2009 Waterford
Water Testing Report
Lakes Environmental Association

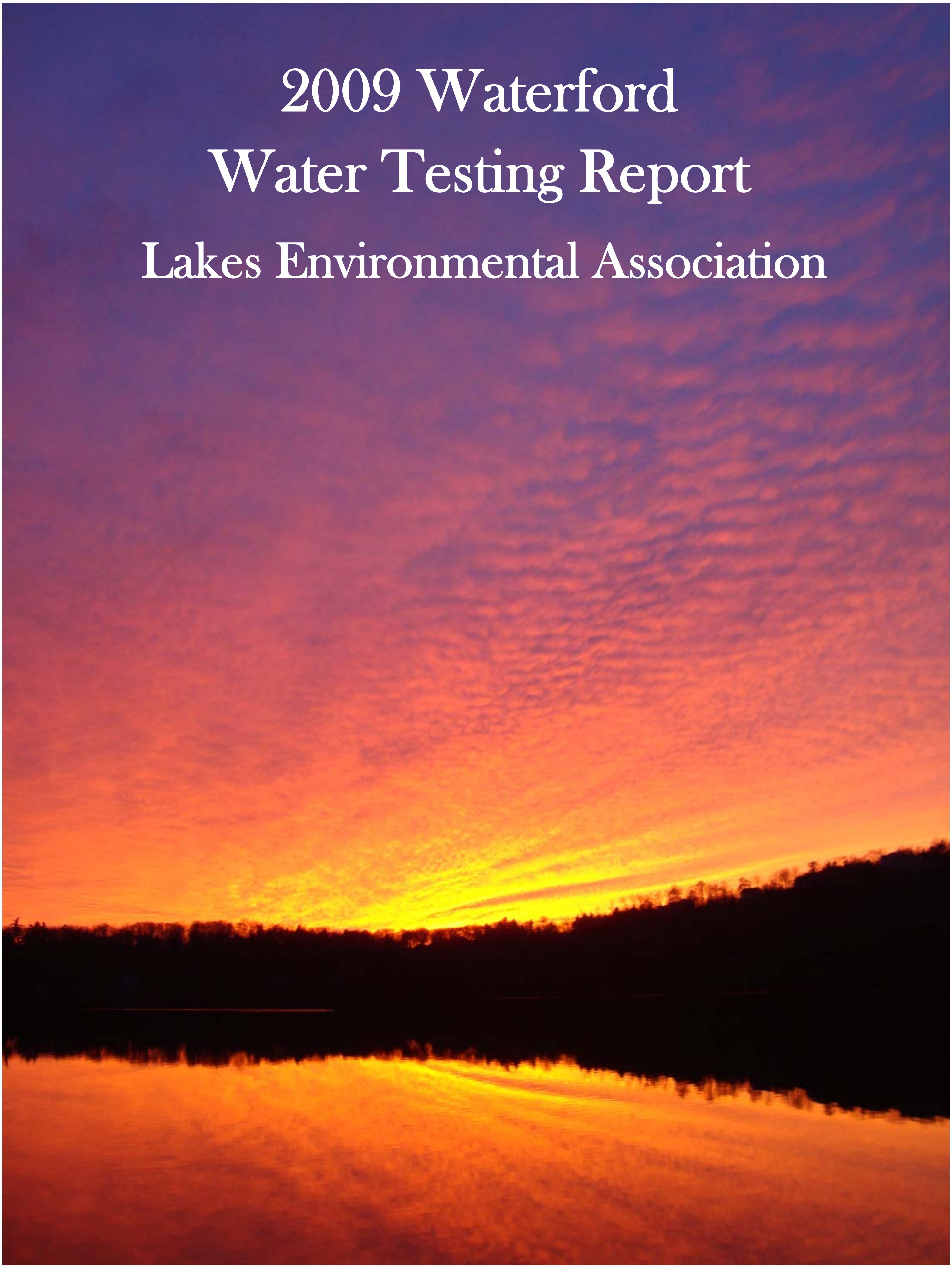


Table of Contents

About LEA	Page 1
2009 Water Quality Summary Statistics	Page 2
LEA Service Area	Page 3
2009 Volunteer Monitors and Interns	Page 4
A Year in the Life of a Lake	Page 5
The Three Layers of Lakes	Page 6
Water Testing Parameters	Page 7
Water Quality Classification	Page 8
2009 as a Year	Page 9
Individual Lake Summaries	Page 9

Please join LEA!

If you swim, boat, fish or simply believe Maine wouldn't be Maine without clear, clean lakes and ponds, please join the Lakes Environmental Association and protect Maine's lakes now and for future generations. Our lakes face serious threats, from erosion to invasive plants. Since 1970, LEA has worked to protect the lakes and ponds of Western Maine through water quality testing, watershed education and outreach programs.

37 lakes tested

LEA protects water quality by helping landowners avoid problems such as erosion and by testing the waters of 37 lakes in Western Maine with help from volunteers and support from the Towns of Bridgton, Denmark, Harrison, Naples, Sweden and Waterford.

LEA leads the milfoil battle

Invasive aquatic plants, such as milfoil, are not native to Maine waters. Once they invade a lake or stream, they:

- Spread rapidly and kill beneficial native plants.
- Form dense mats of vegetation, making it difficult to swim, fish or boat.
- Alter native fish habitats
- Lower waterfront property values.

Watershed education

LEA offers environmental education programs to local schools, reaching roughly 500 students annually. Many more people enjoy nature at LEA's Holt Pond Preserve and others join in the Caplan Series of nature pro-

Landowner and Municipal Assistance

LEA provides free technical assistance to watershed residents interested in preventing erosion on their property. This service, called the "Clean Lake Check Up" helps educate citizens about simple erosion control techniques and existing land use regulations. LEA also works with municipalities on comprehensive planning, natural resources inventories and ordinance development.

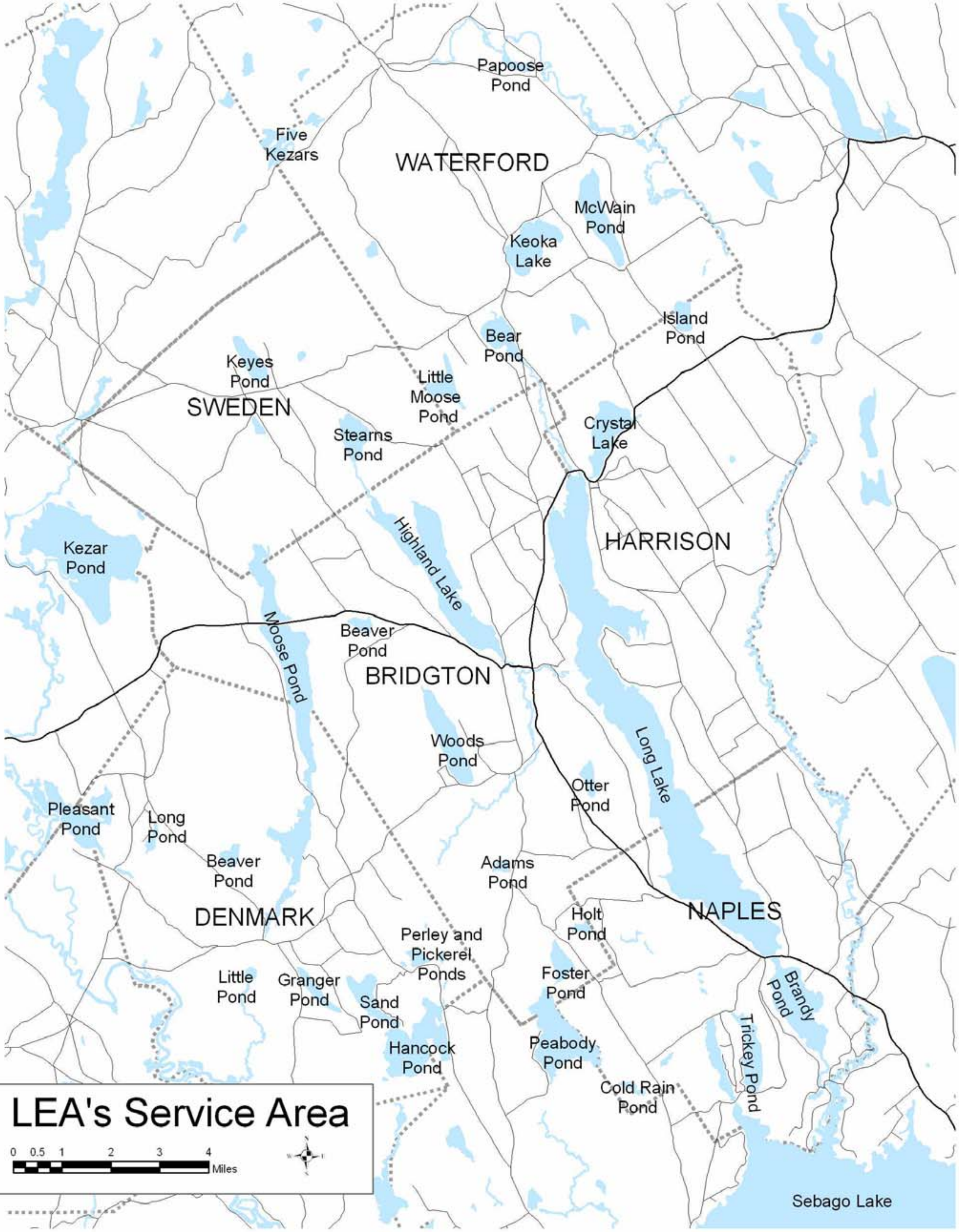
Thousands of students have learned about watersheds on LEA's "Hey You!" cruises.

You can become an LEA member with a donation of any amount. Just mail a check to LEA, 230 Main St., Bridgton, ME 04009 or join online at www.mainelakes.org.

2009 water quality at a glance

Lake	Surface Area (acres)	Watershed Area (acres)	Max. Depth (ft)	Av. Secchi (m)	Av. Color (SPU)	Av. Chl-A (ppb)	Av. Phos. (ppb)	Av. PH	Degree of Concern
ADAMS POND	43	196	51	7.0	11	3.5	8.5	6.8	High
BACK POND	62	584	33	6.4	15	2.0	6.6	6.7	Avg/Mod
BEAR POND	250	5,331	72	4.9	19	4.3	10.3	6.7	Avg/Mod
BEAVER P. (Bridgton)	69	1,648	35	4.9	31	3.6	9.5	6.7	High
BEAVER P. (Denmark)	80	1,288	8	2.5	20	3.1	10.0	6.7	Average
BRANDY POND	733	2,300	44	6.2	16	2.6	7.4	6.7	Mod/High
COLD RAIN POND	36	505	36	4.5	26	5.0	10.0	6.6	High
CRYSTAL LAKE	446	5,345	65	4.9	22	2.9	9.1	6.6	High
FOSTER POND	149	1,090	28	7.5	11	2.2	7.0	6.7	Average
GRANGER POND	125	642	28	7.5	12	2.4	9.5	6.7	High
HANCOCK POND	858	2,222	59	7.0	14	2.8	5.4	6.8	Mod/High
HIGHLAND LAKE	1,295	5,101	50	6.3	12	3.0	6.1	6.7	High
HOLT POND	41	2,118	10	3.0	50	2.4	12.0	6.4	Average
ISLAND POND	115	1,128	48	5.3	18	3.1	8.0	6.7	Mod/High
JEWETT POND	43	638	41	4.3	38	4.2	12.0	6.3	High
KEOKA LAKE	460	3,808	42	5.5	21	4.9	10.0	6.8	Mod/High
KEYES POND	191	1,213	42	6.0	19	3.9	8.0	6.7	Mod/High
KEZAR POND	1,851	10,779	12	3.2	25	3.9	18.0	6.4	Average
LITTLE MOOSE POND	195	1,184	43	7.2	12	3.0	5.9	6.6	Mod/High
LITTLE POND	33	633	13	4.2	15	2.5	7.0	6.5	Avg/Mod
LONG LAKE	4,935	33,871	59	5.9	17	2.8	7.3	6.7	High
LONG POND	44	217	20	5.9	10	3.7	8.0	6.6	Average
McWAIN POND	445	2,505	42	5.8	20	2.7	7.4	6.6	Mod/High
MIDDLE POND	72	231	50	5.0	22	2.4	7.9	6.5	High
MOOSE POND (Main)	1295	7,258	70	6.6	14	3.1	6.0	6.7	High
MOOSE POND (North)	323	10,462	20	4.8	31	3.3	6.0	6.7	Moderate
MUD POND	45	1,661	35	3.6	44	4.7	15.0	6.2	Moderate
OTTER POND	90	814	21	3.7	55	3.8	10.0	6.6	Moderate
PAPOOSE POND	70	192	15	3.2	30	4.2	17.0	6.4	Mod/High
PEABODY POND	740	2,522	64	6.8	12	2.9	6.8	6.7	Mod/High
PERLEY POND	68	293	27	4.3	33	2.7	7.0	6.4	Moderate
PICKEREL POND	17	290	18	5.1	30	2.4	6.0	6.4	Average
PLEASANT POND	604	4,624	11	2.5	55	5.5	19.0	6.2	Moderate
SAND POND	256	1,394	49	6.1	17	3.2	8.9	6.7	High
SEBAGO LAKE	29,526	122,551	326	9.3	10	1.1	5.2	6.7	Average
STEARNS POND	248	4,116	48	4.6	24	3.6	10.6	6.6	Mod/High
TRICKEY POND	315	555	59	10.1	5	2.0	5.0	6.8	Moderate
WOODS POND	462	3,229	29	4.3	37	2.9	9.6	6.4	Average

Note: Secchi disk readings, color, chlorophyll-a, phosphorus and pH are yearly averages from epilimnetic surface cores.



LEA's Service Area
0 0.5 1 2 3 4
Miles
Papoose Pond
Five Kezars
WATERFORD
McWain Pond
Keoka Lake
Island Pond
Bear Pond
Keyes Pond
Little Moose Pond
SWEDEN
Crystal Lake
Stearns Pond
Highland Lake
HARRISON
Kezar Pond
Moose Pond
Beaver Pond
BRIDGTON
Woods Pond
Long Lake
Otter Pond
Pleasant Pond
Long Pond
Beaver Pond
Adams Pond
DENMARK
NAPLES
Holt Pond
Perley and Pickerel Ponds
Little Pond
Granger Pond
Foster Pond
Brandy Pond
Sand Pond
Trickey Pond
Hancock Pond
Peabody Pond
Cold Rain Pond
Sebago Lake

LEA would not be able to test the 37 lakes and ponds of this area without strong support from our surrounding community. Every year, we rely on volunteer monitors, lakefront landowners, summer interns and financial support from the Towns of Bridgton, Denmark, Harrison, Naples, Sweden, and Waterford to continue to collect and analyze lake water quality. **Thank you for all your help!**

2009 Volunteer Monitors and Lake Partners

Harold Arthur	Richard LaRose	Blake Schindler
Richard and Andy Buck	Long Lake Marina	Jane Seeds
Camp Tapawingo	Bob Mahanor	Carolyn Stanhope
Steve Cavicci	Bob Mercier	Foster & Marcella Shibles
Janet Coulter	Richard and Daphne Meyer	Arthur and Jean Schilling
Ken Forde	Earl Morse	Linda Shane
Jean Forshay	Naples Marina	Bob Simmons
Bill Grady	Papoose Pond Campground	Don & Pat Sutherland
Nelson Gouterman	Barry & Donna Patrie	Bob & Ellen Tompkins
Bill & Nancy Hanger	Nancy Pike	Larry and Jan Tuck
Janet Healey	Jean Preis	Shirley Verhoorn
Dick Johnson	Carol and Stan Rothenberg	Camp Wigwam
Kokosing	Don Rung	Rich & Nancy Worthington

2009 Water testing interns

Matt Barnett	Amy Tragert	Conrad Ward
Kristy Garcia		Marguerite Wiser

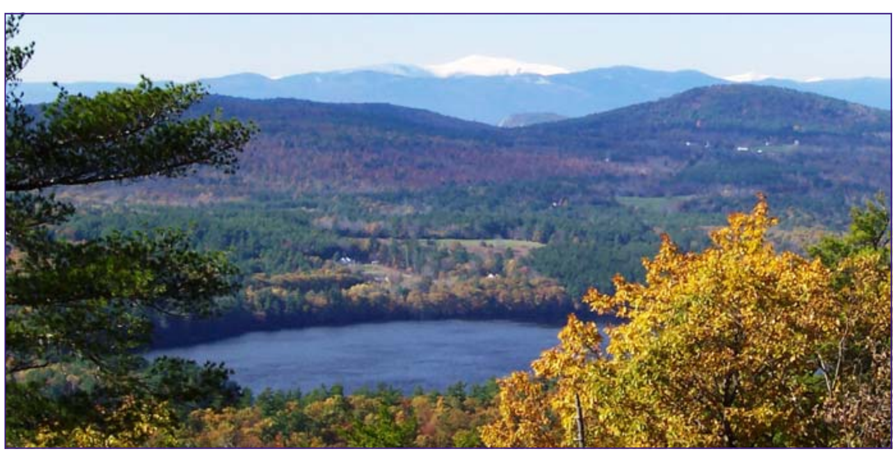
A year in the life of a lake

Winter is a quiet time. Ice blocks out the sunlight and also prevents oxygen from being replenished in lake waters because there is no wind mixing. With little light below the ice and gradually diminishing oxygen levels, plants stop growing. Most animals greatly slow their metabolism or go into hibernation.

Spring is a period of rejuvenation for the lake. After the ice melts, all of the water is nearly the same temperature from top to bottom. During this period, strong winds can thoroughly mix the water column allowing for oxygen to be replenished throughout the entire lake. This period is called spring turnover. Heavy rains, combined with snow melt and saturated soils are a big concern in the spring. Water-logged soils are very prone to erosion and can contribute a significant amount of phosphorus to the lake. Every soil particle that reaches the lake has phosphorus attached to it.

Summer arrives and deeper lakes will gradually stratify into a warm top layer and a cold bottom layer, separated by a thermocline zone where temperature and oxygen levels change rapidly. The upper, warm layers are constantly mixed by winds, which "blend in" oxygen. The cold, bottom waters are essentially cut off from oxygen at the onset of stratification. Cold water fish, such as trout and landlocked salmon, need this thermal layering to survive in the warm summer months and they also need a healthy supply of oxygen in these deep waters to grow and reproduce.

Fall comes and so do the cooler winds that chill the warm upper waters until the temperature differential weakens and stratification breaks down. As in Spring, strong winds cause the lake to turn over, which allows oxygen to be replenished throughout the water column.



The three layers of lakes

The critical element for understanding lake health is phosphorus. It's the link between what goes on in the watershed and what happens in the lake. Activities that cause erosion and sedimentation allow phosphorus from the land to be transported to the lake water.

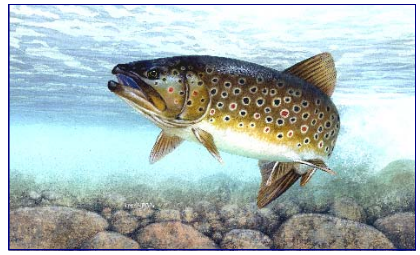
Phosphorus is a naturally occurring nutrient that's abundant on land but quite scarce in lake waters. Algae populations are typically limited by phosphorus concentrations in the water. But when more phosphorous comes into a lake, the added nutrients spur increases in algae growth.

More algae growth causes the water to be less clear. Too much algae will also use up the oxygen in the bottom of the lake. When algae die they drift to the lake bottom and are decomposed by bacteria in a process that consumes the limited oxygen supply. If deep water oxygen levels get too low, cold water fish are unable to grow or reproduce.

If there's no oxygen available at the bottom of a lake, another detrimental process called phosphorus recycling can occur. Phosphorus from sediments on the bottom become re-suspended in the water column. That doubles the lake's nutrient problem, since phosphorus is now coming from watershed as well as the lake itself.

Lake Depth

0-30 feet



Brook Trout

Epilimnion

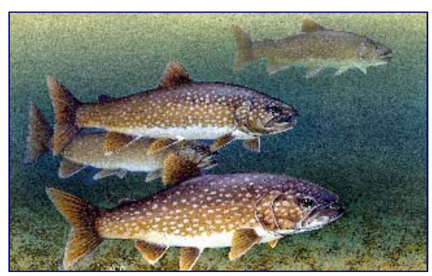
The warm upper waters are sunlit, wind-mixed and oxygen rich.

Landlocked salmon

30-36 feet

Metalimnion

This layer in the water column, also known as the thermocline, acts as a thermal barrier that prevents the interchange of nutrients between the warm upper waters and the cold bottom waters.



Lake trout, also known as togue

Below 36 feet

Hypolimnion

In the cold water at the bottom of lakes, food for most creatures is in short supply, and the reduced temperatures and light penetration prevent plants from growing.

Water Quality Testing Parameters

LEA's testing program is based on parameters that provide a comprehensive indication of overall lake health. Tests are done for transparency, temperature, oxygen, phosphorus, chlorophyll, color, conductivity, pH, and alkalinity.

Transparency is a measure of clarity and is done using a Secchi disk. An 8 inch round disk divided into black and white quarters is lowered into the water until it can no longer be seen. The depth at which it disappears is recorded in meters. Transparency is affected by the color of the water and the presence of algae and suspended sediments.

Temperature is measured at one-meter intervals from the surface to the bottom of the lake. This sampling profile shows thermal stratification in the lake. Lakes deep enough to stratify will divide into three distinct layers: the epilimnion, metalimnion, and hypolimnion. The epilimnion is comprised of the warm surface waters. The hypolimnion is made up of the deep, colder waters. The metalimnion, also known as the thermocline, is a thin transition zone of rapidly decreasing temperature between the upper and lower layers. Temperature is recorded in degrees Celsius.

Phosphorus is a nutrient that is usually present in only small concentrations in the water column. It is needed by algae for growth and reproduction and can therefore give an indication of the potential for an algal bloom. Algal blooms caused by excess phosphorus loading can deplete dissolved oxygen levels in deep water. Phosphorus is measured in parts per billion (ppb).

Dissolved oxygen is also measured at one-meter intervals from the surface to the bottom of the lake. Over the course of the summer, oxygen is depleted in the bottom waters through the process of decomposition of organic matter like dead algae. When there is excessive decomposition, all available oxygen is used up and coldwater fisheries are threatened. If dissolved oxygen concentrations are significantly depleted in bottom waters, a condition occurs which allows phosphorus to be released into the water column from bottom sediments. This is called phosphorus recycling and can cause increased algal growth to further deplete lake oxygen levels. During the fall, cooler temperatures and winds cause the lake to de-stratify and oxygen is replenished in the deep waters as the lake "turns over" and mixes. The same mixing of waters occurs in the early spring right after ice-out. Dissolved oxygen is measured in parts per million (ppm).

Chlorophyll-A is a pigment found in algae. Chlorophyll sampling in a lake gives a measure of the amount of algae present in the water column. Chlorophyll concentrations are measured in parts per billion (ppb).

Conductivity measures the ability of water to carry electrical current. Pollutants in the water will generally increase lake conductivity. Fishery biologists will often use measurements of conductivity to calculate fish yield estimates. Conductivity is measured in micro Siemens (µs).

Color is a measure of tannic or humic acids in the water. These usually originate in upstream bogs from organic decomposition. Chlorophyll results are more important on lakes that are highly colored because phosphorus and transparency results in those lakes are less accurate. Color is measured in Standard Platinum Units (SPU).

pH is important in determining the plant and animal species living in a lake because it reflects how acidic or basic the water is. pH is a measurement of the instantaneous free hydrogen ion concentration in a water sample. Bogs or highly colored lakes tend to be more acidic (have a lower pH).

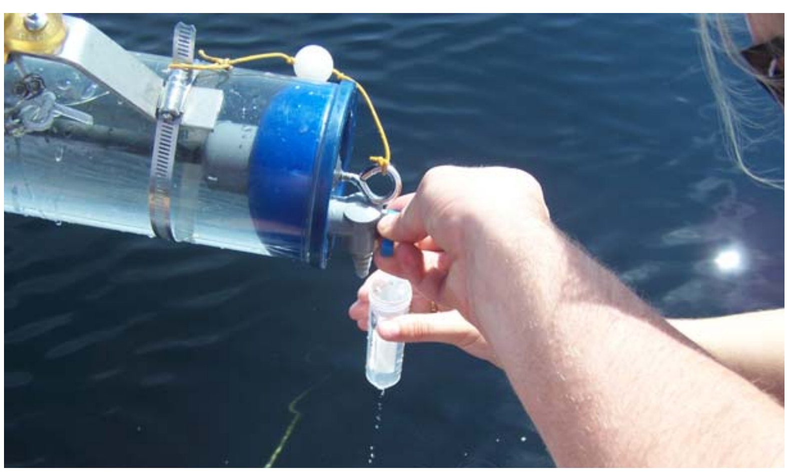
Alkalinity is a measure of the amount of calcium carbonate in the water and it reflects the ability of the water to buffer pH changes. In Maine lakes, alkalinity generally ranges from 4 - 20 parts per million (ppm). A higher alkalinity indicates that a lake will be able to withstand the effects of acid rain longer than lakes with lower alkalinity. If acidic precipitation is affecting a lake, a reduction in alkalinity will occur before a drop in pH.

Water Quality Classification

While all lakes are sensitive to land use and activities within their watershed, the health and longevity of some lakes is more precarious than others. LEA classifies lakes into categories based on their overall health and susceptibility to algal blooms. Lakes in the *Average Degree of Concern* category are those lakes that are not currently showing water quality problems that are likely a result of human activity. The *Moderate Degree of Concern* category describes lakes where testing shows routine dissolved oxygen depletion, elevated phosphorus levels or a potential for phosphorus recycling. The *High Degree of Concern* category is reserved for those lakes that routinely show signs of phosphorus recycling, have a cold water fishery that is regularly impacted by oxygen depletion or have had algal blooms in the past.

The following criteria are used for reviewing transparency, phosphorus, chlorophyll and color data for each lake:

Transparency (m) in meters		Phosphorus (ppb) in parts per billion		Chlorophyll-A (ppb) in parts per billion		Color (SPU) Standard Platinum Units	
10.0 +	excellent	less than 5.0	low	less than 2.0	low	less than 10.0	low
7.1 – 10.0	good	5.1 – 12.0	moderate	2.1 – 7.0	moderate	10.1 – 25.0	moderate
3.1 – 7.0	moderate	12.1 – 20.0	high	7.1 – 12.0	high	25.1 – 60.0	high
less than 3.0	poor	20.1 +	very high	12.1 +	very high	60.1 +	very high



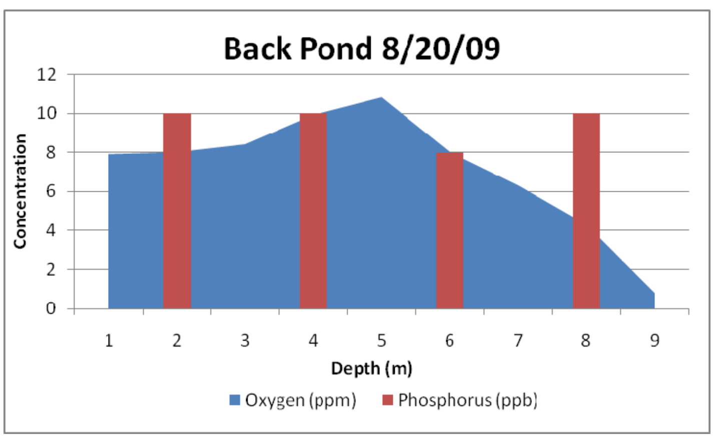
An intern pours off a sample from a deep water grab to be analyzed later for phosphorus concentration.

2009 as a Year

Overall, 2009 was not a good year for most of the lakes LEA samples. This was not a complete surprise considering the unusually warm spring followed by the wettest summer on record for Portland – over 3 inches more rain than the previous wettest summer! The "gully washers" were also more frequent than normal. Intense storms which produced more than 3 inches of rain during a 24 hour period were recorded in June, July and August this past summer. These types of storms cause a large amount of erosion within the watershed and they fill our lakes and ponds with sediment and nutrients. This in turn reduces clarity and increases phosphorus and algal populations. Looking at all the lakes we test on the whole, nearly 2/3rds showed a decline in water clarity. More than half had higher levels of phosphorus. Chlorophyll, which is a measure of the amount of green pigment found in algae is the hardest to correlate because it is influenced by water temperature, turbidity and sunlight as well as the amount of biologically available phosphorus. Chlorophyll levels were split down the middle with about half the lakes we test showing better results than normal and the other half showing worse results.

Individual Lake Summaries:

Back Pond – The 2009 average Secchi disk reading of 6.4 meters was deeper than the long-term average of 6.2 meters. Mild dissolved oxygen depletion occurred again in the bottom 2 meters of the water column beginning in July. Phosphorus concentrations in the surface waters averaged 6.6 ppb, which was higher than the long-term average of 6.2 ppb. Phosphorus levels below the thermocline were moderate and averaged 9.0 ppb. Average alkalinity was 9 ppm, above the long term average of 8 ppm and pH was the same as the long term average of 6.7. Chlorophyll concentrations were the same as the long term average of 2.0 ppb. Conductivity was 17 µs, under the long term average of 22 µs. Average color of 15 SPU was the same as the long-term average . Overall water quality appears stable on the pond. Back Pond remains in the AVERAGE/MODERATE degree of concern category.

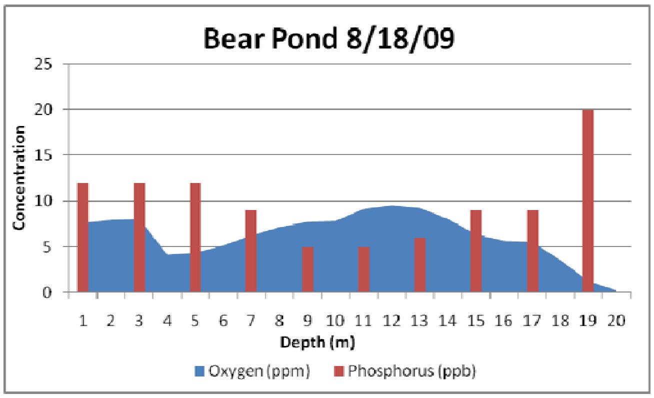


Surface Area:	62 acres
Maximum Depth:	33 feet
Watershed Area:	584 acres
Elevation:	572 feet

Back Pond Quick Statistics
2009 Average Verses the Long Term Average:

Secchi : Better
Chlorophyll: Similar
Phosphorus: Worse

Bear Pond – The 2009 Secchi disk average of 4.9 meters was less deep than the long-term average of 5.7. Oxygen depletion first appeared in the pond in late July and continued throughout the rest of the sampling season in the bottom 3 to 4 meters of the water column. During the height of oxygen depletion, there was still ample cold and well oxygenated water available for cold water fish. Phosphorus concentrations in the upper waters averaged 10.3 ppb, which is higher than the long-term average of 9.1 ppb. Phosphorus levels in the bottom waters of the pond were moderate and averaged 9.4 ppb. Alkalinity was the same as the long term average of 8 ppm and pH was 6.7 for the year, which is below the long term average of 6.8. Chlorophyll levels were moderate at 4.3 ppb, which is higher than the long-term average of 3.7. Average color was the same as the long term average of 19 SPU. Average conductivity was 25 µs, which was lower than the long-term average of 36 µs. Bear Pond again maintained a good volume of well-oxygenated, cold water below the thermocline. These conditions are needed to support a cold-water fishery. Bear Pond remains in the AVERAGE/MODERATE degree of concern category.



Surface Area:	250 acres
Maximum Depth:	72 feet
Mean Depth:	34 feet
Volume:	7,978 acres/feet
Watershed Area:	5,331 acres
Flushing Rate:	2.3 flushes per year
Elevation:	375 feet

Bear Pond Quick Statistics
2009 Average Verses the Long Term Average:

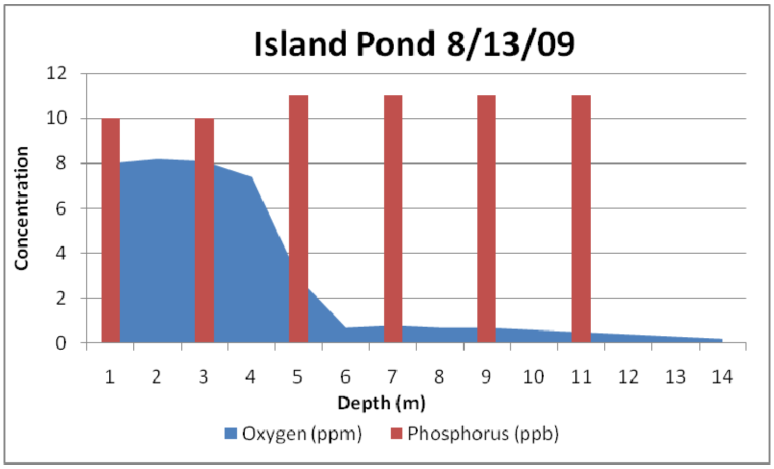
Secchi : Worse
Chlorophyll: Worse
Phosphorus: Worse

Island Pond – The 2009 Secchi disk average of 5.3 meters was less than the long-term average of 6.0. Dissolved oxygen depletion first appeared in early June near the bottom and intensified and expanded upward as the season continued. This past year's level of oxygen depletion was worse than most years. Phosphorus levels in the surface waters averaged 8.0 ppb, which is higher than the long-term average of 7.1 ppb. Phosphorus levels below the thermocline averaged 11.0 ppb. Alkalinity was 9 ppm, which is above the long-term average of 7. pH was the same as the long term average of 6.7. Conductivity averaged 31 µs, which was lower than the long term average of 41 µs. Chlorophyll averaged 3.1 ppb , which is slightly lower than the long-term average of 3.2 ppb. Color was the same as the long term average of 18 SPU. Because of low oxygen conditions and periodically elevated phosphorus levels in the bottom waters, Island Pond is in the MODERATE/HIGH degree of concern category.

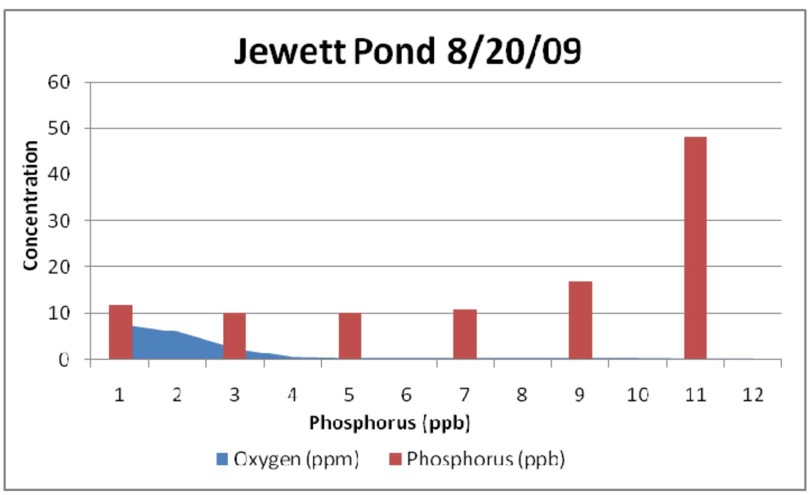
Island Pond Quick Statistics
2009 Average Verses the Long Term Average:

Secchi : Worse
Chlorophyll: Better
Phosphorus: Worse

Surface Area:	115 acres
Maximum Depth:	48 feet
Mean Depth:	16 feet
Volume:	1,626 acres/feet
Watershed Area:	1,128 acres
Flushing Rate:	1.3 flushes per year
Elevation:	448 feet



Jewett Pond – The 2009 Secchi disk average of 4.3 meters was the same as the long-term average. Dissolved oxygen depletion was observed in the bottom waters all season but the extent and intensity of the depletion increased as the summer progressed. Phosphorus concentrations above the thermocline averaged 12 ppb, which is higher than the long-term average of 9.8 ppb. Phosphorus concentrations below the thermocline were high and averaged 19.2 ppb. Average alkalinity was 8 ppm , which is above the long term average of 6 ppm. Chlorophyll levels averaged 4.2 ppb, which is lower than the long-term average of 5.0 ppb. Average conductivity was 21 µs, below the long term average of 24 µs and average color was 38 SPU, which was above the long term average of 34 SPU. Average pH was 6.3, which is below the long term average of 6.5. The low oxygen and high phosphorus conditions in the deeper waters are indicative of phosphorus recycling. For this reason, Jewett Pond remains in the HIGH degree of concern category.

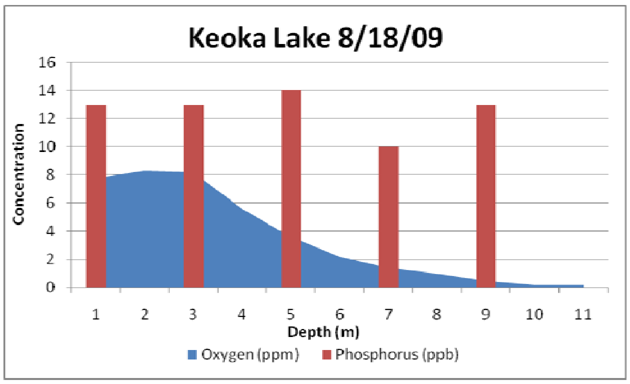


Surface Area:	43 acres
Maximum Depth:	41 feet
Watershed Area:	638 acres
Elevation:	580 feet

Jewett Pond Quick Statistics
2009 Average Verses the Long Term Average:

Secchi : Similar
Chlorophyll: Better
Phosphorus: Worse

Keoka Lake – The 2009 Secchi disk average of 5.5 meters was less deep than the long-term average of 5.9 meters. Dissolved oxygen depletion began to appear in the bottom waters of the pond in late June. As the summer continued, depletion progressed and consumed the bottom 6 to 7 meters of the water column. Phosphorus concentrations in the surface waters were moderate and averaged 10.0 ppb for the year, which is above the long term average of 8.2 ppb. Phosphorus concentrations below the thermocline averaged 12.3 ppb. Alkalinity was 9 ppm, which is below the long term average of 8 ppm and pH was the same as the long term average of 6.8. Average chlorophyll was 4.9 ppb, which is above the long-term average of 3.7. Average conductivity was 28 μs, which is below the long term average of 38 μs. Color was 21 SPU for the year, which is above the long term average of 18 SPU. Because of low oxygen conditions and periodically elevated phosphorus levels in the bottom waters, Keoka Lake is in the MODERATE/HIGH degree of concern category.

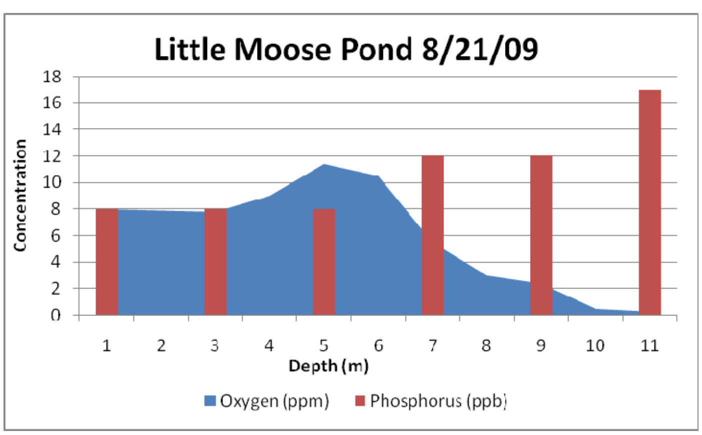


Surface Area:	460 acres
Maximum Depth:	42 feet
Mean Depth:	25 feet
Volume:	10,569 acres/feet
Watershed Area:	3,808 acres
Flushing Rate:	0.7 flushes per year
Elevation:	492 feet

Keoka Lake Quick Statistics
2009 Average Verses the Long Term Average:

Secchi : Worse
Chlorophyll: Worse
Phosphorus: Worse

Little Moose Pond – The 2009 Secchi disk average of 7.2 meters was less deep than the long-term average of 7.4 meters. Dissolved oxygen depletion was first observed in the bottom waters during June sampling. As the season continued, the depletion became more severe and expanded up the water column. Average phosphorus concentrations in the surface waters were moderate and the same as the long term average of 5.9 ppb. Phosphorus levels below the thermocline averaged 13.7 ppb. Alkalinity was 7 ppm, which is above the long term average of 6 ppm. pH readings average 6.6, which is under the long term average of 6.7. Chlorophyll levels averaged 3.0 ppb, which is above the long-term average of 2.4 ppb. Conductivity was 17 μs, which is below the long term average of 24 μs and color was 12 SPU, which is just above the long term average of 11 SPU. Because of oxygen depletion and periodically elevated phosphorus values at depth, Little Moose remains in the MODERATE /HIGH degree of concern category.

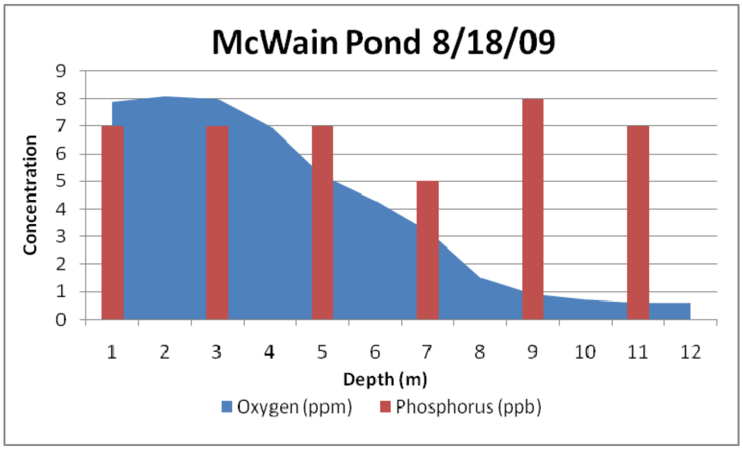


Surface Area:	195 acres
Maximum Depth:	43 feet
Mean Depth:	22 feet
Volume:	4,010 acres/feet
Watershed Area:	1,184 acres
Flushing Rate:	0.6 flushes per year
Elevation:	545 feet

Little Moose Pond Quick Statistics
2009 Average Verses the Long Term Average:

Secchi : Worse
Chlorophyll: Worse
Phosphorus: Similar

McWain Pond – The 2009 Secchi disk average of 5.8 meters was slightly less deep than the long-term average of 6.0 meters for the pond. Dissolved oxygen depletion was first observed in the bottom waters in early July. Depletion continued and expanded up the water column for the rest of the summer. Phosphorus concentrations in the surface waters averaged 7.4 ppb, which is less than the long term average of 7.6 ppb. Below the thermocline, phosphorus concentrations were moderate at 6.8 ppb. Alkalinity was 7 ppm, which is above the long term average of 6 ppm and pH was 6.6 , which is below the long term average of 6.7. Chlorophyll concentrations were moderate at 2.7 ppb, which is lower than the long-term average of 3.2 ppb. Conductivity was 23 µs, which is under the long term average of 29 µs and color was 20 SPU for the year, which is over the long term average of 17 SPU. Because of dissolved oxygen depletion in the bottom waters, McWain Pond remains in the MODERATE/HIGH degree of concern category.



Surface Area:	445 acres
Maximum Depth:	42 feet
Mean Depth:	23 feet
Volume:	9,756 acres/feet
Watershed Area:	2,505 acres
Flushing Rate:	0.5 flushes per year
Elevation:	533 feet

McWain Pond Quick Statistics
2009 Average Verses the Long Term Average:

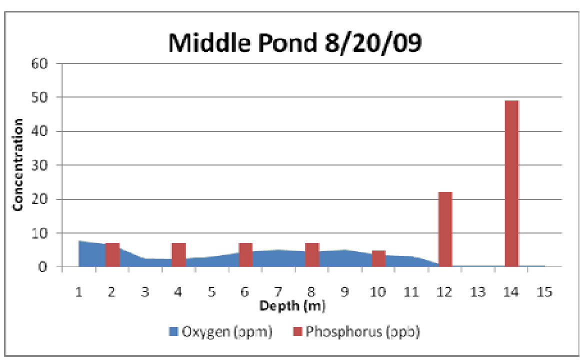
Secchi : Worse
Chlorophyll: Better
Phosphorus: Better

Middle Pond – The 2009 Secchi disk average of 5.0 meters was less deep than the long-term average of 5.2 meters. Dissolved oxygen depletion was first observed in early June in the deeper waters of the pond. The depletion expanded up the water column and increased in severity as the season continued, impacting all but the top 3 to 4 metes of the water column. Phosphorus concentrations in the surface waters were moderate and averaged 7.9 ppb, which was below the long-term average of 8.2 ppb. Phosphorus concentrations below the thermocline were moderate to high, averaging 25.3 ppb. Alkalinity was 8 ppm, which is above the long term average of 6 ppm and pH was 6.5, which is below the long term average of 6.6. Chlorophyll concentrations were moderate and averaged 2.4 ppb, which is under the long-term average of 3.9 ppb. Conductivity was 19 µs, which is just under the long term average of 20 µs and color was 22 SPU for the year, which is under the long term average of 25 SPU. Although there is little development in the watershed, pronounced oxygen depletion and the potential for phosphorus recycling are real concerns for the pond. For this reason, Middle remains in the HIGH degree of concern category.

Surface Area:	72 acres
Maximum Depth:	50 feet
Watershed Area:	231 acres
Elevation:	572 feet

Middle Pond Quick Statistics
2009 Average Verses the Long Term Average:

Secchi : Worse
Chlorophyll: Better
Phosphorus: Better



Mud Pond – The 2009 Secchi disk average of 3.6 was deeper than the long-term average of 3.4 meters. Dissolved oxygen depletion was again very pronounced this year. Low oxygen conditions limited most aquatic life to within 2 to 3 meters of the surface for much of the summer. Phosphorus was 15 ppb, which is above the long-term average of 11.8 ppb on the pond. Alkalinity was 8 ppm, which is above the long term average of 5 ppm and pH was 6.2, which is below the long term average of 6.3. Chlorophyll levels were moderate and averaged 4.7 ppb, which is under the long-term average of 5.4 ppb. Conductivity was 16 µs, which is below the long term average of 18 µs and average color was 44 SPU which is just below to the long term average of 45 SPU. Water quality conditions in Mud Pond are most likely a result of the pond's large surrounding wetland complex. For this reason, the pond is in the MODERATE degree of concern category.

Mud Pond Quick Statistics
2009 Average Verses the Long Term Average:

Secchi : Better
Chlorophyll: Better
Phosphorus: Worse

Surface Area:	45 acres
Maximum Depth:	35 feet
Watershed Area:	1,661 acres
Elevation:	572 feet

Papoose Pond – The 2009 Secchi disk average of 3.2 meters was less deep than the long-term average of 3.5 meters for the pond. Dissolved oxygen depletion was recorded in the bottom 1 to 2 meters of the water column during most sampling events. Phosphorus concentrations were high at 17.0 ppb, which is above the long-term average of 14.1 ppb. Alkalinity was 8 ppm, which is above the long term average of 7 ppm. pH was 6.4, which is below the long term average of 6.6. Chlorophyll was 4.2 ppb, which is below the long term average of 6.5 ppb. Conductivity was 22 µs, which is below the long term average of 34 µs and color was 30 SPU, which is just below the long term average of 31 SPU. Due to high phosphorus concentrations and substantial shorefront development, Papoose Pond is in the MODERATE/HIGH degree of concern category.

Papoose Pond Quick Statistics
2009 Average Verses the Long Term Average:

Secchi : Worse
Chlorophyll: Better
Phosphorus: Worse

Surface Area:	70 acres
Maximum Depth:	15 feet
Watershed Area:	192 acres
Elevation:	490 feet