PHOSPHORUS CONTROL ACTION PLAN

and Total Maximum Daily (Annual Phosphorus) Load Report

Monson Pond – Fort Fairfield and Easton

Aroostook County, Maine

Monson Pond PCAP - TMDL Report

Maine DEPLW - 0810

Maine Department of Environmental Protection

and Maine Association of Conservation Districts

EPA Final Review Document - November 20, 2006

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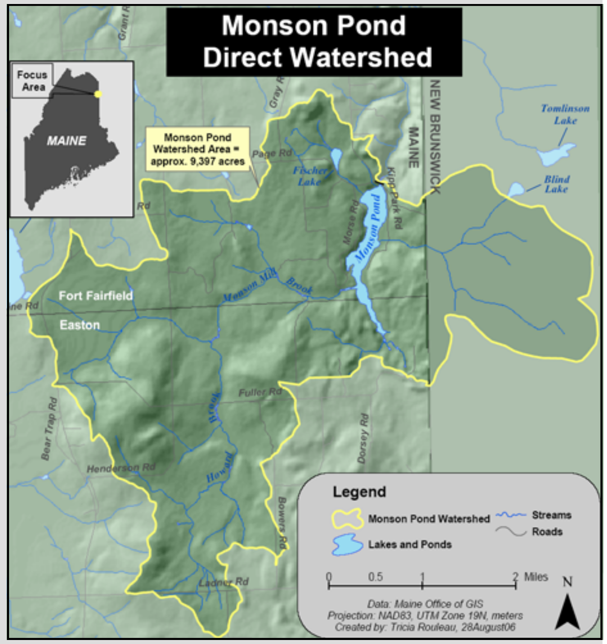
ACKNOWLEDGMENTS

In addition to Maine DEP (Division of Environmental Assessment - Lakes Assessment Section and Watershed Management Division-Augusta and Presque Isle) and U.S. EPA New England Region I staff, the following individuals, groups and agencies were instrumental in the preparation of this Monson Pond combined Phosphorus Control Action Plan and Total Maximum Daily Load report: MACD staff (Jennifer Jespersen, Tricia Rouleau, Forrest Bell and Fred Dillon); Maine Department of Agriculture (David Rocque); Maine Forest Service (Chris Martin); Maine Department of Inland Fisheries and Wildlife (Dave Basley); Central Aroostook Soil and Water Conservation District (Linda Alverson), Frontier Fish & Game Club (Sean Bernard), Town of Fort Fairfield (Tony Levesque), and the Maine Volunteer Lake Monitoring Program. Funding by EPA Section 319 Grant 013.06A.2179.132.NPS05.028.2903.

Monson Pond - Fort Fairfield and Easton Phosphorus Control Action Plan Summary Fact Sheet

Background

MONSON POND (Midas No. <u>1820</u>) is a 160-acre **colored** pond located in the towns of Fort Fairfield and Easton in Aroostook County, Maine. Monson Pond has a **direct drainage area** (see map below and on p. 8) of approximately 14.7 square miles (including approximately 7.2 square miles in New Brunswick, Canada); a maximum depth of 15 feet (5 meters); a mean depth of 8 feet (2 meters); and a relatively high **flushing rate** of 26.7 times per year. Compared with many other Maine lakes, the watershed of Monson Pond is large compared to the size of the waterbody, thus increasing the potential overland flow draining to the Pond.

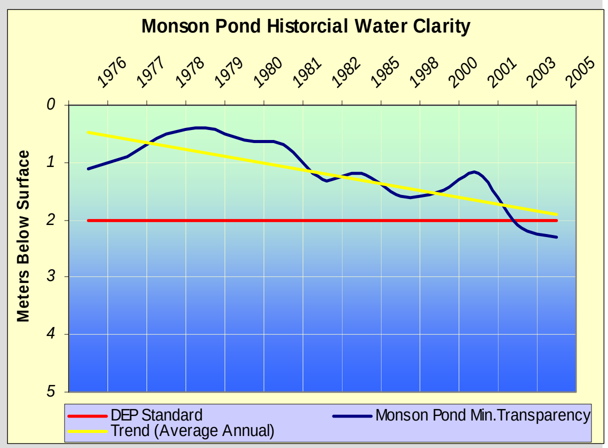


Historical Information

Due to the dominance of limestone in the surrounding watershed, measures of total alkalinity, pH and specific conductivity in Monson Pond are unusually high for Maine lakes (VLMP 2005). This makes Monson Pond unique among the thousands of other lakes in the State.

Monson Pond is a shallow, well-mixed impounded stream created as a millpond on present day Pattee Brook (Tony Levesque, personal communication). Between 1957-58 the dam underwent major repairs. At the same time, all of the trees along the stream corridor were cut down and stumps in the pond considered "unsightly and a hazard to boaters" resulted in a community wide effort to remove the stumps. In 1958 the State "reclaimed" the pond by adding rotenone, a chemical that removes all fish species in order to restock with game fish (see page 11 for more info). This made the shoreline more attractive for and seasonal camps.

It wasn't until almost 20 years later, following a period of nuisance algae blooms, that water quality monitoring began. Blooms have continued into the present, and are primarily attributed to non-point source (NPS) runoff from the surrounding **watershed**. Recent water clarity results for Monson Pond show that water quality may actually be improving with time (right).



Recent clarity measurements for Monson Pond are the first to meet State guidelines for water quality since sampling began.

NPS pollution in Monson Pond stems primarily from soil erosion in the surrounding watershed and stormwater runoff from area roads, agricultural sites, and residential homes and camps (external load). Soil erosion can have far reaching impacts, as soil particles effectively transport **phosphorus**, which serves to "fertilize" the pond and

Key Terms

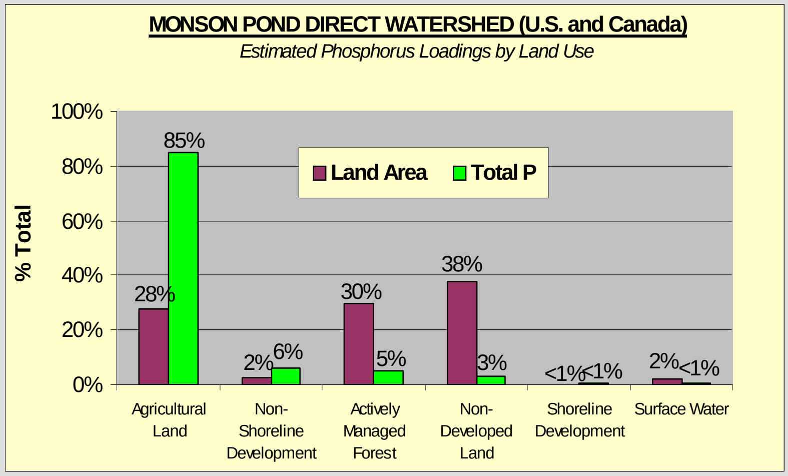
- ***<u>Colored</u>*** *lakes or ponds occur when dissolved organic acids, such as tannins or lignins, impart a tea color to the water, reflected in reduced water transparencies and increased phosphorus values.*
- ***<u>Flushing rate</u>*** *refers to how often the water in the entire lake is replaced on an annual basis.*
- ***<u>Watershed</u>*** *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.*
- ***<u>Phosphorus</u>****: 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.*

decreases water clarity. Excess phosphorus can harm fish habitat and lead to nuisance algae blooms—floating mats of green scum—or dead and dying algae. Studies have shown that as lake water clarity decreases, lakeshore residential property values also decline. Although there have been efforts to reduce erosion and phosphorus loading in the watershed, phosphorus levels are still high enough to affect water quality and promote algal growth. Monson Pond is listed by DEP as "water quality limited" which means that it is well below the minimum standard. It is also listed on Maine's 303(d) list of impaired waterbodies.

What We Learned

The land use assessment conducted for the Monson Pond watershed helped to determine the 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 and verifying aerial photos, consulting with local citizens, and visiting the watershed.

A land-use model estimated that approximately 2,023 kg (4,460 lbs) of phosphorus is exported annually (external load) to Monson Pond from the direct watershed (p. 26). The bar chart (right) illustrates the land area representative land uses as compared to the phosphorus export load for each land use. Sampling data collected in 2001 revealed that the amount of total phosphorus (TP) being recycled internally (internal load - 4 kg/year) from Monson Pond bottom sediments during the summer-time is less than 1% of the pond's natural capacity (663 kg/year) for in-lake phosphorus assimilation (assuming a target goal of 16 ppb for a colored lake). This recent value represents an 80% reduction from historical internal loads (1976, 1981).



Agricultural land uses make up the highest proportion of total phosphorus exported to Monson Pond (see pages 12-15 for explanation).

Phosphorus Reduction Needed

Monson Pond's average summertime TP concentration (originating from a combination of external and internal loading) approximates 22 ppb (902 kg) - equal to an additional 246 kg more than the lake's natural capacity. Including a 21 kg allocation for future development, the total annual amount of phosphorus needed to be reduced to support Maine water quality standards (algal bloom-free total phosphorus concentrations of 16 ppb or less) in Monson Pond approximates 267 kg (see In-Lake Concentration Method p. 17).

What You Can Do To Help!

As a watershed resident, there are many things you can do to protect the water quality of Monson Pond. Shorefront property owners can use phosphorus-free fertilizers and maintain natural vegetation adjacent to the pond. Agricultural land users can consult the USDA/Natural Resources Conservation Service or the Maine Department of Environmental Protection for information regarding **Best Management Practices** (BMPs) for reducing phosphorus loads. Watershed residents can become involved by participating in events sponsored by State agencies and local organizations. The estimated phosphorus loading to Monson Pond originates from shoreline and non-shoreline areas, so all watershed residents must take ownership of maintaining water quality.

Monson Pond stakeholders and watershed residents in Fort Fairfield and Easton can learn more about their pond and the many resources available, including review of the Monson Pond Phosphorus Control Action Plan and **TMDL** report. Following final EPA approval, copies of this detailed report, with recommendations for future NPS/BMP work, will be available online at www.maine.gov/dep/blwq/docmonitoring/tmdl2.htm, or can be viewed and/or copied (at cost) at Maine DEP offices in Presque Isle (1235 Central Drive, Skyway Park), and Augusta (Bureau of Land and Water Quality, Ray Building, AMHI Campus).

Key Terms

- ***Best Management Practices*** *are techniques to reduce sources of polluted runoff and their impacts. BMPs are low cost, common sense approaches to reduce storm runoff and velocity to keep soil out of lakes and tributaries.*
- ***TMDL****, an acronym for Total Maximum Daily Load, 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 lakes PCAP-TMDL project, funded through a Clean Water Act Section 319-grant from the United States Environmental Protection Agency (EPA), was directed and administered by the Maine Department of Environmental Protection (Maine DEP) under contract with the Maine Association of Conservation Districts (MACD), from 2005 to 2006.

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 Monson Pond watershed (see study methodology, p. 7). Simply stated, a TMDL is the total amount of phosphorus that a lake can receive without harming water quality. Maine DEP, with assistance from the MACD, will fully 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 assessment work was conducted by the Maine DEP-MACD project team to help assess **total phosphorus (TP)** reduction techniques that would be beneficial for the Monson Pond watershed. The results of this assessment include recommendations for future conservation work in the watershed to help citizens, organizations, and agencies restore and protect Monson Pond.

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.*

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

Note: *To protect the confidentiality of landowners in the Monson Pond watershed, site-specific information has not generally been provided as part of this PCAP-TMDL report.*

This Phosphorus Control Action Plan (PCAP) report compiles and refines land use data derived from various sources, including the Maine Office of Geographic Information Systems, the Central Aroostook Soil & Water Conservation District (CA-SWCD), and the Maine Forest Service (MFS). Local citizens, active and/or developing watershed organizations, and conservation agencies will benefit from this compilation of both historical and recently collected data as well as the watershed assessment and the NPS Best Management Practice (BMP) recommendations. Above all, this document is intended to help Monson Pond stakeholder groups to effectively prioritize future BMP work in order to obtain the funding resources necessary for further **NPS pollution** mitigation work in their watershed.

Study Limitations

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

Study Methodology

Monson Pond background information was obtained using several methods, including historical information about the pond and watershed, numerous phone conversations and personal communications with regional organizations and state agencies, and field visits to the watershed.

***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.*

***Ground-truthing** involves conducting field reconnaissance in a watershed to confirm the relative accuracy of computer generated maps.*

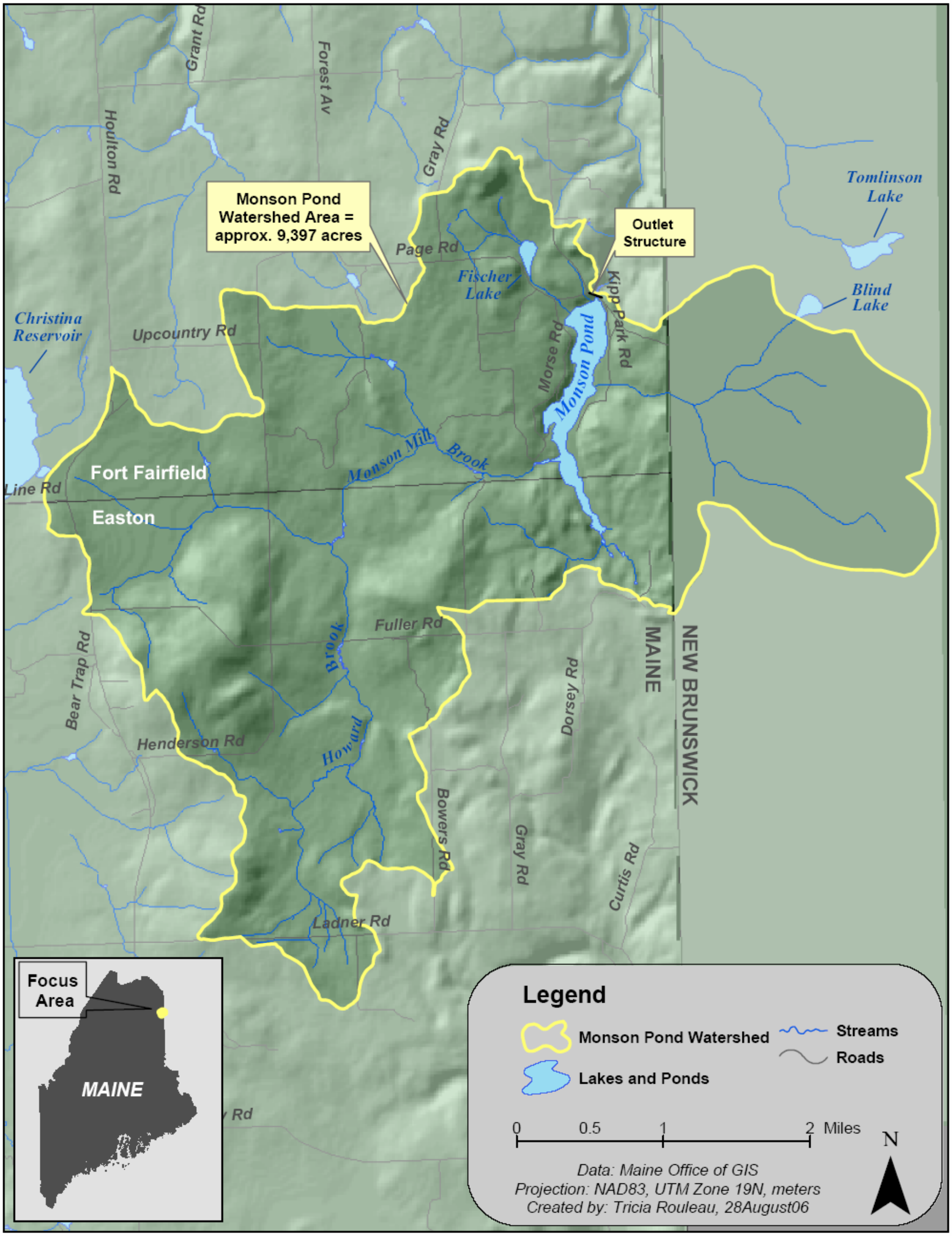
Land use data were determined using several methods, including (1) **Geographic Information System (GIS)** map analysis, (2) analysis of topographic maps, (3) analysis of aerial photographs, and 4) **ground-truthing**. Watershed boundaries, as well as developed and non-developed land use area (e.g., forest, wetland, grassland) were initially determined using a combination of steps 1 and 2. The GIS land use layer used for this analysis was created at the request of the Maine DEP Bureau of Land and Water Quality (BLWQ). It includes those classes in each layer which are best suited to calculating impermeability of watersheds. Though released in 2006, the Maine Land Cover Data (MELCD) used for this analysis is a land cover map for Maine primarily derived from Landsat Thematic Mapping imagery from the years 1999-2001, which was further refined using panchromatic imagery from the spring and summer months of 2004. Land uses within these maps were further refined by MACD based on aerial photos using methods 2-3 for the Canadian portion of the watershed since no land use data was available. Maps were further refined in the field by the Central Aroostook Soil and Water Conservation District (CA-SWCD) using ground-truthing.

Final adjusted phosphorus loading numbers (see Table 2, page 26) were modeled using overlays of soils and slope. All of the land use coverage data for agricultural areas were re-configured using aerial overlays, and reviewed and confirmed by the CA-SWCD in conjunction with the USDA/NRCS. Information regarding forest harvest operations were reviewed by the Maine Forest Service, Department of Conservation.

Roadway widths were estimated from previous PCAP reports where actual measurements were made for the various road types. In general, state-owned roads were found to be 22 meters wide; town-owned roads were found to be 16 meters wide; and privately-owned roads were found to be 6 meters wide. GIS was used to calculate total road surface area.

A picturesque view of a rural roadway and farmhouse in the Monson Pond watershed.

Figure 1. Map of Monson Pond Direct Watershed



MONSON POND Phosphorus Control Action Plan

DESCRIPTION of WATERBODY (MIDAS Number 1820) and WATERSHED

Direct watershed- *refers to the land area that drains to a waterbody without first passing through an associated lake or pond.*

MONSON POND is a 160-acre (65 hectare) (Maine DIF&W survey) colored waterbody situated in the towns of Fort Fairfield and Easton (DeLorme Atlas, Map 65), within Aroostook County, Maine. Monson Pond has a **direct watershed** area (see Figure 1) of approximately 9,397 acres (14.7 square miles) excluding pond surface area. The Monson Pond direct watershed is located within two towns in the United States: Fort Fairfield (33%) and Easton (48%). The eastern portion of the watershed (~1,785 acres) is located in New Brunswick, Canada (19%). Monson Pond has a maximum depth of 15 feet (5 meters), overall mean depth of 8 feet (2 meters), and a relatively high flushing rate of 26.7 times/year.

Drainage System: Monson Pond is impounded on the northern end by a dam-bridge on Dorsey Road. The pond was created as a millpond in 1916 when a crib dam was built on present day Pattee Brook (Tony Levesque, personal communication). Monson Pond receives water from 4 small tributaries including a small unnamed brook that enters the pond on the north-western end from Fischer Lake, from the east via a tributary flowing out of New Brunswick, from the south by an unnamed tributary that drains a wetland, and from the south-west from Monson Mill Brook. The only outlet is on the north end at the dam-bridge which flows to Pattee Brook. Pattee Brook flows north to downtown Fort Fairfield where it meets the Aroostook River which heads east to join the St. John River in New Brunswick. A public boat launch and picnic area are located on the north-west shore of Monson Pond off the unimproved Reed Road.

View from the east shore of the pond toward the outlet structure on the north end of Monson Pond.

Monson Pond Water Quality Information

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

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.*

Monson Pond is listed on the Maine DEP's 2004 303(d) list of lakes that do not meet State water quality standards. Therefore, a combined Phosphorus Control Action Plan and TMDL report was prepared for Monson Pond during the summer of 2006.

Based on **Secchi disk transparencies (SDT),** measures of total phosphorus (TP), and **chlorophyll-a**, (Chl-a), the water quality of Monson Pond is considered to be poor and the potential for nuisance summertime algae blooms is high (Maine VLMP 2005). Together, these water quality data

> ***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 all be used to assess trophic state.*

document a trend of increasing **trophic state,** in direct violation of the Maine DEP Class GPA lakes water quality criteria requiring a stable or decreasing trophic state.

A variety of non-point sources of pollution may be contributing to the poor water quality in Monson Pond. The water quality of Monson Pond is heavily influenced by runoff events from the watershed. During storm events, nutrients such as phosphorus – naturally found in Maine soils - drain into the pond from the surrounding watershed by way of streams and overland flow, eventually being deposited and stored in pond sediments. Fortunately, the potential for TP to leave bottom sediments and become available to algae in the water column (internal loading) is low based on recent oxygen profiles (Maine VLMP 2005).

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 nuisance algae blooms, which can damage the ecology and aesthetics of a lake, as well as the economic well-being of the entire lake watershed.

No formal watershed survey has been conducted for Monson Pond, however, based on surveys conducted for other regional lakes and ponds, we can postulate that intensive land uses such as agriculture, gravel mining, road building, and residential development have all contributed to the poor water quality in Monson Pond. Additional organic and nutrient loading and pollutants to Monson Pond have been noted in past years as a result of inputs of pesticides and fertilizer runoff from surrounding farmland (Maine DEP, 1977). Assistance provided by the USDA/Natural Resources Conservation Service (NRCS) and the Central Aroostook Soil and Water Conservation District (CA-SWCD) in the past several decades has helped local farmers reduce soil erosion, as well as fertilizer and pesticide runoff.

Principle Uses & Human Development: The prevalent human uses of the Monson Pond watershed are primarily actively managed forestland (30%) and agricultural land (28%) (Figure 2). With approximately 60% (5,774 acres) of the land area consisting of developed land, NPS pollution is a significant concern for the watershed. Consequently, Monson Pond is on the State’s 303(d) list due primarily to excessive phosphorus (sediments), lake enrichment and the historical prevalence of nuisance algal blooms.

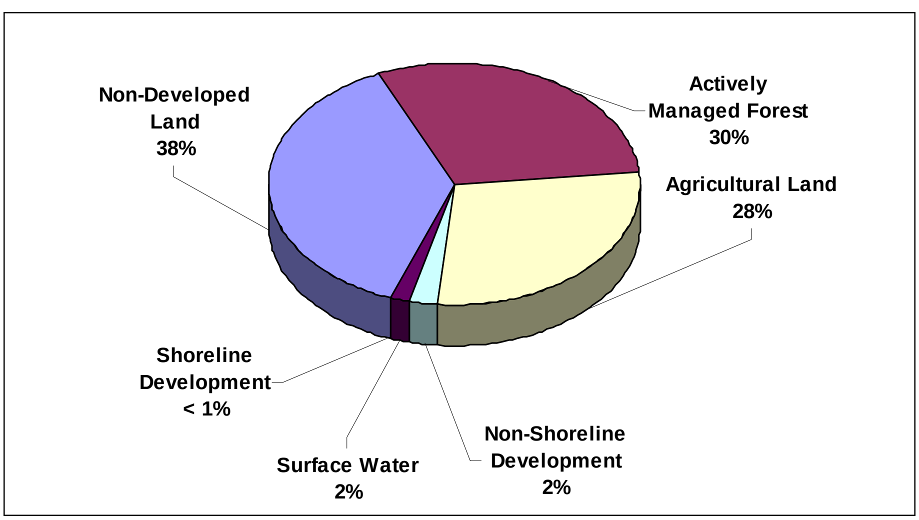


Figure 2. *Combined, the human uses of land within the Monson Pond watershed make up the greatest percent of land area. These include actively managed forestland and agricultural, as well as development such as roads and houses.*

Monson Pond Fish Assemblage & Fisheries Status

Based on records provided by the Maine Department of Inland Fisheries and Wildlife (Maine DIF&W) and recent conversations with fisheries biologist Dave Basley (Region G, Ashland DIF&W office), 160-acre (maximum depth 15 feet) Monson Pond (Fort Fair-field, Pattee Brook - Aroostook River drainage system) is currently managed as a coldwater (brook trout) fishery. Monson Pond was originally surveyed by Maine DIF&W in 1955, while their lake fisheries report was previously revised in 1958 and 1989. A total of 12 fish species are found to occur, including 10 native indigenous fish species (brook trout, longnose and white sucker, threespine and ninespine stickleback, and five northern minnow species - pearl dace, northern redbelly dace, lake and creek chub, and fathead minnow); and 2 introduced non-indigenous fish species (rainbow smelt and golden shiner). Rainbow smelt eggs were first introduced by Maine DIF&W in 1984, 1985, and 1988 in an attempt to provide a supply of bait and a fishery for anglers. Recent fishery surveys indicate that the rainbow smelt population, if present, is fairly low.

Monson Pond was chemically reclaimed in 1958 (rotenone treatment) to remove competing fish species and enhance the brook trout fishery. In the years immediately following reclamation, an attractive sport fishery was created with annual stockings of brook trout. According to Maine DIF&W, habitat conditions resulted in an incomplete kill of fish in 1958 and various competing fish species are present today. An annual stocking of yearling brook trout now provides a popular sport fishery.

Brook trout

Generally, increases in trophic state as a result of non-point source phosphorus loading increases water temperature and reduces dissolved oxygen concentrations. Improvements in water quality, reducing the prevalence of nuisance summertime algal blooms, will serve to enhance existing coldwater fisheries conditions in Monson Pond. Given that the trophic state of Monson Pond has been degraded by cumulative water-shed impacts over the past several decades - then a significant reduction in the total phosphorus loading from the Monson Pond drainage may lead to maintaining in-lake nutrient levels within the natural assimilative capacity of this lake to effectively process total phosphorus - and enhance existing brook trout fisheries.

General Soils Description

The Monson watershed is primarily characterized by soils formed in loose ablation till. In general, soils formed from this parent material have a sandy texture, a high percentage of coarse fragments, and a loose, permeable substratum. They are usually productive soils with good moisture-holding capacity and a deep root zone.

The portion of the watershed located in Maine (7,598 acres – 80%) is predominantly characterized by one general soil association: the Caribou-Mapleton-Conant Association, which is formed in ablation till derived primarily from limestone, sandstone, and shale. The principal soils in this association are the well drained Caribou gravelly loam, the well drained Mapleton shaly silt loam, and the moderately to somewhat poorly drained Conant silt loam. A majority of soils in this association are located on slopes less than 8%, but can be as steep as 30%.

The dominant soil series in this area of the watershed is the Caribou gravelly loam (3,147 acres). Caribou soils are well drained soils located on till ridges, and are good agricultural soils. Soil erodibility ranges from potentially highly erodible to highly erodible, depending on slope (Ferwerda et al., 1997). Areas of poorly drained Easton and Washburn silt loams, formed from glaciofluvial materials, are also found in low-lying areas along streams and wetlands.

Soils in the New Brunswick, Canada portion of the watershed (1,799 acres – 20%), are characterized by the Caribou-Monquart-Carlingford Association, which is also formed from ablation till. The principle soils in this association are the well drained Caribou gravelly loam, the well drained Monquart gravelly loam, and the imperfectly drained Carlingford silt loam. Small areas of the very poorly drained Washburn silty loam also occur in low-lying areas. While soils in this association may be on slopes as steep as 30%, a majority of the soils are located on slopes less than 8%.

Monquart soils are dominant in Canada, occupying approximately 1,285 acres. The Monquart soils have the lithology of the Caribou soils, with a slightly coarser texture. Although Monquart soils are well drained and are excellent agricultural soils, they are potentially highly erodible during the spring runoff when the subsoil is frozen or during the growing season if the soil is not carefully managed (Millette and Langmaid).

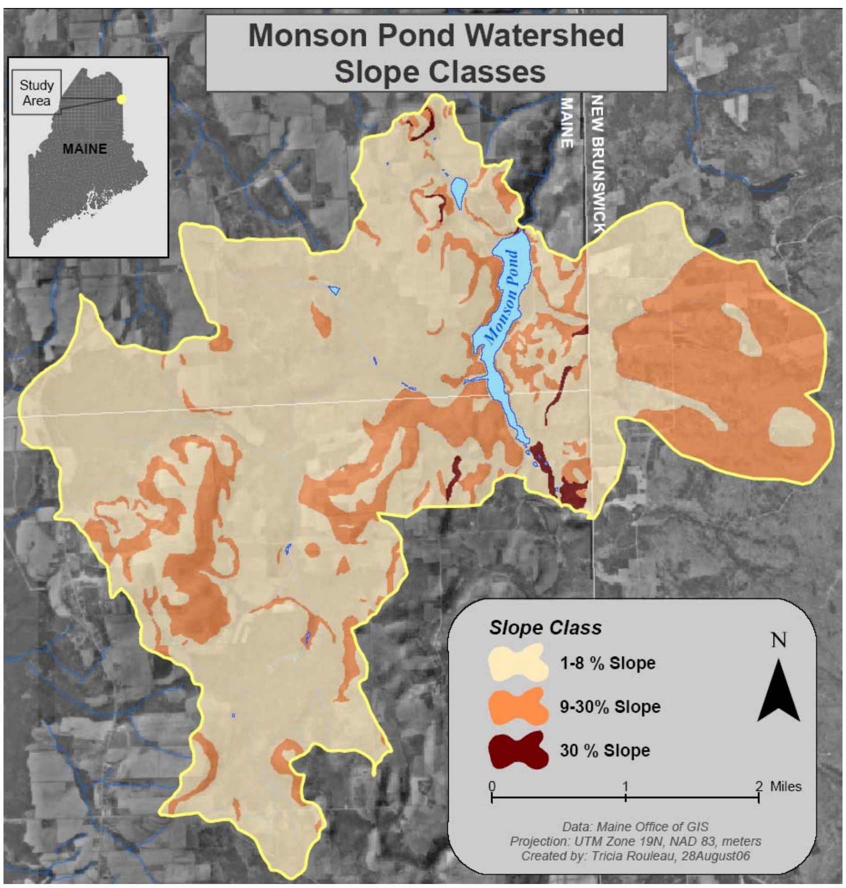


Figure 2. *The majority of slopes in the Monson Pond watershed are less than 8%. Steeper slopes are located in the Canadian portion of the watershed, and on the south end of the pond.*

Land Use Inventory

The results of the Monson Pond watershed land use inventory are depicted in Figure 3 and Table 1 (p.14). The dominant land uses in the watershed are actively managed forest, wetlands, and agriculture. In Table 1, watershed land uses are categorized by developed land vs. non-developed land.

The developed land area comprises approximately 60% of the watershed and the undeveloped land, including the water surface area of Monson Pond, comprises the remaining 40% of the watershed. These numbers may be used to help make future planning and conservation decisions relating to the Monson Pond watershed. The information in Table 1 was also used as a basis for preparing the Total Maximum Daily (Annual Phosphorus) Load report (see Appendices).

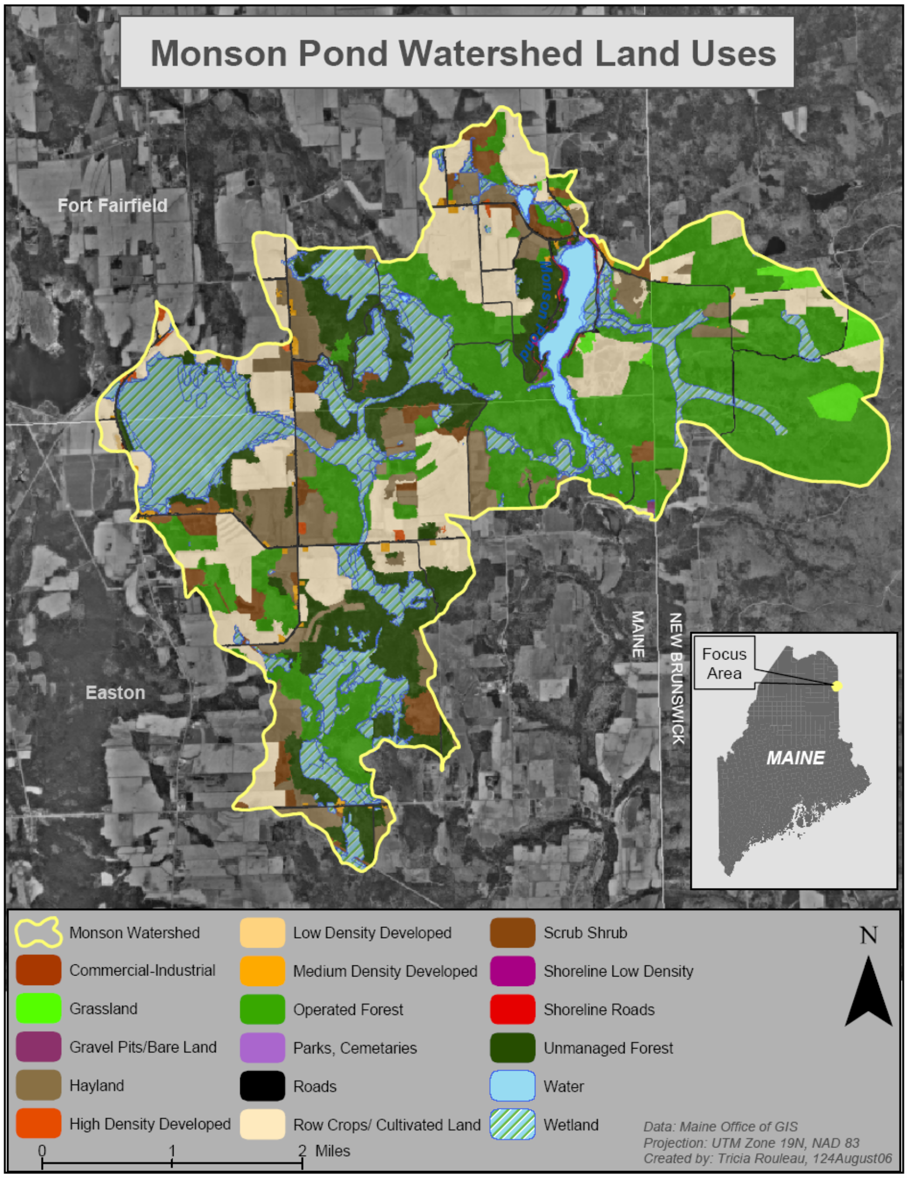


Figure 3: Map of Monson Pond watershed land uses by land use class. Note the preponderance of operated forestland in the eastern (Canadian) portion of the watershed.

Descriptive Land Use and Phosphorus Export Estimates

Agriculture: In the early 1980's all active farming of land directly adjacent to Monson Pond on the Fort Fairfield side of the watershed was discontinued as a result of ownership changes and improvements in farming practices (Tony Levesque, personal communication). Today, agricultural land is estimated to comprise 2,665 acres (28%) of the watershed area including: non-manured hayland (9%), and row crops (19%). These agricultural land uses contribute nearly 1,713 kg (85%) of the total phosphorus loading to Monson Pond. Row crops are the largest agricultural contributor, accounting for approximately 73% of the total phosphorus load to Monson Pond. Hayland contributes approximately 11% of the load. These data were mapped using GIS software and verified by aerial photography and ground-truthing by the CA-SWCD.

- *To convert kilograms (kg) of total phosphorus to pounds - multiply by 2.2046*
- *To convert kg/hectare to lbs/acre– multiply by .892*

Table 1. Monson Pond Direct Watershed—Land Use Inventory and External Phosphorus Loads*

LAND USE CLASS	Land Area Acres	Land Area %	TP Export Load kg TP	TP Export Total %
Agricultural Land				
Hayland (non-manured)	870	9%	226	11%
Row Crops	1,795	19%	1,487	73%
Sub-Totals	**2,665**	**28%**	**1,713**	**85%**
Actively Managed Forest	2,851	30%	97	5%
Sub-Totals	**2,851**	**30%**	**97**	**5%**
Shoreline Development				
Shoreline Roads	13	< 1%	11	< 1%
Shoreline Low Density	11	< 1%	2	< 1%
Sub-Totals	**24**	**< 1%**	**13**	**< 1%**
Non-Shoreline Development				
Roads	145	1.5%	90	4%
Commercial/Industrial	1	< 1%	0.5	< 1%
Low Density Residential	4	< 1%	0.7	< 1%
Medium Density Residential	56	< 1%	23	< 1%
High Density Residential	20	< 1%	11	< 1%
Gravel Pits	6	< 1%	0.03	< 1%
Parks/Cemeteries	1	< 1%	0.4	< 1%
Sub-Totals	**234**	**2%**	**126**	**6%**
Total: DEVELOPED LAND	**5,774**	**60%**	**1,949**	**96%**
Non-Developed Land				
Inactive/Passively Managed Forest	1,181	12%	22	1%
Grassland/Reverting Fields	138	1%	8	<1%
Scrub-Shrub	374	4%	24	1%
Wetlands	1,919	20%	10	<1%
Total: NON-DEVELOPED LAND	**3,612**	**38%**	**63**	**3%**
Total: Surface Water (Atmospheric)	**171**	**2%**	**11**	**1%**
TOTAL: DIRECT WATERSHED	**9,557**	**100%**	**2,023**	**100%**

Includes land area in New Brunswick, Canada.

Actively Managed Forest Land: The estimated operated forest land for the Monson Pond direct watershed consists of 2,851 acres. This estimate is based on a GIS analysis of land uses and represents 30% of the total land area, contributing approximately 5% of the total phosphorus load to Monson Pond. Properly managed forestry operations prevent erosion and sedimentation from logging sites by using well thought out skidding systems, proper placing of log landings, and seeding and stabilizing bare soils following harvest operations. Sustainable forest management can enhance water quality through sequestering excess nutrients, particularly in forested riparian areas. 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.

Shoreline Development consists of all lands within the immediate shoreland area (250 feet) of Monson Pond. This type of development can have a large total phosphorus loading impact in comparison to their relatively small percentage of the total land area in the watershed. This is not the case for Monson Pond, given the sparse extent of shoreline development. There are an estimated 35 houses (seasonal and year-round) along the Monson Pond shoreline. Shoreline residential land use is estimated to consist of only 0.1% of the total watershed land area (11 acres) and contribute less than 1% of the total phosphorus load to Monson Pond. Compared to watershed inputs, the small extent of shoreline development makes the probability of any type of loading from septic systems minimal.

The north and west shores of Monson Pond are dotted with residential development, yet the south and east shores remain relatively undeveloped (above).

Shoreline Roads: NPS pollution associated with shoreline roads (roads within 250 feet of the shoreline) can vary widely, depending upon road type, slope and proximity to a surface water resource. Total phosphorus loading from shoreline roads was estimated using GIS land use data to determine the overall area occupied by this category. The average width for shoreline roads in the Monson Pond watershed was estimated to be about 22 meters for state-owned roads and 16 meters for town-owned roads (based on the findings from previous Maine lake PCAP reports). Based on these factors, shoreline roads were determined to cover about 13 acres and contribute less than 1% (11 kg/yr) of the total phosphorus load to the direct watershed.

Overall, shoreline development, including residential development and roads, comprises less than 1% of the total watershed area and contributes approximately 13 kg of total phosphorus annually, accounting for approximately 1% of the estimated phosphorus load.

Non-Shoreline Development and Land Uses

Non-Shoreline Development consists of all lands outside the immediate shoreline of Monson Pond - including public and private roads, residential and commercial/industrial areas, gravel pits, and parks/ cemeteries. The total land area covered by these land-uses was calculated with GIS land use data.

Roads: Road widths were estimated from previous PCAP reports and from on-screen viewing of aerial photography (private roads were estimated to be 6 meters average width) to determine the amount of total phosphorus loading from this land use category. Based on these factors, non-shoreline roads contribute an estimated 90 kg/year (4%) of the total phosphorus load to Monson Pond's direct watershed.

Commercial/Industrial: Commercial and industrial land uses (such as large barns) make up a small fraction of the Monson Pond watershed (< 1%). This land use consists of approximately 1 acre, and contributes less than 1 kg/year (< 1%) of total phosphorus to the Monson Pond direct watershed.

Residential: Low density residential land use consists of approximately 4 acres and contributes less than 1 kg/year of the total phosphorus loading to the Monson Pond direct watershed. Medium density residential land use consists of approximately 56 acres, while high density residential accounts for 20 acres of the land in the Monson Pond watershed. Combined, these residential land use classes account for about 1% of the land area and less than 2% of the total phosphorus load to Monson Pond.

Gravel Pits: Phosphorus contributions from gravel pits are generally assumed to be negligible since precipitation and surface water theoretically do not leave the site and instead soak completely into the ground. However, gravel pit operations can discharge phosphorus if they are not properly maintained. This land use class consists of approximately 6 acres and contributes less than 1 kg/year (< 1%) of the total phosphorus loading to the Monson Pond direct watershed.

Parks/Cemeteries: This land use class consists of approximately 1 acre and contributes less than 1 kg/year (< 1%) of the total phosphorus loading to the Monson Pond direct watershed.

Phosphorus Loading from Non-Developed Lands and Water

Inactive/Passively Managed Forests: Of the total non-developed land area within the Monson Pond watershed, 1,181 acres are forested, characterized by privately-owned non-managed deciduous and mixed forest plots. Approximately 1% of the phosphorus load (22 kg/year) is estimated to be derived from non-commercial forested areas within Monson Pond's direct drainage area.

Other Non-Developed Land Areas: Combined wetlands, grasslands/reverting fields and scrub-shrub account for approximately 26% of the remaining land area and 2% of the total phosphorus export load.

Atmospheric Deposition (Open Water): Surface waters for Monson Pond's direct watershed comprise 2% of the total land area (171 acres) and account for an estimated 11 kg of total phosphorus per year, representing 1% of the total direct watershed load entering Monson Pond. The total phosphorus loading coefficient chosen (0.16 kg/ha) is similar to that used for central Maine lakes in Kennebec County. This value represents the median of a range of values from Reckhow (1980) of 0.11 kg/ha to 0.21 kg/ha. The upper range generally reflects a watershed that is 50 percent forested, combined with agricultural areas interspersed with urban/suburban land use.

Particulates in the air contribute phosphorus to Monson Pond, and are factored into the GIS land-use model.

PHOSPHORUS LOADS – Watershed, Sediment and In-Lake Capacity

Supporting documentation for the phosphorus loading analysis includes water quality monitoring data from Maine DEP and the Volunteer Lake Monitoring Program, and the development of a phosphorus retention model (see Appendices, p.22, for detailed information). Please note that two methods were used in our total phosphorus loading analysis to assist with the preparation of this report: 1) a GIS-based model to provide a relative estimation of impacts from watershed land uses for the development of phosphorus reduction strategies by stakeholders; and 2) an in-lake phosphorus concentration model to determine the phosphorus reduction needed for the Monson Pond TMDL. These two methods may yield different overall phosphorus loading results depending on the available water quality data and particular characteristics of the watersheds and water bodies being modeled.

1. GIS-Based Land Use and Indirect Load Method

Watershed Land Uses: Total phosphorus loadings to Monson Pond originate from a combination of external watershed and internal lake sediment sources. External watershed total phosphorus sources, totaling approximately 2,023 kg annually (corrected GIS) have been identified and accounted for by land use (See Table 2 - page 26). Average annual internal lake sediment P-loading of 15 kg was estimated from three years of data (1976, 1981, 2001).

2. In-Lake Concentration Method (TMDL)

Pond Capacity: The assimilative capacity for all existing and future non-point pollution sources for Monson Pond is 663 kg of total phosphorus per year, based on a target goal of 16 ppb (See Phosphorus Retention Model - page 30).

Target Goal: A change in 1 ppb in phosphorus concentration in Monson Pond is equivalent to 41 kg. The difference between the target goal of 16 ppb and the measured average summertime total phosphorus concentration (22 ppb or 902 kg) is 6 ppb or 246 kg (6 ppb x 41kg).

Future Development: The annual total phosphorus contribution to account for future development for Monson Pond is 21 kg (0.50 x 41) (see page 29).

Reduction Needed: Given the target goal and a 21 kg allocation for future development, the total amount of phosphorus needed to be reduced, on an annual basis, to restore water quality standards in Monson Pond approximates 267 kg (246 + 21).

PHOSPHORUS CONTROL ACTION PLAN

Recent and Current NPS/BMP Efforts

The Central Aroostook SWCD, the Aroostook County– Central Aroostook Natural Resources Conservation Service (NRCS), and local residents have long recognized the need for reducing NPS pollution to Monson Pond. The Aroostook County– Central Aroostook Natural Resources Conservation Service (NRCS) has an ongoing relationship with land owners in the Monson Pond watershed and has helped them establish voluntary conservation management plans to reduce nutrient export from agricultural operations. These previous efforts to reduce NPS pollution may be contributing to the current positive trend evident in the measurement of water clarity (p. 24).

Continued efforts for installing BMPs and reducing NPS pollution in the Monson Pond watershed are imperative given the current poor water quality conditions. A continued reduction in non-point inputs to Monson Pond, through BMP installation and proper maintenance, is crucial to achieving suitable long-term water quality.

Recommendations for Future NPS/BMP Work

Monson Pond has impaired water quality primarily due to historical high phosphorus inputs from non-point source (NPS) pollution and resultant internal lake sediment recycling of phosphorus. Specific recommendations regarding recent and current efforts in the watershed, Best Management Practices (BMPs), and actions to reduce (1) external watershed and (2) accumulated bottom sediment phosphorus total phosphorus loadings in order to improve water quality conditions in Monson Pond are as follows:

Watershed Management: Several agencies (i.e., Maine DEP, CA-SWCD, USDA/NRCS, watershed towns) have been involved in attempting to restore the water quality of Monson Pond. This PCAP-TMDL report will serve as a compilation of existing information about the past and present restoration projects that have been undertaken in order to adequately assess future NPS BMP needs in the watershed. Efforts should be made to include participants from the Canadian (New Brunswick) portion of the watershed.

Action Item #1 : Coordinate existing watershed management efforts		
Activity	**Participants**	**Schedule & Cost**
Initiate efforts to develop a Monson Pond Advisory Team	CA-SWCD, NRCS, Maine DEP, UMaine Cooperative Extension, watershed towns, shoreline landowners, interested watershed citizens—stakeholders.	Annual roundtable meetings—beginning spring 2007—minimal cost

Forestry: Forestry activities are more limited from a phosphorus loading perspective compared to other land uses in the Monson Pond watershed. However, since operated forestland accounts for the greatest land area in the watershed (30% of the watershed), this land use, if not managed properly, has the potential to negatively affect local streams and ultimately Monson Pond. Existing voluntary state guidelines for simplified pre-harvest plans, filter areas and proper erosion control as described in *Best Management Practices for Forestry: Protecting Maine's Water Quality* would minimize erosion and sedimentation during harvesting. Watershed municipalities should adopt new *Statewide Standards for Timber Harvesting and Related Activities in Shoreland Areas*. For more information contact the Maine Forest Service (1-800-367-0223).

Action Item # 2: Promote sound forest management practices in the watershed		
Activity	**Participants**	**Schedule & Cost**
• Promote use of voluntary forestry BMPs • Adopt statewide Standards for Timber Harvesting and Related Activities in Shoreland Areas • Encourage landowner participation in Be Woods Wise, MFS's education, technical and financial assistance program for forest landowners.	Watershed municipalities, forest landowners, logging professionals, local land trusts, Maine Forest Service	Beginning 2007 (**Cost dependent on activities**) Financial cost-share assistance available to develop long-term forest management plans and implement sustainable forestry projects including NPS corrective action.

Agriculture: While agricultural land uses today are limited along the shoreline of the pond, this land use still encompasses the second largest land area of all land uses in the watershed, and contributes the greatest phosphorus load to Monson Pond. BMP recommendations for agricultural land uses include providing education on conservation practices and planning assistance to local farmers. The Natural Resources Conservation Service provides technical assistance for using proper agricultural BMPs. For more information contact the NRCS office in Aroostook County (207-764-4153 ext. 3).

Action Item # 3: Educate and assist agricultural landowners		
Activity	**Participants**	**Schedule & Cost**
• Conduct workshops encouraging the use of phosphorus control measures within the Monson Pond watershed. • Educate farmers about conservation tillage where appropriate or practical. • Update, inspect, and maintain installed BMPs in the watershed. • Provide education and incentives for maintenance and upkeep of existing BMPs. • Test soil before fertilizing. • Establish and maintain protective vegetated buffers between cropland and Monson Pond. • Build waterways in fields with gully erosion. • Plant crops and till cross-slope. • Use strip cropping on steep slopes. • Plant a winter cover crop to reduce soil erosion during the off season.	CA-SWCD, NRCS, agricultural landowners, UMaine Cooperative Extension, the Towns of Fort Fairfield and Easton.	Annually beginning in 2007 Variable cost depending on type of activities.

Roadways: A common cause of NPS pollution in lake watersheds is often related to roads and roadside ditches, which if not properly designed and maintained can be a major source of erosion and sedimentation into lakes and streams. This PCAP report estimates that public and private roads combined contribute slightly more than 4% of the total phosphorus load per year to Monson Pond. Roadside ditches may be acting as conduits, effectively transporting sediments from bare agricultural fields in the spring and late fall. As such, efforts should be undertaken to identify pollution sources from roads so that appropriate BMPs can be designed and installed to remediate problem areas.

Action Item # 4: Implement roadway best management practices		
Activity	**Participants**	**Schedule & Cost**
• Create or update list of problem areas along roadways. • Repair eroding roads, failing and improperly sized culverts by establishing/implementing roadway BMPs.	Maine DEP, CA-SWCD, watershed towns, interested watershed citizens.	2007-2009 Variable cost depending on extent of repair needed.

Shoreline Residential: Densely developed residential dwellings have the potential to negatively effect water quality. Owners of the approximately 35 seasonal and year-round camps and homes on the north and west shores of the Pond should be encouraged to establish adequate and effective vegetated buffers along the shoreline. For a copy of The Buffer Handbook, contact the Maine DEP's Bureau of Land & Water Quality in Augusta (287-2112) or for technical assistance regarding buffers, contact the CA-SWCD at 834-6435.

Action Item # 5: Educate watershed citizens about shoreline buffers		
Activity	**Participants**	**Schedule & Cost**
Develop a Buffer Awareness Campaign	Maine DEP, CA-SWCD, Towns of Fort Fairfield and Easton, shoreline landowners, interested watershed citizens.	Begin immediately - $1,500/yr

Municipal Action: Municipal officials should be trained in current erosion and sediment control methods in order to ensure public compliance with local and state water quality laws and ordinances (Shoreland Zoning, Erosion and Sedimentation Control Law, plumbing code). This can be achieved through education and enforcement action, when necessary.

Action Item # 6: BMP training for municipal officials		
Activity	**Participants**	**Schedule & Cost**
• Town officials should participate in ME-DEP training opportunities in Erosion & Sediment Control BMPs. • Municipal officials should ensure compliance with local and state water quality laws and ordinances.	Maine DEP, CA-SWCD, local officials, interested watershed citizens.	Annually beginning 2007 Variable cost depending on extent of repair needed.

Individual Action: All watershed residents should be encouraged through continued education and outreach efforts, including: retention or planting of natural vegetation, use of non-phosphate cleaning detergents, elimination of phosphorus-containing fertilizers, and adequate maintenance of septic systems. Monson Pond watershed residents with older septic systems which pre-date Maine's 1974 Plumbing Code are encouraged to contact Maine-DEP for possible technical and/or financial assistance.

Action Item # 7: Expand homeowner education & technical assistance programs		
Activity	**Participants**	**Schedule & Cost**
Provide stormwater management education (including how to properly maintain septic systems) to residents along the shoreline and throughout the watershed.	Maine DEP, CA-SWCD, Towns of Fort Fairfield and Easton.	Begin immediately- $2,000

WATER QUALITY MONITORING PLAN

Historically, the water quality of Monson Pond has been monitored via measures of Secchi disk transparencies during the open water months since 1976 (Maine DEP and VLMP). Continued long-term water quality monitoring (water transparencies) for Monson Pond will be conducted monthly, from May to October, through the continued efforts of Maine DEP and VLMP. Under this planned, post-TMDL water quality-monitoring plan, sufficient data will be acquired to adequately track seasonal and inter-annual variation and long-term trends in water quality in Monson Pond. A post-TMDL adaptive management status report will be prepared 5 to 10 years following EPA approval.

PCAP CLOSING STATEMENT

The Maine Association of Conservation Districts and the Central Aroostook Soil and Water Conservation District, in cooperation with local stakeholders, have initiated the process of addressing non-point source pollution in the Monson Pond watershed. Technical assistance by CA-SWCD is available to both watershed towns (Fort Fairfield and Easton) to mitigate phosphorus export from existing NPS pollution sources and to prevent excess loading from future sources. The Towns of Fort Fairfield and Easton have initiated efforts to address NPS pollution in the Monson Pond watershed, and recognize the inherent value of the pond and its vital link to the community by providing strong support to restoration efforts. The towns should continue with efforts to cooperate with the NRCS, ME-DEP, and the CA-SWCD in the pursuit of local and regional lake protection and improvement strategies. This teamwork approach will result in an eventual and overall improvement in Monson Pond through NPS-BMP implementation and increased public involvement and awareness.

Winter ice covers Monson Pond. Photo courtesy of Sean Bernard, Frontier Fish and Game Club.

APPENDICES

MONSON POND (Fort Fairfield and Easton)

Total Maximum Daily (Annual Phosphorus) Load

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' as historically applied to point-source pollutants. 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, for non-point source pollution. Following EPA guidance (Spring 2006), we now report daily and annual phosphorus loads.

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 32 lakes in Maine which do not meet water quality standards due to excessive amounts of in-lake total phosphorus - the great majority of which are located in south-central Maine.

The first Maine lake TMDL was developed (1995) for Cobbossee Lake by the Cobbossee Watershed District (CWD) - under contract with Maine DEP and U.S. EPA. Recently (June 2006), Cobbossee Lake was officially removed from the TMDL listing of "impaired" waterbodies, in light of 8 years of above standard water clarity measures. TMDLs have been approved by U.S. EPA for Madawaska Lake (Aroostook County), Sebasticook Lake, East Pond (Belgrade Lakes), China Lake, Webber, Threemile and Threecornered ponds (Kennebec County), Mousam Lake, the Highland lakes in Falmouth and Bridgton, Annabessacook Lake, Pleasant Pond, Upper Narrows Pond and Little Cobbossee Lake (under contract with CWD), Sabattus, Toothaker, and Unity ponds and Long Lake (with assistance from Lakes Environmental Association), Togus Pond, Duckpuddle Pond, Lovejoy Pond, Lilly Pond, Sewall Pond, Cross Lake and Daigle Pond. 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 (SWCD's) - for Hermon and Hammond Ponds, Trafton Lake, Echo Lake, and Arnold Brook Lake. PCAP-TMDL studies have also been initiated for Christina Reservoir, the last of the remaining 2004 303(d) listed PCAP-TMDL waterbodies in Aroostook County.

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.

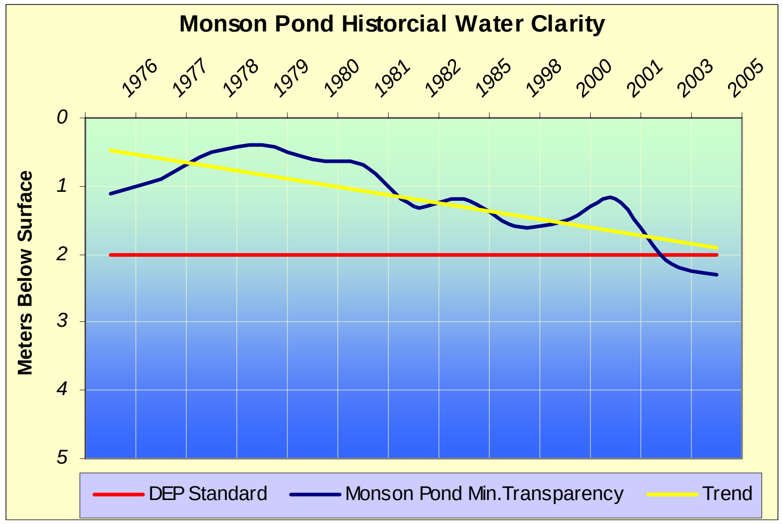
PCAP-TMDLs are important tools for maintaining and protecting acceptable lake water quality and are designed to 'get a handle' on the magnitude of the NPS pollution problem and to develop plans for implementing Best Management Practices (BMPs) to effectively address the lake's water pollution problem. 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 generally intended by Maine DEP to be used for regulatory purposes*.

For further information, contact Dave Halliwell, Maine Department of Environmental Protection,
Lakes PCAP-TMDL Program Manager, SHS #17, Augusta, ME 04333 (207-287-7649).
E-mail: david.halliwell@maine.gov

Water Quality, Priority Ranking, and Algae Bloom History

Water Quality Monitoring: (Source: Maine DEP and VLMP 2005) Water quality monitoring data for Monson Pond (station 1, deep hole) has been collected since 1976 (76-82, 84-85, 98, 00-01, 03, 05). Hence, this present water quality assessment is based on fourteen years of water quality data including 13 years of Secchi disk transparency (SDT) measures, combined with 11 years of epilimnion core total phosphorus (TP) data, 10 years of water chemistry and 8 years of chlorophyll-a measures.

Water Quality Measures: (Source: Maine DEP and VLMP 2005) Historically, Monson Pond has had a range of SDT measures from 0.4 to 2.5 m, with an average of 1.4 m; an epilimnion core TP range of 18 to 77 with an average of 35 parts per billion (ppb), and chlorophyll-a measures ranging from 3.5 to 36 ppb, with an average of 18 ppb. Recent dissolved oxygen (DO) profiles show low DO depletion in deep areas of this very shallow and well-mixed lake. The potential for total phosphorus to leave the bottom sediments and become available to algae in the water column (internal loading) is low (Maine DEP 2005).



The water clarity of Monson Pond has improved gradually over the period of record. Transparency measurements from 2003 and 2005 were the first to meet State guidelines for water quality since sampling began in 1976.

Priority Ranking, Pollutant of Concern and Algae Bloom History: Monson Pond is listed on the State's 2004 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 the need to complete an accelerated approach to lakes TMDL development. This Monson Pond TMDL has been developed for total phosphorus, the major limiting nutrient to algae growth in freshwater lakes in Maine.

As indicated by the figure above, the water quality of Monson Pond has generally been poor during the entire historical monitoring period, but has gradually improved over the period of record. Since sampling began in 1976, minimum transparencies have met the state's water quality limit of two meters in only two years (2003 and 2005). The annual trend of water clarity is a positive sign that the water quality of Monson Pond may be improving, and may continue to improve into the future.

Total phosphorus (22 ppb-based on recent summertime data 1998, 2001, 2003, 2005) has seen a 51% improvement over historical TP concentrations (45 ppb–1976-77, 1980-81, 1985), yet these levels still do not meet State minimum standards for acceptable water quality. While chlorophyll-a has also improved (mean 12.3 ppb-based on recent summertime data from 1998, 2001, 2003) compared to historical levels (mean 19.7 ppb based on summertime data from 1976-78, 1981) it also does not meet State minimum standards for acceptable water quality. Improving water quality may be linked to changing land uses in the watershed and local efforts to prevent non-point source pollution (see p. 18).

Natural Environmental Background levels for Monson Pond were not separated from the total non-point source load because of the limited and general nature of available information. Without more and detailed site-specific information on non-point source loading, it is very difficult to separate natural background from the total non-point source load (US-EPA 1999). There are no known point sources of pollutants to Monson 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 (<30 SPU) and for higher color lakes where low SDT readings are accompanied by elevated chlorophyll a levels (>8 ppb). Monson Pond is a colored lake (average color 52 SPUs), with low late summer SDT readings (annual average of 1.4 meters), in association with high chlorophyll-a levels (18 ppb late summer average). Currently, Monson Pond does not meet water quality standards primarily due to non-attainment of water transparency measures over time. This water quality assessment uses historic documented conditions as the primary basis for comparison.

Designated Uses and Antidegradation Policy: Monson 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 numeric (in-lake) water quality target for Monson Pond is set at 16 ppb total phosphorus (663 kg/yr). Since numeric criteria for phosphorus do not exist in Maine's state 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 May - June) total phosphorus levels in Monson Pond historically (period of record) approximated 29 ppb, while summertime levels averaged 36 ppb. Current total phosphorus (22 ppb-based on recent summertime data 1998, 2001, 2003, 2005) reflect an improvement in the historical levels, but still do not meet water quality standards.

In summary, the numeric water quality target goal of 16 ppb for total phosphorus in Monson Pond was based on observed late spring - early summer pre-water column stratification measures, 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 2 details the numerical data used to determine external phosphorus loading for the Monson Pond watershed. The key below Table 2 on the next page explains the columns and the narrative that follows (p. 26) relative to each of the representative land use classes.

Potato field in flower. Photo by L. Alverson, CA-SWCD

Table 2. Monson Pond Direct Watershed - Estimated Phosphorus Export by Land Use

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 Land							
Hayland (non-manured)	870	9%	0.35-1.34	0.35	352	226	11%
Row Crops	1795	19%	0.26-18.6	*variable	727	1487	73%
Sub-Totals	**2,665**	**28%**			**1,079**	**1,713**	**85%**
Actively Managed Forest	2851	30%	0.04-0.6	0.08	1,154	97	5%
Sub-Totals	**2,851**	**30%**	**0.04-0.6**	**0.08**	**1,154**	**97**	**5%**
Shoreline Development							
Shoreline Roads	13	0.1%	0.60 - 10.0	2.0	5	11	0.5%
Shoreline Low Density	11	0.1%	0.14 - 4.90	0.8	4	2	0.1%
Sub-Totals	**24**	**0.2%**			**9**	**13**	**1%**
Non-Shoreline Development							
Roads	145	1.5%	0.60 - 10.0	1.5	59	89.68	4%
Commercial/Industrial	0.7	0.01%	0.77 - 4.18	1.5	0.3	0.53	0.03%
Low Density Residential	4	0.04%	0.25 - 1.75	0.5	2	0.72	0.04%
Medium Density Residential	56	0.6%	0.40 -2.20	1.0	23	23.01	1%
High Density Residential	20	0.2%	0.56 -2.70	1.4	8.3	11.46	0.6%
Gravel Pits	6	0.07%	0.00-0.01	0.01	2.6	0.03	0.002%
Parks/Cemeteries	1	0.01%	0.14 - 4.90	0.8	0.4	0.38	0.02%
Sub-Totals	**234**	**2%**			**95**	**126**	**6%**
Total: DEVELOPED LAND	**5,774**	**60%**			**2,337**	**1,949**	**96%**
Non-Developed Land							
Inactive/Passively Managed Forest	1181	12%	0.01-0.08	0.04	478	22.12	1.1%
Grassland/Reverting Fields	138	1%	0.1 - 0.2	0.2	56	7.87	0.4%
Scrub-Shrub	374	4%	0.1 - 0.2	0.1	151	23.67	1.2%
Wetlands	1919	20%	0-0.05	0.01	777	9.74	0.48%
Total: NON-DEVELOPED LAND	**3,612**	**38%**			**1,462**	**63**	**3%**
Total: Surface Water (Atmospheric)	**171**	**2%**	**0.11-0.21**	**0.16**	**69**	**11**	**1%**
TOTAL: DIRECT WATERSHED	**9,557**	**100%**			**3,868**	**2,023**	**100%**

Key for Columns in Table 2

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 and aerial photography.

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

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

TP Coeff. Value kg/ha: The selected phosphorus coefficient for each land use category is determined from previous research – usually the median value, if listed by the author. The coefficient is often adjusted using best professional judgment and best management practices (BMPs) 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 each land use. Numbers are adjusted using GIS in order to incorporate both slopes and soil type.

Total Phosphorus Land Use Loads

Estimates of total phosphorus export from different land uses found in the Monson Pond watershed as presented on the previous page in Table 2 represent the extent of the current direct watershed phosphorus loading to the lake (2,023 kg/yr).

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 loading values 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.

Agriculture: Phosphorus loading coefficients as applied to agricultural land uses were adopted from: Dennis and Sage (1981): non-manured hayland (0.64 kg/ha/yr), Reckhow et al. (1980): *row crops/ tillage/cultivation (2.24 kg TP/ha/yr).

**The coefficient used for agricultural land in which BMPs (e.g. grassed waterways and diversion ditches) were implemented (1.66 kg TP/ha/yr) was adjusted using the EPA STEPL model which incorporates annual rainfall, soil P concentration, hydrological soil group, and the percent of area the BMP covers. The coefficient used for all non-manured hayland in the watershed may actually underestimate its impact since some hayland may receive commercial fertilizer.*

Actively Managed Forest Land: The phosphorus loading coefficient applied to actively managed forest land (0.08 kg/ha/yr) was changed beginning with the Long Lake PCAP-TMDL report following consultation with Lakes Environment Association and Maine Forest Service staff. The rationale for this change was based on the fact that properly managed harvest areas will generally act as phosphorus sinks during periods of regeneration. According to the Maine Forest Service, of the nearly 3,500 water quality inspections conducted throughout the state in 2003, approximately 7% of the harvested sites posed “unacceptable” risks to water quality.

PCAP-TMDL reports prior to the Long Lake report identified a “worst case” upper limit phosphorus loading coefficient of 0.6 kg/ha/yr for operated forestland. Therefore, for any given watershed in Maine we determined that applying this “worst case” coefficient to 7% of operated forest land while applying the “best case” coefficient (0.04 kg/ha/yr) to the remaining operated forest land would provide a relatively accurate estimate of total phosphorus loading from operated forest land. Combining worst case and best case coefficients yields the new phosphorus loading coefficient for operated forest land of 0.08 kg/ha/yr [(0.07 x 0.6) + (0.93 x 0.04)]. This category may be underestimated since some of the wetland areas may have been harvested in the past (Linda Alverson, personal communication).

Private and Public Roads: The total phosphorus loading coefficient for private/camp and public roads (2.0 kg/ha/yr for private/camp roads and 1.5 kg/ha/yr for public roads) was chosen, in part, from previous studies of rural Maine highways (Dudley et al. 1997) and phosphorus research by Jeff Dennis (Maine DEP).

Commercial/Industrial: The total phosphorus coefficient for Commercial/Industrial (1.50 kg TP/ha/yr) is based on recommendations by Jeff Dennis (Maine DEP).

Residential Development: The range of phosphorus loading coefficients used for low density residential, including seasonal camps (0.25 – 1.75 kg/ha/yr) was developed from information on residential lot stormwater export of phosphorus as derived from Dennis et al (1992), and first implemented in the 1995 Cobbossee Lake TMDL. Phosphorus loading coefficients for low density residential development was estimated to be 0.50 kg/ha/yr.

Parks/Cemeteries: The phosphorus loading coefficient for parks and cemeteries (0.80 kg TP/ha/yr) is based on unpublished research from Wagner-Mitchell-Monagle (ENSR 1989).

Total Developed Lands Phosphorus Loading: A total of 96% (1,949 kg) of the phosphorus loading to Monson Pond is estimated to have been derived from the cumulative effect of the preceding cultural land use classes: agriculture (85% - 1,713 kg); non-shoreline development (6% - 126 kg); and shoreline development (< 1% - 13 kg) as depicted in Table 2.

Non-Developed Lands Phosphorus Loading: The phosphorus export coefficient for inactive/ passively managed forest land (0.04 kg/ha/yr) is based on a New England regional study (Likens et al 1977) and phosphorus availability recommendation by Jeff Dennis (Maine DEP). The phosphorus export coefficient for grassland/reverting fields (0.20 kg/ha/yr) and scrub/shrub (0.10 kg/ha/yr) is based on research by Bouchard in 1995 (0.20 kg/ha/yr). The export coefficient for wetlands is based on research by Bouchard 1995 and Monagle 1995 (0.01 kg/ha/yr). The phosphorus loading coefficient chosen for surface waters (atmospheric deposition -0.16 kg/ha/yr), was originally used in the China Lake TMDL (Kennebec County), and subsequent PCAP-TMDL lake studies in Maine.

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 phosphorus loading coefficients.

Phosphorus Load Summary

It is our professional opinion that the selected export coefficients are appropriate for the Monson Pond watershed. Results of the land use analysis indicate that a best estimate of the present total phosphorus loading from external non-point source nutrient pollution approximates 2,023 kg/yr.

LINKING WATER QUALITY and POLLUTANT SOURCES

Annual/Daily Load Capacity: Total Phosphorus (TP) serves as a surrogate measure of Maine's narrative water quality standards for lake trophic status. The TP TMDL is originally calculated as an annual load (kg TP/yr), which is based on an in-lake numeric water quality target (ppb or ug/l TP) and the annual flushing rate of the lake, using generally accepted response models for lakes. It is appropriate and justifiable to express the Monson Pond TMDL as an annual load even though the pond has an annual flushing rate of 26.7 (see discussion below and seasonal variation on page 31). The annual flushing rate, or the theoretical rate at which water in a lake is replaced on an annual basis, is calculated as:

 # *Flushes/year* = (Watershed area * Runoff/year) / Lake volume

This TMDL also presents daily pollutant loads of TP in addition to the annual load. Daily flushing rates were determined by first calculating the monthly discharge from Dudley (2004). A number of parameters were required for input into these formulas including: Drainage area; % of significant sand and gravel aquifers; distance from the watershed to a predetermined line off the Maine coast; and mean annual precipitation. These parameters were determined using GIS (ArcMap 8.3).

Once the monthly discharge was determined, this information was used to ascertain the following:

% Total Monthly Discharge = (Total monthly discharge/ Total annual discharge) *100

 # *Flushes/month* = (Total # of flushes/year * % of total monthly discharge)

 # *Flushes/day* = (Flushes/month)/(Days/month)

The majority of the parameters used for calculating the annual loading capacity (kg TP/yr) on page 32 (Dillon and Rigler 1974, where L= (Azp)/(1-R)), remain unchanged for use in calculating the daily loading capacity. The exception is p, where p now equals flushes/month. Thus, the monthly loading capacity is expressed as a proportion of the annual loading capacity, based on the discharge expected for that month. The daily loading capacity was then calculated as follows:

Daily Load Capacity (kg/day) = (Monthly Load Capacity)/(Days/month)

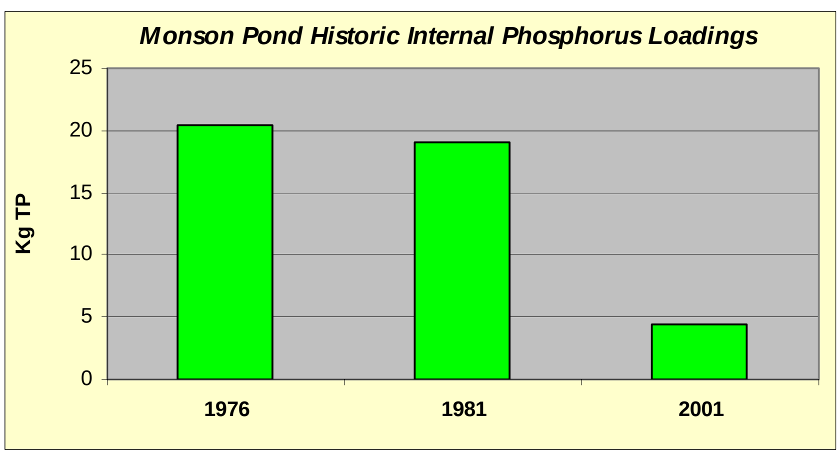
The daily loads for Monson Pond are presented on page 32.

Assimilative Loading Capacity: The Monson Pond basin lake assimilative capacity is capped at 663 kg TP/yr, as derived from the empirical phosphorus retention model based on a target goal of 16 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 16 ppb. This TMDL target concentration is expected to be met at all times (daily, monthly, seasonally, and annually). However, because the annual load of TP as a TMDL target is more easily aligned with the design of best management practices used to implement non-point source and stormwater TMDLs for lakes than daily loads of specific pollutants, this TMDL report recommends that the annual load target in the TMDL be used to guide implementation efforts. Ultimate compliance with water quality standards for the TMDL will be determined by measuring in-lake water quality to determine when standards are attained.

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 Monson Pond watershed approximates 21 kg annually (0.5 x 1 ppb change in trophic state or 41 kg).

Human population growth will continue to occur in the Monson Pond watershed, contributing new sources of phosphorus to the lake. Hence, existing phosphorus source loads must be reduced by at least 21 kg to allow for anticipated new sources of phosphorus to Monson Pond.

Overall, the presence of nuisance algae blooms in Monson Pond may be reduced, along with halting the trend of increasing trophic state, if the existing phosphorus loading is reduced by approximately 267 kg TP/yr.



Internal Lake Sediment Phosphorus Mass: The relative contribution of internal sources of total phosphorus within Monson 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. The only years for which adequate lake profile TP concentration was available to derive reliable estimates (15 kg) of internal lake mass was in 1976, 1981 and 2001. Though only one year (2001) of recent data is available (4 kg), this apparent reduction in internal phosphorus loading from historical levels (mean 19 ppb- 1976 and 1981) represents a reduction of 80%.

Linking Pollutant Loading to a Numeric Target: The basin loading assimilative capacity for colored Monson Pond was set at 663 kg/yr of total phosphorus to meet the numeric water quality target of 16 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 Monson 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.

Monson Pond Total Phosphorus Retention Model

(after Dillon and Rigler 1974 and others)

L = P (A z p) / (1-R) where, **1 ppb change = 41 kg**

663 = **L** = external total phosphorus load capacity (kg TP/year)
16 = **P** = total phosphorus concentration (ppb) = Target Goal = **16 ppb**
0.65 = **A** = lake basin surface area (km^2)=65 ha or 160 acres
2.0 = **z** = mean depth of lake basin (m) **A z p = 34.8**
26.74 = **p** = annual flushing rate (flushes/year)
0.84 = **1- R** = phosphorus retention coefficient, where:
0.16 = **R = 1 / (1+ sq. rt. p)** (Larsen and Mercier 1976)

Previous use of the Vollenweider (Dillon and Rigler 1974) type empirical model for Maine lakes, e.g., Cobbossee, Madawaska, Sebasticook, East, China, Mousam, Highland (Falmouth), Webber, Threemile, Threecornered, Annabessacook, Pleasant, Sabattus, Toothaker, Unity, Upper Narrows, Highland (Bridgton), Little Cobbossee, Long (Bridgton), Togus, Duckpuddle, Lovejoy, Lilly, Sewall Cross and Daigle PCAP-TMDL reports (Maine DEP 2000-2006) have all 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 Monson 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 (Vollenweider 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

Weaknesses:

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

❖ Based upon experience with other lakes in the northeastern U.S. region, the empirical phosphorus retention model was determined to be marginal for the application lake due to the relatively high annual flushing rate of 26.7.

Critical Conditions occur in Monson Pond during the summertime, when the potential (both occurrence and frequency) of nuisance algae blooms are greatest. The loading capacity of 16 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 Monson Pond equals 663 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 2). Direct external TP sources (totaling 2,023 kg annually) have been identified and accounted for in the land-use breakdown portrayed in Table 2 (corrected GIS). Further reductions in non-point source phosphorus loadings are expected from the continued implementation of NPS best management practices (see summary, pp. 18-21). 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, China Lake, and subsequent TMDLs), in-lake nutrient loadings in Monson Pond originate from a combination of direct external and internal (lake sediment) sources of total phosphorus.

WASTE LOAD ALLOCATIONS (WLA's): Since there are no known existing point sources of pollution (including regulated storm-water sources) in the Monson Pond watershed, the waste load allocation (WLA) is set at 0 (zero) and all of the loading capacity is allocated as a gross allotment to the "load allocation".

MARGIN OF SAFETY (MOS): The TMDL expressed in terms of annual and daily loads includes an implicit MOS through the relatively conservative selection of the numeric water quality target (based on a state-side database for lakes, supported by in-lake data). Based on both the Monson Pond historical records and a summary of statewide Maine lakes water quality data for colored (> 30 SPU) lakes - the target of 16 ppb (663 kg/yr in Monson Pond) represents a highly conservative goal to assure future 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 colored Maine lakes indicate that summer nuisance algae blooms (growth of algae which causes water transparency to be less than 2 meters) are more likely to occur at 18 ppb or above.

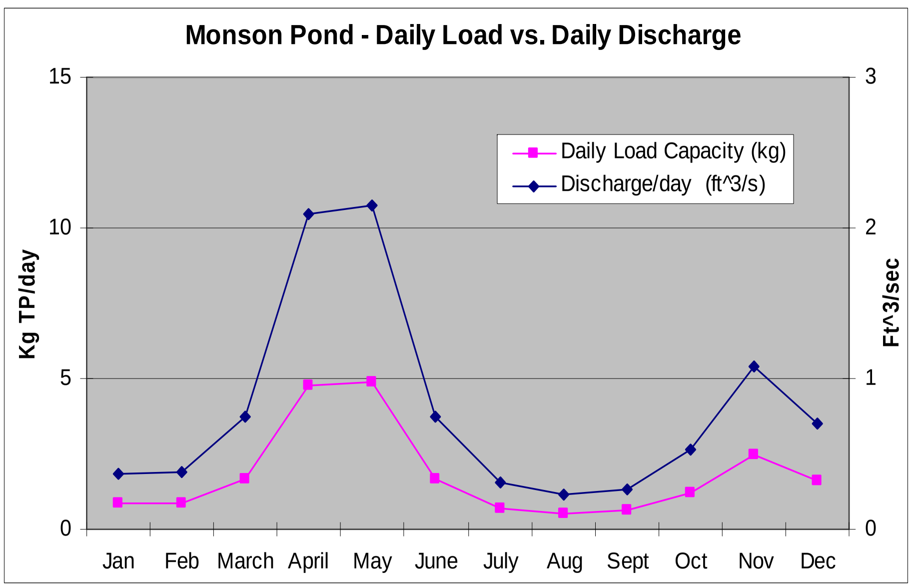
SEASONAL VARIATION: The Monson Pond TMDL is protective of all seasons, as the allowable annual load was developed to be protective of the most sensitive time of year – during the summer, when conditions most favor the growth of algae and aquatic macrophytes. Maine DEP lake biologists, as a general rule, 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. With an average flushing rate of 26.7 flushes/ year, average monthly phosphorus loads are most critical to the water quality in Monson Pond. Non-point source best management practices (BMPs) proposed for the Monson Pond watershed have been generally designed to address total phosphorus loading during all seasons.

This variation is further accounted for in calculations of seasonal (May-October, November– April), monthly, and daily TP load calculations (see page 32). These numbers are derived from formulas developed by Dudley (2004) for ungaged rivers in Maine, and are based on several physical and geographic parameters including: 1) drainage area of the waterbody, 2) percent of sand and gravel aquifers in the drainage area, 3) distance from a stationary line along the Maine coast, and 4) mean annual precipitation. Daily loading rates are then determined using variables from Dillon and Rigler (1974) for calculating the external total phosphorus load capacity (page 28) for the lake.


Geese on Monson Pond. Photo by L. Alverson, CA-SWCD.

Monson Pond Daily Load Calculations

Month	Discharge/Month (ft^3/s)	% of Total	Flushes/month	Monthly Load Capacity (kg)	Discharge/day (ft^3/s)	Flushes/Day	Daily Load Capacity (kg)
Jan	11.50	4%	1.05	26.11	0.37	0.034	0.84
Feb	10.59	4%	0.97	24.04	0.38	0.035	0.86
March	23.00	8%	2.10	52.21	0.74	0.068	1.68
April	62.89	22%	5.75	142.77	2.10	0.19	4.76
May	66.59	23%	6.09	151.15	2.15	0.20	4.88
June	22.34	8%	2.04	50.70	0.74	0.068	1.69
July	9.61	3%	0.88	21.82	0.31	0.028	0.70
August	7.00	2%	0.64	15.88	0.23	0.021	0.51
September	8.03	3%	0.73	18.22	0.27	0.024	0.61
October	16.42	6%	1.50	37.27	0.53	0.048	1.20
November	32.56	11%	2.98	73.90	1.09	0.10	2.46
December	21.89	7%	2.00	49.68	0.71	0.065	1.60



Vollenweider: L = P (Azp) / (1-R)	
L = external P load capacity (kg TP/yr)	**663**
P = total P concentration (ppb)	16
A = lake basin surface area (km2)	0.65
z = mean depth of lake basin (m)	2
p = annual flushing rate	26.74
1-R = P retention coefficient	0.84
R = 1 / (1 + sq. rt. p)	0.16

Season	% of Total	# Flushes
May -October	44%	11.9
November-April	56%	14.9

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

1. **September 26, 2005:** MACD staff traveled to Aroostook County to meet with staff from Maine DEP and the CA-SWCD to gather information and discuss the water quality of Monson Pond.
2. **September 27, 2005:** MACD staff met with Maine DEP and CA-SWCD staff in the field and were given a short tour of the Monson Pond watershed.
3. **May 30, 2006:** MACD staff Jennifer Jespersen contacted MDEP biologist Linda Bacon to discuss the surface area of the pond.
4. **July 10, 2006:** MACD staff Tricia Rouleau sent tentative land use maps to Linda Alverson (CA-SWCD) for ground-truthing.
5. **July 13, 2006:** MACD staff Jennifer Jespersen contacted Kathy Hoppe (MDEP) and Linda Alverson (CA-SWCD) to gather historical information about the Monson Pond watershed.
6. **July 18, 2006:** Sean Bernard from the Frontier Fish and Game Club sent historical information and pictures of Monson Pond to MACD staff Jennifer Jespersen.
7. **July 20, 2006:** MACD staff contacted the Maine VLMP to find out if there is a current monitor for Monson Pond. According to the records, active volunteer monitors are needed.
8. **July 20, 2006:** CA-SWCD staff drove the watershed ground-truthing the land use maps.
9. **August 24, 2006:** MACD staff Tricia Rouleau incorporated land uses changes provided by CA-SWCD to be used in the GIS model.
10. **October 3, 2006:** Town of Fort Fairfield Code Enforcement Officer and Director of Community and Economic Development provided MACD staff with more detailed information about the history of the pond.

STAKEHOLDER AND PUBLIC REVIEW PROCESS

A two-week stakeholder review was distributed electronically on October 2, 2006 to the following individuals who expressed a specific interest, participated in the field work, or helped develop the draft Monson Pond PCAP-TMDL report: Maine DEP (Kathy Hoppe); Central Aroostook SWCD (Linda Alverson); Maine Forest Service (Chris Martin); Maine Department of Agriculture (David Rocque); Maine Department of Inland Fisheries and Wildlife (Dave Basley), St. John Valley-Aroostook RC&D (Skip Babineau), USDA/Natural Resources Conservation Service (Ken Hill and Bill Sheehan); Frontier Fish & Game Club (Sean Bernard), Town of Fort Fairfield (Tony Levesque), and the Maine Potato Board (Tim Hobbs).

The following statement was advertised in the *Bangor Daily* News October 28-29, 2006 and the *Aroostook Republican* October 18, 2006:

MONSON POND - Fort Fairfield and Easton

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 a combined Phosphorus Control Action Plan (PCAP) and Total Maximum Daily Load (TMDL) nutrient report (DEPLW-0810) for the **MONSON POND WATERSHED**, located within the Towns of Fort Fairfield and Easton, and New Brunswick, Canada. This PCAP-TMDL report identifies and provides best estimates of non-point source phosphorus loads for all representative land use classes in the **MONSON POND** direct watershed and the total phosphorus reductions required to restore and maintain acceptable water quality conditions. A Public Review draft of this report may be viewed at Maine DEP Northern Maine Regional offices in Presque Isle (1235 Central Drive, Skyway Park) or at the Central Maine DEP offices in Augusta (Ray Building, Hospital Street - Route 9, Land & Water Bureau) or on-line: http://www.maine.gov/dep/blwq/comment.htm. Please send all comments, in writing by November 15, 2006 to Dave Halliwell, Lakes TMDL Program Manager, Maine DEP, State House Station #17, Augusta, ME 04333. or e-mail: david.halliwell@maine.gov

PUBLIC REVIEW Comments Received

COMMENTS - from Steve Sutter, Sutter Farm – November 13, 2006

As a member of the public, I offer the following comments on the Draft Phosphorus Control Action Plan for Monson Pond – Fort Fairfield and Easton, October 2006.

1. The report should identify the primary author by name, title, and agency.
2. Acknowledgements should include the EPA Section 319 Project Number, and the amount of the grant.
3. Public participation has been inadequate or weak. There is little evidence the preparers actively sought timely input and involvement from the agricultural producer community in the watershed or surrounding area, or Board Members of the Central Aroostook Soil and Water Conservation District, or local faculty of the University of Maine Cooperative Extension.
4. Public Notification of the report should have been placed in The Star Herald (Presque Isle), rather than Caribou's Aroostook Republican. Fort Fairfield and Easton citizens read the more local Star Herald
5. The underpinning load calculations in the report are poorly explained in the text. How were the TP coefficients derived, and what region's data are they based on? Whose best professional judgment may have been used? What was the land use model mentioned?
6. Action Plan 3 is vague. Roughly, how many agricultural producers (who contribute 85% of the TP export) are in the watershed? How would they be recruited to participate in an annual workshop? Who would instruct them, and what phosphorus control measures would be emphasized?

RESPONSE – from Dave Halliwell, Maine DEP (Maine Lakes PCAP-TMDL Program Manager)

Hi Steve - we thank you for your timely comments and critical review of the Monson Pond PCAP-TMDL report. These lake reports are drafted for preliminary stakeholder review under *contract with the Maine Association of Conservation Districts. The primary author is Maine DEP (lakes assessment section in Augusta - with assistance from DEP- NMRO, Presque Isle, in the case of Aroostook County waters) who work closely with MACD at all stages, including preparation of the Public Review draft. Following the public review process, a revised final report is then submitted to US-EPA for their approval. The EPA Section 319 Account number for this project is 013.06A.2179.132.NPS05.028.2903 and the 2005-07 MACD grant amounted to $178,418.00 (including 11 lakes, 7 of which are located in Aroostook County, average cost per lake = $16,220). We do not agree that this latter information should necessarily be included in these reports. Public participation is indeed an important component of this process and we are confident that coordinating our efforts through the local county Soil and Water Conservation Districts, inclusive of a 2-week stakeholder review process, are usually more than adequate. Our project team will further review your comments and provide responses to your unanswered questions/comments in the near future. Thanks again for your interest in improving the water quality of Monson Pond.*

RESPONSE -from Jennifer Jespersen, MACD (Monson Pond Project Manager)

Dear Mr. Sutter,

Thanks again for your comments on the Monson Pond TMDL report. Below you will find additional responses to questions that you raised during this public review process. We hope that these responses adequately address your concerns.

Public participation has been inadequate or weak. There is little evidence the preparers actively sought timely input and involvement from the agricultural producer community in the watershed or surrounding area, or Board Members of the Central Aroostook Soil and Water Conservation District, or local faculty of the University of Maine Cooperative Extension. *The Central Aroostook Soil and Water Conservation District has been aware of this report since planning began in the fall of 2005. When preparations for the report began, the CA-SWCD was consulted for background information, and delineated land use maps of the watershed. The CA-SWCD used these maps to field verify the land uses (specifically agriculture) and to document agricultural land in which BMPs were installed. Staff at the CA-SWCD provided us a list of key Stakeholders to contact during the process. These individuals receive a copy of both the Stakeholder Review Draft of the report as well as the revised Public Review Draft when it is available. Staff at the CA-SWCD receive both versions of these reports and have the opportunity to forward to their Board, and to provide us feedback on the report. For a full list of Stakeholders that received the report, see page 33. If you prefer, we can add you to the Stakeholder list for the 3 remaining TMDL lakes in Aroostook County (Echo, Arnold Brook and Christina).*

Public Notification of the report should have been placed in The Star Herald (Presque Isle), rather than Caribou's Aroostook Republican. Fort Fairfield and Easton citizens read the more local Star Herald. *We were informed that the Republican was the best paper to advertise in for this particular Lake. We plan to use the Star Herald for the next three lake reports (Echo Lake, Arnold Brook Lake and Lake Christina).*

The underpinning load calculations in the report are poorly explained in the text. How were the TP coefficients derived, and what region's data are they based on? *The watershed total phosphorus loading values were primarily determined using literature and* *locally-derived export coefficients (often from previous Maine Lake TMDLs based on professional recommendations by Maine DEP staff). The source of these coefficients are described in more detail on pages 27, 28 and 30 of the report. The references are listed in the report on pages 36-41.* **Whose best professional judgment may have been used?** *Best professional judgment was used by the project team throughout the process from interpretation of water quality data (Maine-DEP and MACD), to GIS modeling and aerial photo interpretation (MACD), to ground-truthing and map analysis (CA-SWCD).* **What was the land use model mentioned?** *The intent of the GIS-based land use model is to provide a relative estimation of impacts from watershed land uses for the development of phosphorus reduction strategies by stakeholders. The methods and tools used to run the land use model are explained in detail on page 7 of the report (Study Methodology).*

Action Plan 3 is vague. Roughly, how many agricultural producers (who contribute 85% of the TP export) are in the watershed? How would they be recruited to participate in an annual workshop? Who would instruct them, and what phosphorus control measures would be emphasized? *It is our recommendation that a Monson Pond Advisory Team (see page 18 for a list of potential contributors) come together and address several questions including the questions that you are asking. Action Item # 3 provides a list of potential phosphorus control measures.*

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