

5. Lake and Watershed Assessment

5.1. Lake Questionnaire Results

The Muskellunge Lake questionnaire was developed to better understand the concerns, goals, and attitudes of homeowners living around the lake. Their thoughts and ideas about the use and the quality of your lake are shown below. The questionnaire was sent to 123 property owners, and 97 property owners responded to the Muskellunge Lake questionnaire.

Muskellunge Lake Management Plan Survey 2004

1. How long have you lived on Muskellunge Lake?

The average time people have lived on the lake is approximately 15.7 years

2. What do you enjoy the most about Muskellunge Lake? (Rank 1 through 8 with 1 being the highest rank. The lower the score, the higher the preference.)

	Rating							
	1	2	3	4	5	6	7	8
Fishing	60	17	12	7	7	3	0	0
Boating/Canoeing	8	19	19	27	12	5	0	0
Swimming	2	8	8	14	12	11	10	7
Aesthetics/Viewing	39	25	12	6	11	2	0	0
Wildlife	20	28	25	13	9	5	1	0
Water sports	6	2	0	6	12	32	11	5
Ice fishing	1	12	4	9	11	9	14	8
Others*	0	1	1	1	0	2	2	19

*moderate size, lesser boat traffic, snowmobiling, cross country skiing, peace and quite during week

3. What is the current water quality of Muskellunge Lake? (Water quality indicators are things such as water clarity, algae, weeds or plants, swimming conditions, or fishing conditions.

- 1 Excellent
- 10 Very good
- 39 Good
- 39 Fair
- 13 Poor

4. Since you have lived on or near Muskellunge Lake, the quality has:

- 9 Improved
- 22 Degraded considerably
- 23 Remained the same
- 39 Degraded slightly
- 7 No opinion/can't tell
- 1 Other--Degraded

5. What do you see as the most important issue regarding the lake?

	Rating										
	1	2	3	4	5	6	7	8	9	10	11
Exotic species	31	1	1	0	0	1	2	0	0	1	0
Poor fishing	9	3	2	0	2	1	0	0	1	0	0
Weeds	63	2	4	1	2	0	0	1	0	0	0
Algae	23	2	0	4	2	1	1	1	0	0	0
Water clarity	32	2	1	4	2	1	0	0	1	0	0
Water level	10	0	0	0	1	1	1	1	0	1	0
Shoreline development	13	3	1	0	0	0	1	0	0	1	0
Crowding on the lake	16	0	1	0	0	1	0	1	0	1	0
Noise	8	2	3	1	0	0	1	0	0	0	1
Harassment of wildlife	4	1	1	1	1	0	1	1	0	1	0
Muck	31	0	2	1	0	0	0	1	1	2	1

6. Because Muskellunge Lake is very fertile, there is plant growth in the lake. Aquatic plants are good for lakes. However, some aquatic plants can create nuisance conditions. If you could manage Muskellunge Lake for plant growth, what plant condition would you prefer?

	Rating					Additional responses not ranked
	1	2	3	4		
Mechanical harvesting	10	13	1	0		21
Chemical control with herbicides	23	11	2	0		19
Hand pulling	8	6	7	3		27

7. Do you think individuals have an impact on lake water quality? (either positively or negatively)

YES 43

NO 3 (positively 17 negatively 22)

COMMENTS fertilizing lawns, not updating septic

8. Of the following, which do you think are the most responsible for protecting and improving the lake? (rank with 1 being the most important).

	Rating							
	1	2	3	4	5	6	7	8
Federal government	2	3	2	1	3	11	14	5
State government	13	2	7	12	12	11	3	0
County government	5	7	14	13	15	3	1	1
Local government/Cloverland Township	7	9	16	14	7	3	0	0
MLA	25	25	3	4	4	1	0	0
Individual property owners	43	17	6	0	5	3	1	0
General public	7	7	12	6	7	6	4	0
All of the above equally	28	2	2	2	1	2	1	0

COMMENTS: The DNR can help.

9. What is the age of your septic system?

45 System is ten years old or less--low risk

22 System is between ten and twenty years old--medium risk

19 System is more than twenty years old--high risk

10. Where is your septic system located in relationship to the lake?

- 83 Drain field is over 50 feet from surface water--low risk
- 1 Drain field is 50 feet or less from surface water--high risk

11. What is your septic tank maintenance program?

- 67 The tank is pumped on a regular basis as determined by inspection every 1-3 years-- low risk
- 4 The tank is pumped, but not regularly--medium risk
- 1 The tank is not pumped--high risk
- 8 The tank is pumped on a regular basis_7_yearly_2_every two years_4_every three years

12. Is your system exhibiting any problems?

- 81 Household drains flow freely. There are no sewage odors inside. There is no ponding (water or effluent) over the drain field--low risk
- 0 Household drains run slowly. Soil over drain field is sometimes wet--medium risk
- 0 Household drains back up. Sewage odors can be noticed in the house or yard. Soil is wet or spongy in the drain field area--high risk

13. What specific things would you like to see changed or improved on/in Muskellunge Lake?

Mandatory inspection; Improve fishing habitat
Promote catch and release; Improve fish stocking program with DNR
Decrease weeds and algae; Get more people involved (8)
No fertilizer on lawns; Dredge to get rid of muck (4)
Keep septic up to date; Shoreline management/natural shoreline
Enforce no wake (6); Boat wash at boat landing
Decrease no wake by one hour; Close boat landing
Ban personal water craft (2) Use it, but don't abuse it.
No jet skis, large boats and motors; Permanent marker(low area)center of lake; Get rid of floating rafts;
Reduce water fertility
Limit horsepower; Improve water quality
Boaters to stay out of weeds; Control weeds (8)

14. You have options for managing your yard. How is your yard maintained?

- 62 No fertilizer applied
- 3 Fertilizer is applied_5_one_1_two_0_three times per year
- 0 Use a commercial fertilizer service
- 39 Maintain natural landscaped area
- 38 Maintain a vegetative buffer between lake and mowed lawn
- 2 Other (please specify) Milorganite

15. Are you interested in participating in a Lake Management Program on a personal level?

- 31 Yes
- 19 No 23 No answer

Are you willing to do any of the following?

- 21 Use soil recommendations for fertilizer application
- 42 Plant native wildflowers, grasses, etc. to attract wildlife
- 47 Leave as is or restore natural shoreline vegetation
- 29 Volunteer to help control aquatic plant growth as part of a whole lake effort
- 1 Other ideas-- Not specified.

16. Where do you get your information on how our lake works?

- 76 Lake association newsletters COMMENTS = MLA meetings
- 25 Wisconsin DNR Lake Tides (newsletter) 3
- 18 Newspapers Very little info from newsletters
- 6 Television
- 1 Internet
- 0 Other (please specify)

The following are comments by 35 respondents to the MLA 2004 survey question:

How long have you lived on the lake? and What was the lake like back then?

A resident who first came to the lake in 1945 stated that there was more wildlife to be seen then and less noise.

In the 1960's the weeds were primarily lily pads, cabbage weeds, and (?) pinocle weeds. There were whippoorwills in the spring, bats in the evening air, More bank and tree swallows, and beaver lodges in the southwest bay. Loons were on the lake all summer. Chipmunks, mice, and eagles continue to be observed.

In 1966, we used to be able to drink the water if the pump didn't work.

It was more peaceful in 1975 when there were only rowboats and excellent fishing. There were fewer homes and less boat traffic.

In 1977-78 the water level was 12 inches higher with a fraction of the weeds and muck. There were a few beaches. The water was clearer. The shoreline had 50% fewer cottages. There were fewer speed boats.

Fishing was better in 1983 when there was less boat traffic and the boat landing was not used as much by boats from the outside.

One resident emphatically stated that People are the problem.

Almost all commented on the increase in residential structures/piers. Lawns/yards reach to the shoreline. More and bigger boats/motors including pontoon boats and the dawn of personal water craft have contributed to the status of our lake today.

The lake has turned into a recreational lake. There is more noise, bigger power boats, bigger houses, and jet skis. There is no respect for the "no wake" rule.

Weeds are a major concern. Comments from 1965/1970--the types of weeds have changed and the density has increased. They are thicker and extend further out from the shores. Some bays cannot be fished. Swimming must occur in the middle of the lake, if it is done at all. The Northeast bay is unfishable and unboatable.

The creek bay is especially full of weeds. Our fish are healthier because of all of the weeds, believes a resident from 1989. Some believe that fishing is not as good due to increased pressure on the fishery and more difficult due to the weeds.

There is more algae bloom and earlier. More floating weeds due to power boats and personal water craft.

Overview of Lake Milestones Over the Years (submitted by the Muskellunge Lake Association)

Historically, the Railroad Commission of the State of Wisconsin had jurisdiction over the property where the dam now exists. At some time this was turned over to the Public Service Commission of Wisconsin and eventually to the DNR in the 1960's.

At a hearing on September 18, 1945 between the Public Service Commission of Wisconsin and residents of Muskellunge Lake to determine the normal water level of the lake the following was excerpted from the testimony given.

"Muskellunge Creek is meandering (approximately 3 miles from the Lake to Little St. Germain Lake), narrow, and of low gradient. It was subject to the accumulation of logs, brush, and debris. It seems to be the habitat of the beaver for many years. The beavers would build their dams in the stream and maintain the same until the timber in the vicinity used for food became exhausted and then moved to a different location. As far as the record shows, beavers had dams in the stream as far back as 31 years ago. From time to time until about 1935, some of the dams were abandoned by the beavers and rebuilt in different locations, whereas some of the dams were destroyed by man. From 1932-1935 the beavers "finally got out of control" and their dams were blasted from time to time because they caused high water which inundated the town road. Thus the activities of the beavers resulted in undesirable fluctuations of the water level of the lake. Their dams were finally removed about 1935-1937. It also appears that a crew from

the C.C.C. camps cleared Muskellunge Creek of brush and other obstructions, including beaver dams."

At this hearing various testimony was given regarding the water level of the lake. This hearing established that the normal water level is 91.84 feet elevation with reference to specific benchmarks described at this hearing. A recommendation was given at this hearing that the residents of Muskellunge lake, the town of Cloverland, or Vilas county construct, maintain, and operate a dam in the outlet stream for the purpose of maintaining the lake at normal level.

A note of interest was that a descriptor of the lake in 1945 indicated the lake contained a water surface of about 272 acres. The same as it is in 2004. A government survey map recorded June 9, 1864 indicates the Lake's bays were smaller and in the case of the north bays considerably smaller. In 1881 Vilas and Oneida Counties were created from Lincoln County. Survey/plat maps from that era to about 1908 show that Muskellunge Lake was labeled John Scott Lake at that time.

In the fall of 1948, the Muskellunge Lake Property Owners Association was granted permission to construct, maintain and operate said dam to maintain the normal water/lake level for conservation of the lake.

Not all residents of the lake agreed with the normal level of 91.84 as set by the Public Service commission. Some believed that the lake level needed to be higher, so they attempted to build up the dam with old bedsprings, sheet metal, logs, etc. Others believed that the water level needed to be lowered and would "blow" up the dam. This would occur about every three years. This ongoing dispute occurred at least between 1956 and into the mid 1980's.

The Muskellunge Lake boat landing has been evolving since it's inception. It has always belonged to one department or another in Vilas County. In spite of some reports, the DNR has never had jurisdiction over it.

The first "public" boat landing is noted around 1966. Boats could be "dragged" into the lake in the area of the culvert on Musky Road. Because this landing was so close to the public road, Vilas County had the right away to the property. In 1973 when a subdivision was approved for the area, the boat landing was moved to its present location after an easement was granted to the Vilas County Forestry Department from the nearby property owner. Pictures from that era show a rudimentary approach with a small pier. It consisted of a concrete plank landing, parking for 6 cars with trailers, and a gravel road. The Forestry Department has upgraded the landing through the years with the latest occurring in 2003-2004 making it handicapped accessible and a fine improvement for boat launching.

Aerial photos from the Forestry Department show a significant increase in shoreline structures from 1950-2000. In 1950 there were approximately 16 structures including two resorts. In 2000 there were indications of at least 85 structures/piers.

MUSKELLUNGE LAKE ASSOCIATION HISTORY

October 20, 1990 an organizational meeting was held with 47(37 property owners) in attendance to establish a lake association. Guest speakers from the DNR and the Wisconsin Federation of Lakes, Inc. spoke on who and why to establish a lake association. By-laws were approved.

Sixty of the 93 parcel owners on the lake became members at this time. (Currently there are 105 members.) In 1990, the primary concerns of the members were the disrepair of the dam and the weed growth on the lake.

Association membership fee is set at \$10 per year to carry on the business of the association. An optional lake improvement fee is set at \$20 per year. This fund is used for dam maintenance and lake improvements as needed.

Muskellunge Lake Association Achievements

Spring, 1991	Water sample testing began using sampling kits purchased through and tested by UW-Stevens Point.
1992	The DNR provided water sampling testing kits at no cost.
Winter 1992	A freeze out on the lake killed much of the fish population. (Over the years, the lake experienced several freeze-outs.) As a result the Lake Association decided to install an aerator to supply adequate oxygen levels to prevent future fish kills. A 1/10 acre of land on Musky Road which includes 176 feet of lake frontage was deeded to the association in 1993 by Milo Schandelmeir for \$1.00. The DNR and the Sport Fishing Restoration Club provided the funding for the aerator system and the small building that houses the aerator, fencing, and other miscellaneous equipment.
1993	Dam repair work was completed.
Winter 1994	The aerator was in place and operating. Maintenance of the aerator is the responsibility of the lake association. It is now put into operation every year when the ice reaches a thickness of 12 inches.
1994	A general plant survey was conducted by the DNR Rhineland, Wisconsin office.
July 1994	A petition was circulated to all property owners to rezone privately owned land around and adjacent to Muskellunge Lake from All Purpose-General Business to R-1 single family residential. County owned forestry land was exempted.
January 1995	The Vilas County Board approved the rezoning resolution.
1995	The Lake Association purchased their own testing equipment allowing for sampling and testing time to be reduced from 2 1/2-3 hours to 20 minutes. The unit can be used to take water samples in freezing temperatures.
1996	A macro-invertebrate study was completed as part of a research project sponsored by the Wisconsin Academy of Science.
2002	Completion of a three year USGS study for lake hydrology, water quality, and phosphorus loading.

Over the years, the association has held various social events including family picnics, chilifests on the ice, winter social dinners. Fund raisers have included auctions, rummage sales, Association logo on T-shirts, hats and sweatshirts.

Contributors for the above history: Lake residents; Vilas County Forestry Department; Public Service Commission of Wisconsin; Wisconsin DNR; Vilas County Survey Department; Town of Cloverland; Eagle River Historical Society/Museum; Eagle River Memorial Library

5.2. Muskellunge Lake Status

The status of Muskellunge Lake is slightly eutrophic meaning it has moderate fertility. Muskellunge has phosphorus concentrations that are slightly higher compared to many of the surrounding lakes. One way to compare the status of Muskellunge Lake is to compare it to other lakes in a similar setting or ecoregion.

Ecoregions are geographic regions that have similar geology, soils, and land use. The continental United States has been divided into 84 ecoregions, and there are six ecoregions in Wisconsin. A map of Wisconsin ecoregions is shown in Figure 25. Muskellunge Lake is in the Northern Lakes and Forests ecoregion (Figure 25). Lakes in this area of the state have some of the best water quality values in the State. A range of ecoregion values for lakes in the ecoregion along with actual Muskellunge Lake data is shown in Table 15.

Table 15. Muskellunge Lake data are compared to summer average quality characteristics for lakes in the Northern Lakes and Forest ecoregion (Minnesota Pollution Control Agency, 1988). Muskellunge Lake data from 2001 are used because there was a full summer of data.

Parameter	Northern Lakes and Forests	Muskellunge (2001)
Total phosphorus (ug/l) - top	14-27	46
Algae [as Chlorophyll (ug/l)]	<10	24
Chlorophyll - max (ug/l)	<15	47
Secchi disc (ft)	8-15	4.1

These comparisons indicate that the water quality of Muskellunge Lake is not within range compared to relatively unimpacted lakes within the Northern Lakes and Forests Ecoregion. The challenge will be to determine what kind of water quality can be achieved by Muskellunge Lake.

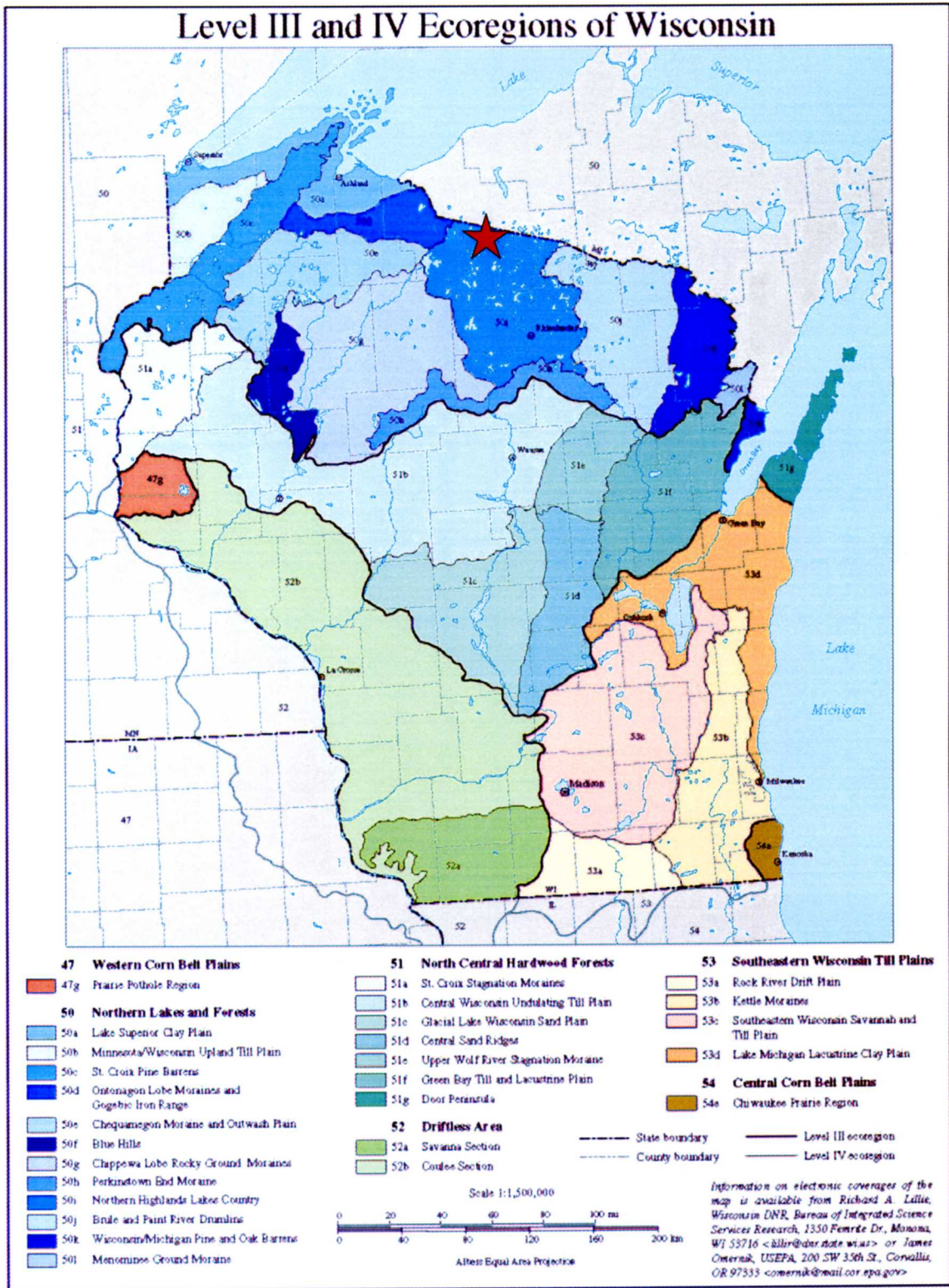


Figure 25. Ecoregion map for Wisconsin. Areas that are labeled with a “50” are within the Northern Lakes and Forest Ecoregion. Areas labeled with a “51” are in the Central Hardwood Forest Ecoregion. Muskellunge Lake, located in central Vilas County is officially in the Central Hardwood Forest Ecoregion but close to the Northern Lakes and Forest Ecoregion.

5.3. Nutrient Inputs to Muskellunge Lake

Based on Northern Lakes and Forests Ecoregion ranges, Muskellunge Lake has phosphorus levels that are out of range of lakes in this ecoregion. The reason for the high lake phosphorus concentration is not exactly clear, but is probably due to the amount of phosphorus coming into Muskellunge Lake from the watershed as well as from the lake sediments.

A summary of estimated phosphorus loads is shown in Figure 26. Using a lake model, a total annual phosphorus load of 675 pounds of phosphorus is estimated based on a lake phosphorus concentration of 46 ppb and a contributing watershed size of 2,602 acres. Estimates of the sources of phosphorus to Muskellunge Lake are based on a USGS study conducted in 2000-2001 with an estimated lake sediment contribution determined in this study (Figure 26). The lake sediment contribution was determined by subtracting the USGS estimated load of 437 pounds from a total estimated load used in this study of 675 pounds. Therefore the estimated phosphorus contribution from lake sediments is 238 pounds.

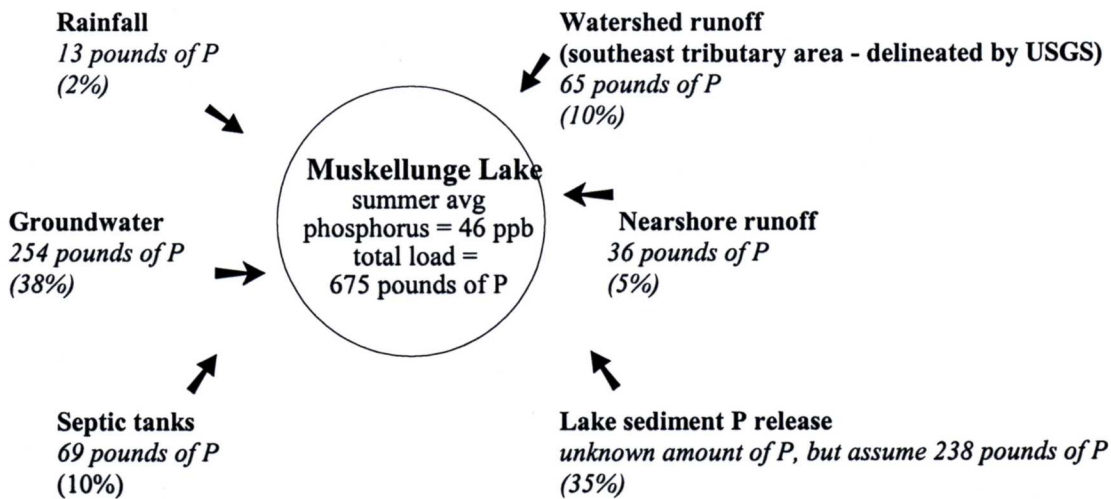


Figure 26. Sources of watershed phosphorus (P) that feed into Muskellunge Lake are shown above. It is estimated that approximately 675 pounds of phosphorus enter Muskellunge Lake on an annual basis.

5.4. Setting Water Quality Goals for Muskellunge Lake

It appears water quality in Muskellunge Lake has the potential to be better based on the ecoregion setting. Lake models were run to help determine feasible water quality goals for Muskellunge Lake. A lake model is a mathematical equation that uses phosphorus inputs along with lake and watershed characteristics to predict what a lake phosphorus concentration should be. Once a lake phosphorus concentration is determined, then seasonal water clarity and algae concentrations can be calculated as well.

Two lake models were run for the following conditions and then compared to existing observed conditions.

1. Phosphorus loading under ecoregion pre-development conditions (run-off phosphorus concentration at 20 ppb).
2. Phosphorus loading from relatively unimpacted lakes under current ecoregion conditions (runoff phosphorus concentration at 50 ppb).

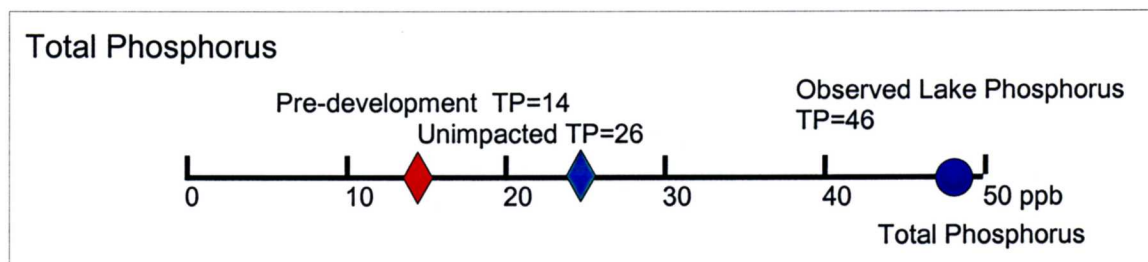


Figure 27. Comparison of total phosphorus (TP) conditions for Muskellunge Lake in 2001 (blue dot) to predicted conditions for a lake the size of Muskellunge Lake situated in the Northern Lakes and Forest (NLF) ecoregion under two runoff conditions: pre-development (red diamond) and unimpacted lake with some development (green diamond).

Results of the model run indicate Muskellunge Lake has the potential to maintain a seasonal phosphorus average of about 26 ppb compared to the 46 ppb observed in 2001. The reason for Muskellunge Lake having higher than expected phosphorus concentrations is because approximately 73% of the phosphorus load is coming from groundwater and the lake sediments. Most lakes do not have this high of a percentage input from groundwater and lake sediments.

The Secchi disc transparency is lower than expected and chlorophyll a is higher than expected when Muskellunge Lake is compared to other lakes in the ecoregion. The challenge to improving water quality is to address groundwater and lake sediment nutrient inputs.

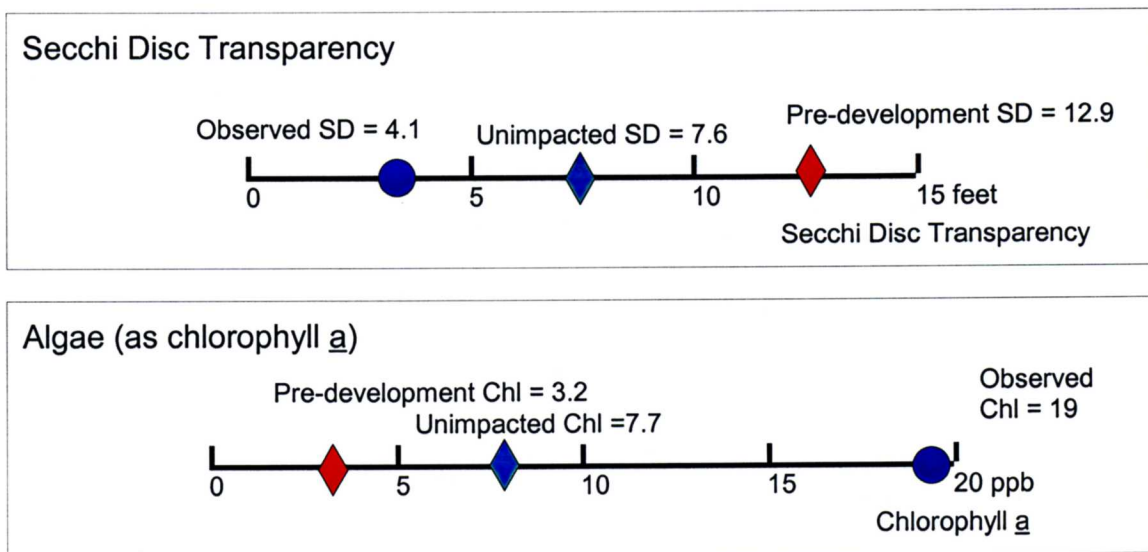


Figure 28. Comparison of Secchi disc transparency (feet) and algae (chlorophyll a – ppb) conditions for Muskellunge Lake in 2001 (blue dots) to predicted conditions for a lake the size of Muskellunge Lake situated in the Northern Lakes and Forest (NLF) ecoregion under two runoff conditions: pre-development (red diamond) and unimpacted lake with some development (green diamond).

Lake Goals

Based on lake modeling considerations it appears Muskellunge Lake has the potential for better water quality conditions.

The proposed water quality goal for lake phosphorus concentration is tentatively set at the ecoregion estimate of 26 ppb. However, this goal may be expensive to attain.

The key to achieving this lake phosphorus goal will be to maintain low nutrient inputs into Muskellunge Lake.

5.5. Significant Findings and Water Quality Strategy

- Water quality of Muskellunge is not within range of other lakes in the Lakes and Forests Ecoregion. Water quality parameters consisted of transparency readings, phosphorus, and chlorophyll.
- The watershed is in relatively good shape and does not appear to contribute excessive amounts of phosphorus to Muskellunge Lake.
- The findings of this study indicate the primary factors affecting water quality in Muskellunge Lake are nutrients from groundwater inputs and from phosphorus release from lake sediments.
- It may very well be that elevated levels of phosphorus have arrived in Muskellunge Lake by way of groundwater and this has occurred over a lengthy time period (at least the last 100 years).
- As phosphorus was delivered to the lake, not all of it left the lake. Much of the phosphorus was retained and has settled and accumulated in the lake sediments. Some of this phosphorus is released every year and contributes to algae blooms.
- It is possible that a high sediment pH (greater than 8.0) could account for some of the phosphorus release from the lake sediments. Sediment pH should be checked over the summer.
- Water quality can be improved, but it would be costly. A lake sediment alum treatment could improve water quality for 5 to 10 years but the cost would be approximately \$240,000.
- Native aquatic plants are diverse and no exotic aquatic plants were found in the two surveys conducted in 2004.
- Coontail, a native plant, grows abundantly in the northern bays. If control is considered, mechanical harvesting would be the recommended option.
- The winter aeration system is probably necessary to prevent winterkill in Muskellunge Lake.