarded a Clean Lakes Grant in June of 1984 and the Webber Pond restoration project was outlined in a June 1991 Final Report by Maine DEP. The restoration work included enhanced seasonal drawdown, shoreline stabilization of thousands of feet of eroding banks and other NPS work including implementation of agricultural BMPs. This restoration project was supported by and included active participation by the Webber Pond Association , KC-SWCD, USDA NRCS and the Town of Vassalboro.

In 1997 a volunteer watershed survey, sponsored by the Maine DEP and the CRLA, was completed for the Webber Pond watershed. The watershed was split into sectors and trained volunteers surveyed their sectors for evidence of soil erosion and sedimentation. Lower-than-expected volunteer turnout resulted in only 10% of the watershed being surveyed – namely, the developed portion on the east shoreline of the lake and a small portion on the west shoreline (CRLA 2002).

There were 32 problem sites identified in the 1997 survey, including 8 road-ditch-culvert problems, 2 stream erosion sites and 22 lake shoreline erosion sites and 1 “other” category site. By the end of 1998, 25 of the identified sites had been repaired and/or mitigated, including 20 of the shoreline sites, 1 of the stream bank sites and 4 of the road sites. These numbers do not include sites where work was done without the assistance of the CRLA or sites where technical assistance was provided but landowners did not report completed site repairs (CRLA 1999).

From June 1997 to September 1999, the China Region Lakes Alliance (CRLA) administered Phase II of the Webber and Threemile Ponds Watershed Project. (Phase I covers Threemile Pond). During this three-year period, the CRLA worked to address existing sources of NPS pollution by providing information, offering technical assistance and repairing problem sites with the Webber Conservation Corps. Initially scheduled to last two years, this project was extended to three years with the support of town taxpayers. Part of this project entailed oversight of the

Webber Pond Conservation Corps. During the three-year period 1997 to 1999, the Corps implemented 58 BMPs, including: 43 riprap jobs (mostly shoreline), 6 water bars installations on camp roads, 3 vegetative buffer plantings, 5 culvert stabilizations (rip-rap), 1 culvert maintenance, and 1 beach debris clean-up (CRLA 2001).

The Webber Pond Conservation Corps, sponsored by the CRLA, provides free labor to landowners for NPS pollution BMP implementation. The corps operates for an eight to 10-week period during the summertime. During the summer seasons 1999-2001, the Corps worked on 30 sites within the Webber Pond watershed as well as 2 camp road projects during the 2001 season. Work completed by the Corps includes rip-rap reinforcement of shorefront (27), shoreline stabilization (2), buffer strip plantings (5), and waterbar installation (2) (WPCC Seasonal Reports 1999 - 2001). During the 2002 season, the Corps completed 4 rip-rap jobs along the shoreline of Webber Pond (Reb Manthey, personal communication, 2002).

More recently, the CRLA has developed a Watershed Management Plan for China Lake, Threemile and Webber ponds for the 1998-2008 time period. The goal of this watershed management project is to restore and prevent further degradation of the water quality of the three lakes, as well as to educate local citizens about the effects of their activities on water quality (CRLA 1999). This project works to implement erosion control practices and provide technical assistance to watershed stakeholders. Future projects include the establishment of shoreline buffer strips, completing and updating watershed surveys, exploring options for watershed management sustainability without relying on federal funding, updating cover type and land use information and increasing educational efforts and outreach (CRLA 1999). Major elements of this project include: site selection and design, BMP project management, Conservation Corps activities, information and education, and continued water quality monitoring (adaptive management).

In December of 2000, the CRLA initiated the Camp Road Runoff Abatement Project . This project makes cost share funds available to organized road associations for help with road repairs. This project seeks to educate camp road users about the importance of good design and maintenance of camp roads and its direct connection to water quality. By the fall of 2002, six private/camp roads had BMPs implemented under this project, including waterbars, culvert replacement, crowning and ditching, at an estimated cost to landowners of $19,650 with $9,100 reimbursed by the CRLA.

Recommendations for Future Work

Webber Pond is a waterbody that has impaired water quality due mostly to nonpoint source (NPS) pollution and resultant internal sediment recycling of phosphorus. Specific recommendations regarding recent and current efforts in the watershed, Best Management Practices (BMPs), and actions to reduce external watershed total phosphorus loadings in order to improve water quality conditions in Webber Pond are as follows:

Watershed Management: Since the mid-1990's, the China Region Lakes Alliance (CRLA) has taken an active role in documenting and mitigating nonpoint source (NPS) pollution sites throughout the Webber Pond watershed. The last documented survey was performed in 1997 and the CRLA Watershed Management Plan (1998 - 2008) outlines future plans for surveying the watershed for potential NPS pollution sites. This plan can help achieve locally supported watershed management programs to facilitate widespread implementation of BMPs or other management measures in order to reduce or eliminate NPS pollution in Webber Pond. The Webber Pond Association, watershed residents, municipal officials and the Maine DEP should support the CRLA in its continued efforts to implement the Watershed Management Plan.

Action Item # 1: Coordinate Existing Watershed Management Efforts		
Activity	**Participants**	**Schedule & Cost**
Develop a Webber Pond Leadership Team	CRLA, KCSWCD, WPA, MDEP, municipalities, local business, watershed citizens	Annual Roundtable Meetings beginning in 2003—**minimal cost**

Shoreline Residential: These areas have the potential to negatively impact the water quality of Webber Pond. The 2001 MACD shoreline survey found that many of the residential shoreline lots have inadequate or nonexistent vegetative buffers. Many of the shoreline areas have been adequately rip-rapped, however, there is a noticeable lack of vegetative plantings above these rip-rapped areas, necessary to decrease and slow run-off from shore land sites. An effort should be undertaken to encourage landowners to establish adequate and effective vegetated buffers along the shoreline. Free technical assistance by the CRLA, the KC-SWCD, and free labor provided by the Webber Pond Conservation Corps should be well-publicized to all shoreline landowners.

Action Item # 2: Implement a Buffer Awareness and Planting Campaign		
Activity	**Participants**	**Schedule & Cost**
Develop a Buffer Awareness Campaign for Watershed Citizens	CRLA, KCSWCD, WPA, MDEP, watershed citizens, local nurseries	Annually beginning in 2003 **$5,000/yr**

Roadways: Few camp roads are designed and maintained properly and can be a major source of erosion and sedimentation to the lake. During the MACD Webber Pond watershed inventory in 2001, six camp roads were noted as potential NPS sites. Road problems noted include moderate to severe surface erosion, poor shaping, moderate to severe shoulder erosion and an unstable culvert. For free technical assistance about proper camp road maintenance and potential cost-share funds, contact the CRLA (China Town Offices) or the KC-SWCD (Augusta).

Action Item # 3: Implement Camp Road Best Management Practices		
Activity	**Participants**	**Schedule & Cost**
Continue to Implement Roadside BMPs watershed-wide	CRLA, KCSWCD, WPA, MDEP, watershed road associations	Annually beginning in 2003 **$10,000/yr**

Agriculture: Since the early 1980's, the Kennebec County Soil and Water Conservation District and the USDA Natural Resources Conservation Service (NRCS) have worked cooperatively with landowners to install agricultural conservation practices in the watershed. For free technical assistance, potential cost-share funds or for more information about proper agricultural BMPs, contact the KC-SWCD or NRCS offices in Augusta.

Forestry: Landowners, loggers and foresters working within the watershed should contact the Maine Forest Service (1-800-367-0223) for a copy of Forestry BMP guidelines and other forest management assistance. Special attention should be given to forest access roads and proper erosion control measures should be utilized.

Action Item # 4: Conduct Workshops for Agriculture and Forestry Operators		
Activity	**Participants**	**Schedule & Cost**
Conduct workshops encouraging the use of phosphorus control measures	CRLA, KCSWCD, NRCS, MFS, forestry and agriculture community	Annually beginning in 2003 **$1,000/yr**

Non-Shoreline Residential and Commercial: These properties should be considered as potential problem areas for phosphorus input, especially those adjacent to Webber Pond watershed brooks and streams. These areas should be included in future education and outreach efforts as all residents within the watershed will benefit from improved water quality in Webber Pond.

Action Item # 5: Develop Stewardship Initiatives for Webber Pond Tributaries		
Activity	**Participants**	**Schedule & Cost**
"Adopt" local streams to promote stewardship efforts including education and water quality monitoring	CRLA, KCSWCD, MDEP Stream Team, local schools, golf courses, and watershed citizens	Annually beginning in 2003 **$500/yr**

Individual Action: All watershed residents should be encouraged through continued education and outreach efforts, including: retention or planting of natural vegetation of buffer strips, use of non-phosphate cleaning detergents, elimination of phosphorus-containing fertilizers, adequate maintenance of septic systems.

Action Item # 6: Expand Homeowner Education & Technical Assistance Programs		
Activity	**Participants**	**Schedule & Cost**
Increase outreach and education efforts to watershed citizens including technical assistance to landowners	CRLA, KCSWCD, WPA	Annually beginning in 2003 **$1,500/yr includes printing of educational materials**

Municipal Action: Should include ensuring public compliance with local and state water quality laws and ordinances (Shoreland Zoning, Erosion and Sedimentation Control Law, plumbing code) through education and enforcement action, when necessary.

Water Level Management: The continuance of annual late summer/early fall pond drawdown is an important means for partially controlling total phosphorus concentrations in Webber pond via the annual flushing of phosphorus-laden algae from the lake. This management tool, if properly applied (e.g., maximum water release at the time of highest TP content in the water column: late August, early September) should be an effective means for helping to restore water quality, along with a significant reduction in the external watershed loads in both Webber and Threemile ponds.

Action Item # 7: Utilize Water Level Management Plan		
Activity	**Participants**	**Schedule & Cost**
Utilize existing water level plan for phosphorus control and keep log of drawdown (duration and water level)	WPA, MDEP	2003-2004 **No cost**

WATER QUALITY MONITORING PLAN

Historically, the water quality of Webber Pond has been monitored via measures of Secchi disk transparencies during the open water months since 1975 (Maine DEP and VLMP). Continued long-term water quality monitoring within Webber Pond will be conducted bi-weekly, from May to October, through the continued efforts of the Maine Volunteer Lake Monitoring Program (VLMP) in cooperation with Maine DEP. Under this planned, post-TMDL water quality-monitoring scenario, sufficient data will be acquired to adequately track seasonal and inter-annual variation and long-term trends in water quality in Webber Pond. A post-TMDL adaptive management status report will be prepared five to ten years following EPA approval.

PCAP CLOSING STATEMENT

The China Region Lakes Alliance, with the Conservation Corps and the Webber Pond Association, has worked since the mid-1990's addressing NPS pollution sites in the watershed. Technical assistance and grant funding, when available, are provided by the China Region Lakes Alliance to mitigate identified NPS pollution sources. The Kennebec County Soil and Water Conservation District has taken an active role in water quality and conservation issues in the County by hosting watershed-wide conservation meetings as well as maintaining an informative and educational web site. The CRLA and the WPA educate watershed landowners through newsletter publication. The Town of Vassalboro has been successful with its septic system component of its shoreland zoning ordinance – for an estimated 95% compliance. The Town of Vassalboro and its residents should be commended for their efforts and encouraged to remain diligent in their efforts to protect their water resources. The extent of technical and financial resources available to watershed residents indicates that there is a high probability that future BMP implementation will continue to take place as long as watershed residents remain informed and motivated to take part in restoring and enhancing the water quality of Webber Pond.

APPENDICES

WEBBER POND

Total Maximum Daily (Annual Phosphorus) Load

Introduction to Maine Lake TMDLs and Phosphorus Control Action Plans (PCAPs)

You may be wondering what the acronym 'TMDL' represents and what it is all about. TMDL is actually short for 'Total Maximum Daily Load.' This information, no doubt, does little to clarify TMDLs in most people's minds. However, when we think of this as an annual phosphorus load (*Annual Total Phosphorus Load),* it begins to make more sense.

Simply stated, excess nutrients or phosphorus in lakes promote nuisance algae growth/blooms - resulting in the violation of water quality standards as measured by water clarity depths of less than 2 meters. A lake TMDL is prepared to estimate the total amount of total phosphorus that a lake can accept on an annual basis without harming water quality. Historically, development of TMDLs was first mandated by the Clean Water Act in 1972, and was applied primarily to *point sources* of water pollution. As a result of public pressure to further clean up water bodies, lake and stream TMDLs are now being prepared for watershed-generated *Non-Point Sources* (NPS) of pollution.

Nutrient enrichment of lakes through excess total phosphorus originating from watershed soil erosion has been generally recognized as the primary source of NPS pollution. Major land use activities contributing to the external phosphorus load in lakes include residential-commercial developments, roadways, agriculture, and commercial forestry. Statewide, there are 38 lakes in Maine which do not meet water quality standards due to excessive amounts of in-lake total phosphorus.

The first Maine lake TMDL was developed (1995) for Cobbossee Lake by the Cobbossee Watershed District (CWD) - under contract with Maine DEP and US-EPA. TMDLs have been approved by US-EPA for Madawaska Lake (Aroostook County), Sebasticook Lake, East Pond (Belgrade Lakes), and China Lake. PCAP-TMDLs are presently being prepared by Maine DEP, with assistance from the Maine Association of Conservation Districts (MACD) and County Soil and Water Conservation Districts (SWCDs) - for Mousam and Highland Lakes in southern Maine (final EPA review). Ongoing PCAP-TMDL lake studies include: Long and Highland lakes (Bridgton); Annabessacook and Little Cobbossee lakes and Pleasant and Upper Narrows Ponds - the latter four under separate contract with CWD. A non-MACD supported PCAP-TMDL for Unity Pond (Waldo County) is being developed in preliminary draft form with the assistance of Unity College staff. PCAP-TMDL studies have also been initiated for Sabattus, Togus, and Lovejoy ponds.

Lake PCAP-TMDL reports are based in part on available water quality data, including seasonal measures of total phosphorus, chlorophyll-a, Secchi disk transparencies, and dissolved oxygen-water temperature profiles. Actual reports include: a lake description; watershed GIS assessment and estimation of NPS pollutant sources; selection of a total phosphorus target goal (acceptable amount); allocation of watershed/land-use phosphorus loadings, and a public participation component to allow for stakeholder review.

PCAP-TMDLs are important tools for maintaining and protecting acceptable lake water quality and are designed to 'get a handle' on the magnitude of the NPS pollution problem and to develop plans for implementing Best Management Practices (BMPs) to effectively address the lake's water pollution problem. Landowners and watershed groups are eligible to receive technical and financial assistance from state and federal natural resource agencies to reduce watershed total phosphorus loadings to the lake. **Note:** for non-stormwater regulated lake watersheds, the *development of phosphorus-based lake PCAP-TMDLs are not intended by Maine DEP to be used for regulatory purposes*.

For further information, you may contact Dave Halliwell, Maine Department of Environmental Protection, Lakes PCAP-TMDL Program Manager, SHS #17, Augusta, ME 04333 (287-7649).

Water Quality Monitoring: (Source: Maine DEP and VLMP 2002) Water quality monitoring data for Webber Pond has been collected annually since 1975. This water quality assessment is based on 27 years of Secchi disk transparency (SDT) measures, combined with 14 years of epilimnion core total phosphorus (TP) data, 12 years of water chemistry and 25 years of chlorophyll-a monitoring data.

Water Quality Measures: (Source: Maine DEP and VLMP 2002) Webber Pond has a range of SDT measures from 0.4 to 5.6 meters, with an average of 2.8 m, an epilimnion core TP range of 14 to 35 with an average of 25 parts per billion (ppb), and chlorophyll-a measures ranging from 2 to 85, with an average of 13 ppb. Recent dissolved oxygen (DO) profiles indicate low levels of DO in deep areas of the lake. Late summer dissolved oxygen levels in 2001 remained fairly low (0-4 ppm) with 50% of the water column (lower 6 meters) unsuitable for salmonid species (e.g., brown trout). The potential for total phosphorus to leave the bottom sediments and become available to algae in the water column (internal loading) is moderate to high (Maine DEP 2001). Together, these data indicate a documented trend of increasing trophic state and hence a violation of the Class GPA water quality criteria requiring a stable or decreasing trophic state.

Priority Ranking, Pollutant of Concern and Algae Bloom History: Webber Pond is listed on the State's 1998 303(d) list of waters in non-attainment of Maine state water quality standards and was moved up in the priority development order due to stakeholder interest and need to complete an accelerated approach to lakes TMDL development. The Webber Pond TMDL has been developed for total phosphorus, the major limiting nutrient to algae growth in freshwater lakes in Maine.

The water quality of Webber Pond during the summers of 2001-02 appear to be unimproved in contrast to 2000 and the preceding 25 years of record. Minimum transparencies dropped to 1.2 meters (2.8 average) and total phosphorus (23 ppb) and chlorophyll-a (mean 19.9 ppb) levels remained fairly high. Nuisance algae blooms were prevalent during the summers of 2001-02.

Natural Environmental Background Levels: For Webber Pond were not separated from the total nonpoint source load because of the limited and general nature of available information. Without more and detailed site-specific information on nonpoint source loading, it is very difficult to separate natural background from the total nonpoint source load (US-EPA 1999). There are no known point sources of pollutants to Webber Pond.

WATER QUALITY STANDARDS & TARGET GOALS

Maine State Water Quality Standard for nutrients which are narrative, are as follows *(July 1994 Maine Revised Statutes Title 38, Article 4-A*): "Great Ponds Class A (GPA) waters shall have a stable or decreasing trophic state (based on appropriate measures, e.g., total phosphorus, chlorophyll a, Secchi disk transparency) subject only to natural fluctuations, and be free of culturally induced algae blooms which impair their potential use and enjoyment."

Maine DEP's functional definition of nuisance algae blooms include episodic occurrence of Secchi disk transparencies (SDTs) < 2 meters for lakes with low levels of apparent color (<26 SPU) and for higher color lakes where low SDT readings are accompanied by elevated chlorophyll a levels. Webber Pond is a non-colored lake (average color 20 SPU), with an average SDT of 2.8 m (9.2 feet), in association with elevated average chlorophyll a levels of 12.7 ppb (1975 -2001). Currently, Webber Pond does not meet water quality standards due to annual summertime nuisance algae blooms, hence a continued trend of increasing trophic state. This water quality assessment uses historic documented conditions as the primary basis for comparison. Given the context of "impaired use and enjoyment," along with a realistic interpretation of Maine's goal-oriented Water Quality Standards (WQS), Maine DEP has determined that episodic, non-cyanobacteria based algae blooms (e.g. diatoms), limited to the fall or spring periods only, are in WQS attainment for GPA waters.

Designated Uses and Antidegradation Policy: Webber Pond is designated as a GPA (Great Pond Class A) water in the Maine DEP state water quality regulations. Designated uses for GPA waters in general include: water supply; primary/secondary contact recreation (swimming and fishing); hydro-electric power generation; navigation; and fish and wildlife habitat. No change of land use in the watershed of a Class GPA water body may, by itself or in combination with other activities, cause water quality degradation that would impair designated uses of downstream GPA waters or cause an increase in their trophic state. Maine's anti-degradation policy requires that "existing in-stream water uses, and the level of water quality necessary to sustain those uses, must be maintained and protected."

Numeric Water Quality Target: The water quality goal for Webber Pond is to halt its trend of increasing trophic state so that it can meet the Maine DEP standard of stable or decreasing trophic state. The numeric (in-lake) water quality target for Webber Pond, to meet this goal, is set at 15 ppb total phosphorus (968 kg TP/yr). Since numeric criteria for phosphorus do not exist in Maine's water quality regulations - and would be less accurate targets than those derived from this study - we employed best professional judgment to select a target in-lake total phosphorus concentration that would attain the narrative water quality standard. Spring-time (late April – early May) total phosphorus levels in Webber Pond approximated 15 ppb during the time period 1999-2002. In direct contrast, in-lake (epilimnion core) total phosphorus summer-time (June through August) measures averaged 18-25 ppb (severe algal bloom conditions). In summary, the numeric water quality target goal of 15 ppb for total phosphorus in Webber Pond was based on available late spring – early summer pre water column stratification data, generally corresponding to non-bloom conditions, as reflected in suitable (water quality attainment) measures of both Secchi disk transparency (> 2.0 meters) and chlorophyll-a (< 8.0 ppb).

ESTIMATED PHOSPHORUS EXPORT BY LAND USE CLASS

Table 4 details the numerical data used to determine external phosphorus loading for the Webber Pond watershed. The key below explains the columns and the narrative that follows the table (pages 31-32) relative to each of the representative land use classes.

Key for Columns in Table 4

Land Use Class: The land use category that was analyzed for this report

Land Area in Acres: The area of each land use as determined by GIS mapping, aerial photography, Delorme Topo USA software, and field reconnaissance.

Land Area %: The percentage of the watershed covered by the land use.

TP Coeff. Range kg TP/ha: The range of the total phosphorus coefficient values listed in the literature associated with the corresponding land use.

TP Coeff. Value kg TP/ha: The selected coefficient for each land use category. The total phosphorus coefficient is determined from previous research – usually the median value, if listed by the author. The coefficient is often adjusted using best professional judgment based on conditions including soil type, slope, and best management practices (BMP's) installed.

Land Area in Hectares: Conversion, 1.0 acre = 0.404 hectares

TP Export Load kg P: Total hectares x applicable total phosphorus coefficient

TP Export Total %: The percentage of estimated phosphorus exported by the land use.

Table 4. WEBBER Pond Direct Watershed - Phosphorus Export by Land Use Class

LAND USE CLASS	Land Area Acres	Land Area %	TP Coeff. Range kg TP/ha	TP Coeff. Value kg TP/ha	Land Area Hectares	TP Export Load kg TP	TP Export Total %
Agricultural and Forested Land			**Webber**	**Pond**			
Cropland	121	1.9%	0.26 - 18.6	1.50	49.0	73.5	14.0%
Hayland (Manured)	175	2.7%	0.65 - 1.81	0.65	70.8	46.0	8.8%
Low Intensity Hayland	149	2.3%	0.35 - 1.35	0.35	60.3	21.1	4.0%
Orchard	11	0.2%	0.06 - 0.75	0.40	4.0	1.6	0.3%
Pasture	61	1.0%	0.14 - 4.90	0.81	24.7	20.0	3.8%
Operated Forest Land	170	2.7%	0.20 - 0.60	0.40	68.8	27.5	5.2%
Sub-Totals	**687**	**11%**	**Webber**	**Pond**	**278**	**190**	**36%**
Shoreline Development							
Low Impact Residential	28	0.4%	0.25 - 1.75	0.25	11.3	2.8	0.5%
Medium Impact Residential	44	0.7%	0.40 - 2.20	0.50	17.8	8.9	1.7%
High Impact Residential	10	0.2%	0.56 - 2.70	0.70	4.0	2.8	0.5%
Residential Septic Systems	**Webber**	0.0%	**Pond**	**Septic**	**Model**	12.0	2.3%
Camp and Private Roads	30	0.5%	0.60 - 10.0	2.00	12.1	24.3	4.6%
Recreational	49	0.8%	0.25 - 1.75	0.50	19.8	9.9	1.9%
Sub-Totals	**161**	**2%**	**Webber**	**Pond**	**65**	**60**	**11%**
Non-Shoreline Development							
State Roads	2	0.0%	0.60 - 10.0	1.50	0.8	1.2	0.2%
Town Roads	51	0.8%	0.60 - 10.0	1.50	20.6	31.0	5.9%
Low Density Residential	254	4.0%	0.25 - 1.75	0.25	102.8	25.7	4.9%
Commercial	4	0.1%	0.77 - 4.18	1.50	1.6	2.4	0.5%
Institutional	25	0.4%	0.77 - 4.18	1.50	10.1	15.2	2.9%
Golf Course - Tees and Greens	3	0.0%	1.55 - 4.50	4.50	1.2	5.5	1.0%
Golf Course - Fairways	12	0.2%	0.70 - 4.50	0.70	4.9	3.4	0.6%
Golf Course - Other Areas	86	1.3%	0.70 - 4.50	0.70	34.8	24.4	4.6%
Sub-Totals	**437**	**7%**	**Webber**	**Pond**	**178**	**109**	**21%**
Total: DEVELOPED LAND	**1,285**	**21%**	**Webber**	**Pond**	**521**	**359**	**68%**
Non-Developed Land							
Inactive/Passively Managed Forest	3,035	47.6%	0.01 - 0.04	0.04	1,228.2	49.1	9.3%
Wetlands	208	3.3%	0.00 - 0.05	0.02	84.2	1.7	0.3%
Scrub Shrub	355	5.6%	0.10 - 0.20	0.10	143.7	14.4	2.7%
Reverting Fields	285	4.5%	0.10 - 0.20	0.20	115.3	23.1	4.4%
Open (Bare) Land	4	0.1%	0.25 - 1.75	0.98	1.0	1.0	0.2%
Total: NON-DEVELOPED Land	**3,887**	**61%**	**Webber**	**Pond**	**1,572**	**89**	**17%**
Total: Surface Water (Atmospheric)	**1,201**	**19%**	0.11 - 0.21	0.16	**486**	**78**	**15%**
TOTAL: DIRECT WATERSHED	**6,373**	**100%**	**Webber**	**Pond**	**2,579**	**526**	**100%**

Total Phosphorus Land Use Loads

Estimates of total phosphorus export from different land uses found in the Webber Pond direct watershed are presented in Table 4 representing the extent of current external phosphorus loading to the lake. Total phosphorus loading from the associated upstream Threemile Pond (405 kg TP/yr) accounts for loading from the indirect watershed, determined on the basis of *flushing rate x volume x TP concentration,* and typical area gauged streamflow calculations (Jeff Dennis, Maine DEP).

Total phosphorus loading measures are provided as a range of values to reflect the degree of uncertainty generally associated with such relative estimates (Walker 2000). The watershed total phosphorus loadings were primarily determined using literature and locally-derived export coefficients as found in Schroeder (1979), Reckhow et al. (1980), Dennis (1986), Dennis et al. (1992), and Bouchard et al. (1995) for residential properties, roadways, agriculture and other types of land uses (e.g., recreational, commercial).

In some cases (primarily roads and shoreline residential) selected phosphorus loading coefficients were reduced to account for the estimated bioavailability of the soil runoff sources according to available literature (Lee et al. 1980 and Sonzogni et al. 1982) and to better account for algal available-P export values as reflected in Dennis et al. (1992). These adjustments accounted not only for the readily available SRP (soluble-reactive-phosphorus) in the runoff, but also a substantial portion of the particulate inorganic component, particularly the P which is weakly adsorbed on the surface of soil particles (relative to discussion in Chapra 1997, pg. 524). **Note:** *These adjustments in P-load coefficients did not effectively alter the overall conclusions and final recommendations of the Webber Pond PCAP-TMDL report regarding identified needs and NPS/ BMP implementation plans for the Webber Pond watershed.*

Agricultural and Forest Operational Lands: Phosphorus loading coefficients as applied to agricultural land uses were adopted, in part, from Reckhow et. al. 1980: manured hayland 0.65 kg TP/ha, pasture 0.81 kg TP/ha; and Dennis and Sage 1981: low-intensity hayland 0.35 kg TP/ha; and from past Maine DEP 1982 studies and discussions with Kennebec County SWCD/NRCS offices: row crops 1.50 kg TP/ha. The phosphorus loading coefficient applied to operated forestlands (0.40 kg TP/ha) was derived (best estimate) from the original Cobbossee Lake TMDL report (Monagle 1995).

Shoreline Residential Lots (House and Camp): The range of phosphorus loading coefficients used (0.25 – 2.70 kg ha/yr) were developed using information on residential lot stormwater export of algal available phosphorus as derived from Dennis et al (1992) .

Private Camp Roads: The total phosphorus loading coefficient for private camp roads (2.00 kg/ha) was chosen, in part, from previous studies of rural Maine highways (Dudley et al. 1997), as well as best professional judgement (Jeff Dennis, Maine DEP).

Non-Shoreline Development

Residential: Non-shoreline residential areas in the watershed are best characterized as low density residential - reflected in the 0.25 TP loading coefficient.

Golf Courses: The total phosphorus loading coefficient range (0.70 – 4.50 kg TP/ha) applied to the golf course area takes into account the varying amounts of fertilizer used on tees, greens, fairways and "rough" as well as proximity to the resource and the area drained with direct flow to the lake. The comparatively low coefficients selected generally reflect the limited use of fertilizer containing phosphorus and the minimal amount of soil erosion taking place during spring runoff.

Public Roadways: Town and state roadways (22 ha) were assigned a total phosphorus loading rate of 1.50 kg per hectare per year. This coefficient was chosen, in part, from previous studies of rural Maine highways (Dudley et al. 1997).

Total Developmental Phosphorus Loading: A total of 68% (359 kg) of the total phosphorus loading to Webber Pond is estimated to have been derived from the cumulative effect of the preceding cultural land use classes: agriculture and forestry (36% - 190 kg); non-shoreline development (21% - 109 kg) and shoreline development (11% - 60 kg), including septic systems (2.3% - 12 kg) and camp/private roads (4.6% - 24 kg) – as depicted in Table 4.

Non-Developmental Phosphorus Loading: The phosphorus export coefficient for forested land (0.04) is based on a New England regional study (Likens et al 1977). The lower total phosphorus loading coefficient chosen for atmospheric deposition (0.16 kg TP/ha) is similar to that used for the China Lake TMDL (Kennebec County), while the upper range (0.21 kg TP/ha) generally reflects a watershed that is 50 percent forested, combined with agricultural areas interspersed with urban/ suburban land uses (Reckhow et al. 1980). Other Non-Cultural Land Uses: Combined wetlands, reverting fields, old field scrub shrub and open land account for the remaining 7.9 % (40 kg) of the total non-cultural or non-developed land total phosphorus export load of 89 kg (Table 4).

Atmospheric Deposition (Open Water): Webber Pond surface waters (486 ha) comprise 19% of the total watershed area (2,579 ha) and account for an estimated 78 kg of total phosphorus, representing 15% of the total phosphorus load entering Webber Pond.

Phosphorus Load Summary

It is our professional opinion that the selected export coefficients are appropriate for the Webber Pond watershed. Results of the land use analysis indicate that a best estimate of the present total phosphorus loading from external (watershed generated) nonpoint source pollution approximates 526 kg TP/yr. This annual external watershed generated loading to Webber Pond equates to a total phosphorus loading modeled at 8 ppb (519 kg TP/year) - approximately 450 kg below the TMDL target goal of 15 ppb (968 kg TP/year). Obviously, both indirect (Threemile Pond = 405 kg) and internal (pond bottom sediments = 537 kg) sources of phosphorus are significant additional contributors to the existing nonpoint pollution related water quality problem in Webber Pond.

LINKING WATER QUALITY and POLLUTANT SOURCES

Assimilative Loading Capacity: The Webber Pond TMDL is expressed as an annual load as opposed to a daily load. As specified in 40 C.F.R. 130.2(i), TMDLs may be expressed in terms of either mass per unit time, toxicity, or other appropriate measures. It is thought appropriate and justifiable to express the Webber Pond TMDL as an annual load because the lake basin has a annual flushing rate of 1.52, approximating the average flushing rate for Maine lakes of 1.50.

The Webber Pond basin lake assimilative capacity is capped at 968 kg TP/yr, as derived from the empirical phosphorus retention model based on a target goal of 15 ppb. This value reflects the modeled annual phosphorus loading responsible for current trophic state conditions, based on a long term goal of maintaining average phosphorus concentrations at or below 15 ppb.

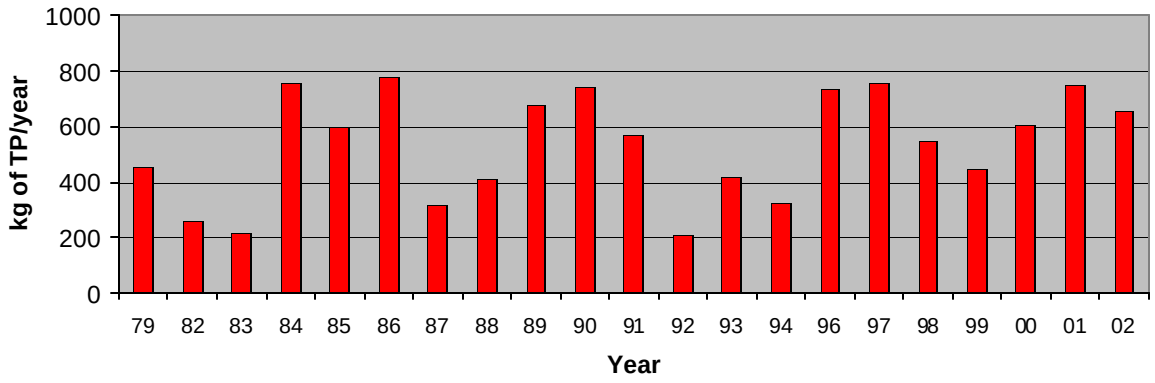
Future Development: The Maine DEP water quality goal of maintaining a stable trophic state includes a reduction of current P-loading which accounts for both recent P-loading as well as potential future development in the watershed. The methods used by Maine DEP to estimate future growth (Dennis et al. 1992) are inherently conservative, as they provide for relatively high-end regional growth estimates and largely non-mitigated P-export from new development. This provides an additional non-quantified margin of safety to ensure the attainment of state water quality goals. Previously unaccounted P-loading from anticipated future development on Webber Pond watershed approximates 32 kg annually (0.5 x 1 ppb change in trophic state = 64 kg).

Undoubtedly, human growth will continue to occur in the Webber Pond watershed, contributing new sources of phosphorus to the lake. Hence, existing phosphorus source loads must be drastically reduced (500+ kg) to allow for anticipated new sources of phosphorus to Webber Pond.

Overall, the presence of nuisance algae blooms in Webber Pond may be reduced, along with halting the trend of increasing trophic state, if the existing combined phosphorus loading is reduced by approximately 500 kg TP/yr. Reductions already underway in nonpoint source total phosphorus loadings are expected from the continued implementation of best management practices - primarily from improvements to roadways and residential shoreline vegetative buffer plantings (see NPS/ BMP Implementation Plan and PCAP Summary).

Internal Lake Sediment Phosphorus Mass: The relative contribution of internal sources of total phosphorus within Webber Pond - in terms of sediment TP recycling - were analyzed (using lake volume-weighted mass differences between early and late summer) and estimated on the basis of water column TP data from 1991 to 2001 (Figure 4, previous page). Approximate internal sediment TP loads for this 10-year period (1995 missing) ranged from 210 to 759 kg with an average annual value of 537 kg. Internal sediment loads estimates for the previous decade (1979-1990, 1981 missing) quite similarly ranged from 220 to 779 (sans 1,370 kg outlying value from 1980), with a very similar average annual value of 536 kg (Maine DEP 1991). During these years, fairly complete lake profile TP concentration measures were available to derive reliable estimates of internal lake loads. The similarity between these two time periods indicates that, over the past two decades (1979 to 2001), the amount of TP being released from the sediments of Webber Pond, during the summer period, has been fairly regular and approximates over one-half of Webber

Figure 4: Webber Pond Internal Load Sediment TP



Pond's capacity for in-lake phosphorus assimilation (968 kg TP/year).

Linking Pollutant Loading to a Numeric Target: The basin loading assimilative capacity for

Webber Pond was set at 968 kg/yr of total phosphorus to meet the numeric water quality target of 15 ppb of total phosphorus. A phosphorus retention model, calibrated to in-lake phosphorus data, was used to link phosphorus loading to numeric target.

Supporting Documentation for the Webber Pond TMDL Analysis includes the following: Maine DEP and VLMP water quality monitoring data, and specification of a phosphorus retention model – including both empirical models and retention coefficients.

Total Phosphorus Retention Model (after Dillon and Rigler 1974 and others)

L = P (A z p) / (1-R) where,

968 = **L** = external total phosphorus load capacity (kg TP/year)
15.0 = **P** = spring overturn total phosphorus concentration (ppb)
4.86 = **A** = lake basin surface area (km^2)
4.80 = **z** = mean depth of lake basin (m) **A z p = 35.5**
1.52 = **p** = annual flushing rate (flushes/year)
0.55 = **1- R** = phosphorus retention coefficient, where:
0.45 = **R = 1 / (1+ sq.rt. p)** (Larsen and Mercier 1976)

Previous use of the Vollenwieder (Dillon and Rigler 1974) type empirical model for Maine lakes, e.g., Cobbossee, Madawaska, Sebasticook, East Pond, China Lake, Mousam, and Highland lake TMDLs (Maine DEP 2000-2003) have shown this approach to be effective in linking watershed total phosphorus (external) loadings to existing in-lake total phosphorus concentrations.

Strengths and Weaknesses in the Overall TMDL Analytical Process: The Webber Pond TMDL was developed using existing lake water quality monitoring data, derived watershed export coefficients (Reckhow et al. 1980, Maine DEP 1981 and 1989, Dennis 1986, Dennis et al. 1992, Bouchard et al. 1995, Soranno et al. 1996, and Mattson and Isaac 1999) and a phosphorus retention model which incorporates both empirically derived and observed retention coefficients (Vollenwieder 1969, Dillon 1974, Dillon and Rigler 1974 a and b, and 1975, Kirchner and Dillon 1975). Use of the Larsen and Mercier (1976) total phosphorus retention term, based on localized data (northeast and north-central U.S.) from 20 lakes in the US-EPA National Eutrophication Survey (US-EPA-New England) provides a more accurate model for northeastern regional lakes.

Strengths:

- Approach is commonly accepted practice in lake management
- Makes best use of available water quality monitoring data
- Based upon experience with other lakes in the northeastern U.S. region, the empirical phosphorus retention model was determined to be appropriate for the application lake.

Weaknesses:

- Inherent uncertainty of TP load estimates (Reckhow 1979, Walker 2000) and associated variability and generality of TP loading coefficients.

Critical Conditions - Occur in Webber Pond during the summertime, when the potential (both occurrence and frequency) of nuisance algae blooms are greatest. The loading capacity of 15 ppb of total phosphorus was set to achieve desired water quality standards during this critical time period, and will also provide adequate protection throughout the year (see Seasonal Variation).

LOAD ALLOCATIONS (LA's) The load allocation for Webber Pond equals 968 kg TP on an annual basis and represents, in part, that portion of the lake's assimilative capacity allocated to non-point (overland) sources of phosphorus (from Table 4). Direct external TP sources (averaging 526 kg annually) have been identified and accounted for in the land-use breakdown portrayed in

Table 4. Further reductions in non-point source phosphorus loadings are expected from the continued implementation of NPS best management practices (see summary page 22-26). As previously mentioned, it was not possible to separate natural background from non-point pollution sources in this watershed because of the limited and general nature of the available information. As in other Maine TMDL lakes (see Sebasticook Lake, East Pond, and China Lake TMDLs), in-lake nutrient loadings in Webber Pond originate from a combination of direct and indirect external (watershed + Threemile Pond) and internal (lake sediment) sources of total phosphorus.

WASTE LOAD ALLOCATIONS (WLA's): There are no known existing point sources of pollution (including regulated storm-water sources) in the Webber Pond watershed, hence, the waste load allocation for all existing and future point sources is set at 0 (zero) kg/year of total phosphorus.

MARGIN OF SAFETY (MOS): An implicit margin of safety was incorporated into the Webber Pond TMDL through the conservative selection of the numeric water quality target, as well as the selection of relatively conservative phosphorus export loading coefficients for cultural pollution sources (Table 4). Based on both the Webber Pond historical records and a summary of statewide

Maine lakes water quality data for non-colored (< 26 SPU lakes) - the target of 15 ppb (968 kg TP/ yr in Webber Pond) represents a highly conservative goal to assure attainment of Maine DEP water quality goals of non-sustained and non-repeated blue-green summer-time algae blooms due to NPS pollution or cultural eutrophication and stable or decreasing trophic state. The statewide data base for uncolored Maine lakes indicate that summer nuisance algae blooms (growth of algae which causes Secchi disk transparency to be less than 2 meters) are more likely to occur at 18 ppb or above. The difference between the in-lake target of 15 ppb (968 kg) and 17 ppb (1,096 kg), or 128 kg, represents a 12-13% implicit margin of safety for Webber Pond. A non-quantified margin of safety for attainment of state water quality goals is additionally provided by the inherently conservative methods used by Maine DEP to estimate future growth in the Webber Pond watershed.

SEASONAL VARIATION: The Webber Pond TMDL is protective of all seasons, as the allowable annual load was developed to be protective of the most sensitive time of year – during the summer, when conditions most favor the growth of algae and aquatic macrophytes. With an average hydraulic retention time of 1.52 flushes/year, the average annual phosphorus loading is most critical to the water quality in Webber Pond. Maine DEP lake biologists, as a general rule, use more than six flushes annually (bi-monthly) as the cutoff for considering seasonal variation as a major factor (to distinguish lakes vs. rivers) in the evaluation of total phosphorus loadings in aquatic environments in Maine. Nonpoint source best management practices (BMPs) proposed for the Webber Pond watershed have been designed to address total phosphorus loading during all seasons.

PUBLIC PARTICIPATION: Adequate ('full and meaningful') public participation in the Webber Pond TMDL development process was ensured - during which land use and phosphorus load reductions were discussed - through the following avenues:

1. From December of 2001 to August of 2002, MACD project team member Jodi Michaud Federle attended CRLA board meetings. Updates on the lake TMDL development process were provided. (*The board is made up of members of the lake associations of Webber Pond, Threemile Pond, Threecornered Pond and China Lake, as well as the Kennebec Water District and the meetings are attended by the Executive Director of the CRLA).*

2. MACD project team member Jodi Michaud Federle and KC-SWCD Lake Specialist Nate Sylvester toured the lake watershed in September of 2001 in order to field verify agricultural land use in the watershed.

3. During the summer and fall of 2001, MACD project personnel - particularly Webber Pond coordinator Jodi Michaud Federle and Forrest Bell - paid numerous visits to the Vassalboro town office and to the Kennebec County SWCD office in order to compile necessary watershed inventory information.

4. On February 28, 2002, a locally-lead Watershed Conservation meeting was hosted by the Kennebec County SWCD at the China Town Office. The meeting was attended by approximately 12 people, including residents of the Webber, Threemile and Three-cornered Pond watersheds. Lake TMDL studies were explained and discussed.

5. A follow-up Watershed Conservation meeting was held on March 28, 2002, hosted by the KC-SWCD at the Vassalboro Town Office. This meeting was attended by 14 people, including residents of the Webber, Threemile and Threecornered Pond watersheds. Water quality information used in creating the TMDL report was supplied to watershed residents.

6. The China Region Lakes Alliance's 2002 spring newsletter featured an article about the TMDL studies for Webber, Threemile and Threecornered ponds.

7. MACD project personnel Jodi Michaud Federle and Forrest Bell met with the owner of the local golf course to discuss the TMDL study and to assess on-site BMPs.

8. A TMDL presentation was made at the Webber Pond Association annual meeting on August 7, 2002 (ca. 25 shoreline residents). The public review and comment period was also discussed.

STAKEHOLDER AND PUBLIC REVIEW COMMENTS

A preliminary stakeholder review draft Webber Pond TMDL report was provided to 13 interested individuals who received electronic or hard copy versions of the report on November 22, 2002, and were requested to comment by the end of the day on December 6, 2002 (two-week review period). The following summarized comments were received:

Reb Manthey, Executive Director of the CRLA – provided written comments about how to enhance the overall readability of the report for the layperson.

Morten Moesswilde, Maine Forest Service – commented about liking how the forestry information is distinguished from agriculture and provided more detailed contact information regarding assistance with forestry management.

Frank Richards, Webber Pond Association, President – provided written comments regarding how to enhance the readability of the report; requested more specific information about the drawdown and in-lake remedial options.

Jenna Richardson, CRLA – asked questions regarding phosphorus loading, 'natural background' levels and water quality monitoring.

Public Review Comment: (Review Period: March 8—April 7, 2003) The following Public Review document was posted on the Maine DEP website on March 7, 2003 and 'legal' advertising in local newspapers appeared March 15-16, 2003: Morning Sentinel (Waterville) and the Kennebec Journal (Augusta):

> **Webber-Threemile-Threecornered Ponds (Kennebec County) Watershed/Lake Nutrient Control/Management Reports (PCAP-TMDL)**
> In accordance with Section 303(d) of the Clean Water Act, and implementation regulations in 40 CFR Part 130 - the Maine Department of Environmental Protection has prepared combined Phosphorus Control Action Plan (PCAP) and Total Maximum Daily Load (TMDL) nutrient reports (DEPLW 2002-0556/0058/0562) for the Webber, Threemile and Threecornered ponds/watersheds, located in the towns of Vassalboro, China, Windsor, and Augusta, within Kennebec County. These

PCAP-TMDL reports identify and estimate non-point source phosphorus loadings within all representative land use classes of the Webber-Threemile-Threecornered ponds/watersheds and the phosphorus reductions needed to establish and maintain acceptable water quality conditions. Public Review drafts of these reports may be viewed at Maine DEP Central Offices in Augusta (Ray Building, Hospital Street-Route 9). Send all comments, in writing-by April 7, 2003, to Dave Halliwell, Lakes TMDL Program Manager, Maine DEP, State House Station #17, Augusta, ME 0433. 207-287-7649 or e-mail: david.halliwell@maine.gov. Files: Webber Pond; Threecornered Pond; Threemile Pond.

Note: *Maine DEP/MACD response to comments appear in italics.*

Public Review Comment (Frank Richards - Webber Pond Association)

Dave - Jodi

I am the President of the Webber Pond Association. Thanks for sending me on the most recent draft. My comments are as follows.

I suggested editing to make the first draft more readable. I no longer have the original document. However, it looks as if someone has done a great deal of work. This draft just seems much easier to read. The graphs in particular are a big help.

Other

Page 11 notes the dam was reconstructed in 1993. That date should be checked again. I wasn't involved with the Webber Pond Association at that time, however, I have a strong sense that this date is wrong. I think I brought this up in my original comments. Obviously, I may be wrong. However, many people reading this report will know the correct date. They will scoff to everyone they know, if it is incorrect.

Comment noted and addressed on page 11.

Page 26 - Drawdown. This helps me. It is a scientific reference to cite when people want to do the drawdown much later. However, I'd like to ask for more help. If you could add language to give the drawdown a push, explaining its
benefits and pointing out that perhaps it has spared the lake from even worse algae blooms.

I don't know if science can do this. However, if you could estimate how many Kg of phosphorus are exported when we flush a foot of thick algae v how much is exported later in September when the water is close to clear - that would be highly useful information.

I am pushing to do a gradual drawdown starting in mid August. Taking green slurry off the pond with about a 6 inch draw until Sep 1st then doing another foot in early Sep and pulling the plug in mid Sep. Today, with the golf course, campground, and extended seasonal use of the lake, we get too many complaints with a pull the plug type drawdown before mid September. I fear we would eventually face legal action if we ignored these complaints.

Continue to use the 1996 DEP guidance for drawdown. Maximum water release at the time of highest P content (or likely minimum secchi for the year) is still the most practical for phosphorus removal. Usually, people will not want an August drawdown, even if it would be best for the lake, but even drawing down the lake 6 inches during the height of the bloom is beneficial. The 1996 guidance document recommends a post-Labor Day drawdown which reflects a compromise with recreational uses. Long-term trend analysis does not show a significant improvement in water quality, but the trend numbers are at least positive. It may be that the drawdown simply keeps up with the internal loading but can't get ahead of it since there are still high total P concentrations during the late summer.

Many residents are highly supportive of the drawdown. They aren't the problem. I seem to be able to slowly take 6 inches in August and another foot in early September with no problem. The inconvenience is much less and complaints (with just one year of experience) were minimal. My hand is strengthened in either

type of drawdown if I can say X kg per foot early, much less than X if the water is clear.

In order to provide this type of information, it would be necessary to keep a written log of drawdown and record water levels.

Lastly, I'd like you to think about adding other options for addressing the sediments. Long term residents will say water quality has improved over 20 years. And, per your study, it does look like much less phosphorus is entering the lake than say 20 or 30 years ago. However, year to year it is hard to see the effect of the drawdown.

Parallel to the TMDL study, a class at Colby college did an assessment of Webber. They somehow measured the phosphorus in the bottom at about 40 feet. It measured about 300 ppb. They asserted that low oxygen levels in the hypolinium cause phosphorus to be released from the sediments. I'd never heard anything like it. They recommended extracting water from the depths, hypolinetic withdrawal was the phrase I think.

I would welcome a discussion, even a second opinion, about options for the sediments like hypolinetic withdrawal. I suspect the drawdown and erosion control are just not adequate to deal with the sediments. It is all we've got and it is low cost. If there is something else (Alum is a non starter due to costs and effectiveness questions) I think my membership would be highly interested.

The Maine DEP has not looked into hypolimnetic withdrawal (a) for the golf course since it may be too little to affect the dynamics of the situation, regardless of the cost to do so, or (b) from the lake in general as there are likely problems with low dissolved oxygen or high iron/manganese in the discharge if water was to be siphoned or pumped from deep water rather than a drawdown from the surface.

Sincerely
Frank Richards (March 17, 2003)

Public Review Comment (Morten Moesswilde, Maine Forest Service)

Jodi,

Thanks again for your work on these. The forestry information on all three looks ok to me. Thanks for keeping me posted as well.

Let me know if you are doing more of these in the coming field season.

Best regards,
Morten (March 14, 2003)

Public Review Comment (Robert Browne, Natanis Golf Course)

Dave Halliwell
Aquatic Biologist
D.E.P.
Bureau of Land and Water Quality

Natanis Golf Course
735 Pond Road
Vassalboro, Maine 04989
207-622-6164

Dear Dave,

After reviewing your "Phosphorus Control Action Plan" report on Webber Pond, we would like to submit the following comments.

Firstly, we commend you on the thoroughness and readability of your report. It certainly seemed to include all information currently available and, given that information, provides a fair assessment of the various causes of the algae bloom in Webber Pond.

As the owners of the public golf course in the report we are, however, concerned that folks reading the report will determine that the golf course is a major phosphorus contributor to the watershed and pond. We are especially concerned because 1.) we do not like to think of ourselves as polluters, and 2.) we think that there is the possibility that your conclusions may be incorrect.

The golf course is estimated to contribute 6% of the total phosphorus load to Webber Pond and is not necessarily a "major" contributor. However, most large (developed) areas of cleared land in a watershed would have similar loadings (agriculture, for example).

In general, golf course fertilizers are low to no phosphorus fertilizers, such as 22-0-22 or 32-2-6, for quick, green grass growth. In particular , the soils at our golf course test at an optimum level of phosphorus available and we very seldom apply fertilizer with phosphorus here. In addition, fertilizer is not applied before mid to late June and by that time the streams "that traverse the course -all of which have direct flow to the lake" have low to no flow.

Furthermore, on the new section of the course, and most of the old, the holding ponds (built to DEP specification) are 1.5 to 2 acres in size with a depth of 12-19 feet. This size allows sediment to settle out and avoids its being carried out in the streams.

We feel that we fairly addressed the use (or lack thereof) of fertilizer in our phosphorus load estimation (see Non-shoreline Development section, page 33). Please be aware that if there were significant storm events after mid or late June, then it is still likely that the phosphorus would reach the streams, and possibly, the lake.

We would also like to point out that the two holes adjacent to the lake have at least two hundred feet of natural vegetation between them and the shore. The "sloping field" in the report is actually in front of the Baptist Camp Ground. The campers there use this shore front for swimming and boating. We understand that this was one of the test sites for the golf course figures used in the report.

We have noted the ownership of the field, and have adjusted the text accordingly. This area was not a "test site" for the figures used in this report.

For these reasons we would like to suggest that new and more frequent testing be done. At our own expense, we would like to test water as it enters and as it leaves the watershed area where the golf course is located. From these tests perhaps it could be determined what the TP load attributable to golf course practices actually is. If we are a major phosphorus contributor we would like to correct that. If not, we would like the report to reflect those results.

We are pleased that Natanis has started to sample the stream that traverses the golf course, a Webber Pond tributary. The test results will help to determine how much phosphorus is entering the stream from the golf course. We appreciate your interest and participation in this process and for being proactive in addressing phosphorus pollution concerns related to Webber Pond and its tributaries.

Thank you for your time and consideration.

Sincerely,
Robert Browne
Natanis Golf Course (Undated)

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