LPL-257

Tomah Lake Committee

Monroe Co.

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Lake Tomah Management Plan

A Strategy to Improve the Recreational Use and Ecological Value of Lake Tomah

Photo by Terry Amundson, Tomah, WI

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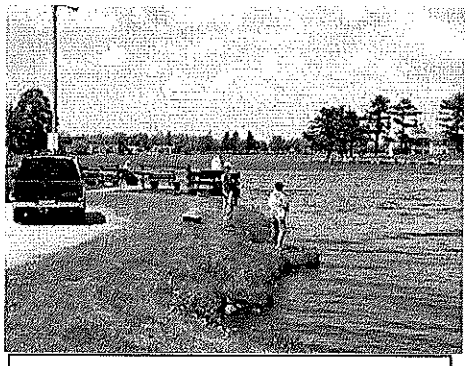
Chapter
1

Introduction

Lake Tomah: a valued community resource

Lake Tomah has been a valued recreational resource for the community of Tomah since the lake was formed by damming the South Fork of the Lemonweir River in 1938 and 1939. The lake and surrounding shoreline is used by community residents for fishing, boating, hunting, picnicking, and many other outdoor recreational activities. Lake Tomah is used by many area residents and over 80 percent of the city residents completing a lake assessment survey in October 2007 visit or use the lake one or more times per year. The majority of the residents value the lake as a recreational resource.



Shore fishing at one of the many public parks located on Lake Tomah

The most recent effort to improve Lake Tomah was in 1992 and 1993 when the lake was dredged and a new dam was built. Carp soon became abundant in the lake after the dredging and are a major contributor to the poor lake conditions which exist today. The carp degrade lake habitat by preventing the growth of aquatic plants, degrade water quality and dominate the fishery. Excessive runoff of nutrients from agricultural lands and urban areas which drain to Lake Tomah also contribute significantly to poor water quality. The degraded environmental conditions in the lake limit recreational use and the fishery. Most residents of Tomah feel the lake will worsen or remain the same if actions are not taken to improve the lake.

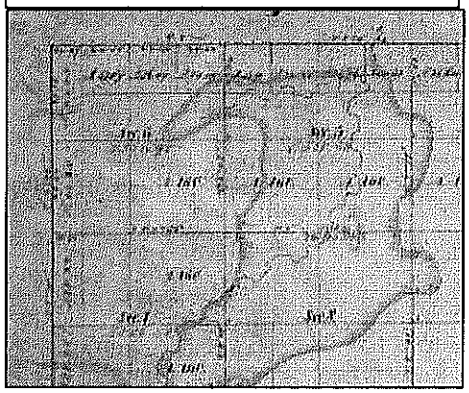
The community of Tomah through the City Council and the Lake Committee (community members appointed by the mayor and approved by City Council) working in partnership with community residents, the Monroe County Land Conservation Department staff and staff from the Wisconsin Department of Natural Resources have completed a Lake Tomah Revitalization Plan. This plan outlines a framework of lake stewardship activities which will provide improved recreational opportunities (including both motorized and non-motorized activities), fish and aquatic life habitats and water clarity. This lake plan includes clearly defined goals and activities that will be the road map to improve the attributes of Lake Tomah that are valued by the residents of the community.

BACKGROUND

Lake Tomah has been a valued community resource since the lake was created 70 years ago in 1938 and 1939 by damming the South Fork of the Lemonweir River. The lake was created from land donated to the City of Tomah by Lloyd Jones and Al Butts. The 251 acre lake has provided many decades of outdoor recreational enjoyment for the community of Tomah. The city has two public parks on the lake, a walking trail, and three public access sites which provide access to a variety of outdoor activities on and near the lake. The city has a 15 foot corridor of land around the lake which was created for public access at the time the lake was formed. The lake is used by the community for fishing, water skiing, picnicking, canoeing, wildlife viewing, education, ice skating, walking and sailing. It is truly a total community resource.

The City of Tomah has lead and conducted many lake stewardship activities over the decades to enhance the lake for the community. The lake has historically experienced excessive growth of algae and aquatic plants and sedimentation. A portion of the lake was dredged to remove sediments in the 1960's. Algae blooms and aquatic plants were treated with aquatic herbicides from 1966 through 1984. Aquatic plants were harvested with an aquatic plant harvester in the late 1980's. The city enhanced its stewardship of the lake in 1974 by creating the Tomah Lake Protection and Rehabilitation District. The city manages the lake district through a Lake Committee which are citizens appointed by the city council. The lake committee leads lake management activities and makes recommendations to the city council for approval. The City and Lake Committee have completed several lake and watershed studies, a lake management plan in 1986, a major dredging project in 1993, and constructed a new dam in 1993. The Monroe County Land Conservation Department working in partnership with the landowners of the Lake Tomah watershed from 1993 through 2003 conducted a watershed management project which has significantly reduced watershed erosion and the sedimentation of the lake.

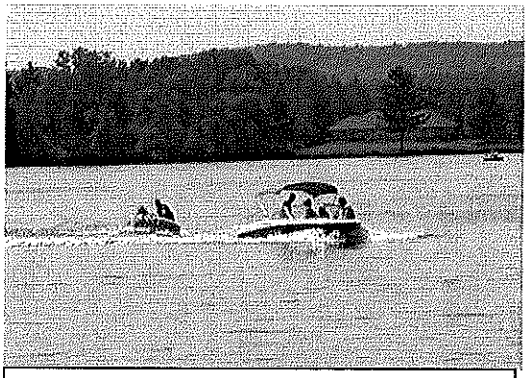
Wisconsin Public Land Survey – 1839
☆ *Location of Existing Dam*



Nonetheless, the lake continues to experience frequent summer algae blooms, degraded lake habitats and a fishery dominated by carp. The carp are a major factor in degrading lake habitat and provide a significant source of nutrient contributing to excessive algae growth. Carp dominate the fishery preventing the success of desirable gamefish species, resuspend bottom sediments preventing

the growth of desirable aquatic plants, and excrete high amounts of nutrients which contribute to the growth of algae. The stormwater runoff from the watershed continues to be the major source of nutrients stimulating algae growth in the lake.

The Lake Committee, the City of Tomah and interested community members initiated a partnership with the Wisconsin Department of Natural Resources and the Monroe County Land Conservation Department to explore the opportunity to improve the current conditions of Lake Tomah in the spring and summer of 2007. This partnership group identified several lake management opportunities that could lead to the improvement of the lake. The partnership group presented a variety of potential management actions to the city council and at public meetings. The City Council approved the Lake Committee to survey the community of Tomah in late 2007. Approximately 3200 surveys where sent to the citizens of Tomah with 1088 returned surveys (34%). This was considered a very good to excellent return. A total of seven questions were asked on the survey, which centered on the usage of the lake, water quality, future status of the lake, and support of a restoration project. It would be safe to say that the general consensus showed concern for the lake and its future. The community of Tomah by a 2 to 1 response was in favor of going forward with the development of this lake management plan and improving the quality of Lake Tomah.



A day of boating and tubing on Lake Tomah

Committing to achieving the lake management goals and implementing the lake management objectives are critical to the improvement of Lake Tomah. The goals for the lake include carp eradication, restoring a quality sport fishery, decreasing nutrient levels, decreasing nuisance algae blooms, improving water clarity, improving aquatic plant habitats, improving shoreland habitats, enhancing recreational opportunities (water sports including motorized and non-motorized activities) and prevent aquatic invasive species from entering the lake.

Chapter
2

Management Goals and Objectives

The goals for the lake were derived from the values and concerns of those people who live and recreate in the community of Tomah and from the scientific understanding of Lake Tomah. These goals must be inspirational, believable, actionable and achievable if we are going to be successful. Implementing the goals and objectives of the Lake Tomah Management Plan will enhance what we value most for the current and future generations of those that appreciate and use Lake Tomah. The lake goals will direct the lake management activities by the City of Tomah, the Wisconsin Department of Natural Resources, the Monroe County Land Conservation Department and residents of the Lake Tomah watershed all working in partnership.

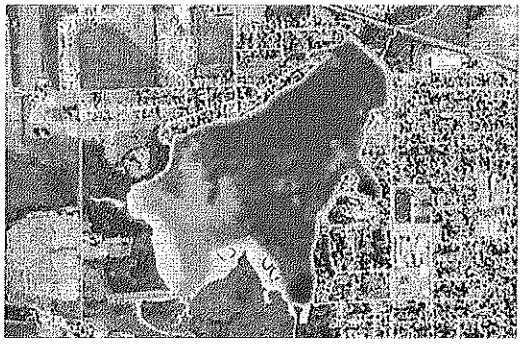
Lake improvement goals are included for restoring the fishery, improving habitat, improving water quality, improving recreational opportunities, preventing invasive species introductions and continuing to reduce sediment and nutrient inputs from the watershed.

The objectives included in the goals are the activities that must be completed to insure that the Lake Tomah Restoration project will be successful.

GOAL I: Restore and improve the fishery and aquatic life of Lake Tomah including a self sustaining sport fishery.

Restoring the sport fish community of the lake will provide many days and hours of outdoor recreational enjoyment for the community of Tomah. The fishery restoration will require a new lake map, a lake drawdown, carp eradication using rotenone, and sport fish stocking.

Objectives



1) **New Lake Map**. A new lake map will be completed in 2008. The map will provide an accurate characterization of the lake water volume, depth and lake bed characteristics, and lake physical habitat locations and characteristics. The information on the map will be

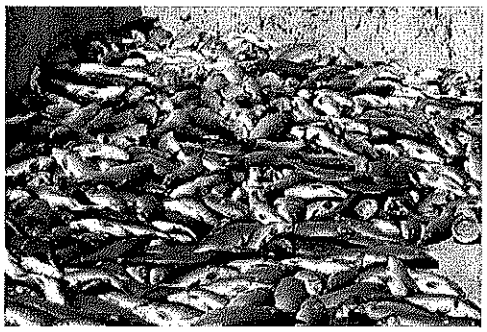
used to calculate lake water volumes for the carp eradication, monitor lake sedimentation, and provide all lake users with lake access locations and habitat features. The lake map is being developed for the City of Tomah by the University of Wisconsin Eau Claire. The development of the map was paid for by the City of Tomah and a lakes planning grant from WDNR.

2) **Lake Drawdown**. Lake Tomah will need to begin to be drawndown in the late summer of 2009 for the rotenone treatment. The lake will be lowered to an elevation of 953.4 ft (MSL) equating to a 7-foot drawdown. Lowering the water level helps reduce the cost of the rotenone treatment by reducing the volume of water needed to be treated. The lower water levels also helps group the carp into well formed pools of water increasing the effectiveness of the treatment. The 953.4 ft (MSL) will maintain a 4 foot hydraulic height at the dam discharge which is planned to keep the discharge velocities fast enough to prevent carp from swimming back upstream into the lake.

   In the spring of 2010, the lake will be raised from 953.4 to 957.4 ft (MSL) equating to a 3 foot drawdown. The lake will remain at this partial drawdown level until mid-summer 2010 to facilitate the growth of native emergent and submergent aquatic plants in the near shore areas of the lake. The City of Tomah will need to obtain a draw down permit from WDNR and manage the dam operation to facilitate the draw down. WDNR will waive the permit fee as the project is being done in partnership with WDNR. The City of Tomah will be responsible for managing the dam for the draw down.

3) **Liberalize Fishing Regulations**. Once the City Council approves the plan, the DNR will suspend all fishing regulations including size and bag limits, gear restrictions until the time of the carp eradication. This will provide opportunities for anglers to catch game fish that will otherwise be destroyed during the rotenone treatment. If the lake management schedule proceeds as planned, fishing restrictions could be suspended in the fall of 2008.

4) **Carp Eradication**. Carp are by far the dominant fish currently in the lake and prevent the establishment of a quality sport fishery. Their feeding behavior prevents the growth of valuable aquatic plants and degrades water quality by resuspending lake sediments and excreting high amounts nutrients. In the past, DNR fisheries crew have electro-shocked Lake Tomah in attempts to remove carp from the lake. Although truck loads of carp were removed, the removal really had a negligible effect on the carp population. The carp eradication will be conducted by WDNR in the late fall of 2009. All waterways and wetland areas expected to hold carp will be treated with rotenone which will kill all fish species. The WDNR will develop the carp eradication plan and environmental assessment by June 2009. The funding for the carp eradication will be provided by WDNR through an EPA 319 grant or lake protection implementation grant. The carp



5) **Sport Fishery Restoration.** The restocking of sport fish will begin in the spring of 2010 following the fall 2009 rotenone treatment. Fish species which will be stocked post-treatment include northern pike, largemouth bass, black crappie, and bluegill. The Wisconsin Department of Natural Resources will obtain fry of each species from the Genoa Federal Fish Hatchery to stock in spring post-treatment. Adult bluegill and black crappie may be obtained to supplement this initial stocking. Forage (minnow) species may be stocked based on species found upstream in the watershed. Stocked fish should provide anglers a fishery within 3 to 4 years post treatment. However, protection from harvest is essential in order to produce a natural reproducing fish community. After stocking, restrictive size and bag limits will be proposed via the Spring Conservation Congress Hearings in order to protect fish from harvest. Proposed size and bag limits include: northern pike, 32 inch minimum length and a daily bag of one fish, largemouth bass, 18 inch minimum length limit with a daily bag of one fish, panfish, no minimum size limit with a daily bag of 10 fish. This protection will allow fish to grow to adulthood, reproduce, and maintain a healthy fish community without the need additional stocking events into the future. In addition, these protective size and bag limits will allow for a quality fishing experience, while allowing harvest of some fish.

Goal II Improve water clarity and reduce algae levels by reducing nutrient concentrations in Lake Tomah.

The community of Tomah deserves to have improved water quality to enhance the recreational use and enjoyment of the lake. Reducing in lake phosphorus levels to 60-80 micrograms per liter will improve water clarity and reduce algae levels. This goal is achievable by successfully eradicating the carp and implementing land management practices which minimize nutrient losses in stormwater runoff from agricultural and urban lands in the Lake Tomah watershed.

Nuisance algal blooms have become a more frequent problem at Tomah Lake in the last decade.

OBJECTIVES

1) **Carp Eradication**. Carp feed on lake bottom dwelling invertebrates. This feeding behavior resuspends bottom sediments, prevents the growth of aquatic plants and carp excrete high amounts of nutrients which stimulates algae growth. The eradication of carp will improve the sport fishery, allow aquatic plants to grow and reduce algae growth. The carp eradication is described in Goal I.

2) **Urban Stormwater Management**. Stormwater runoff from the City of Tomah and development in the rural watershed carries nutrients and sediments to the lake. The City of Tomah will continue to implement stormwater runoff and construction site erosion control management to prevent nutrients and sediment from entering the lake. These efforts need to include street sweeping and yard care practices. The City of Tomah and WDNR will continue to work in partnership to insure that current stormwater runoff and construction site erosion control rules are effectively and fairly implemented.

3) **Agricultural Runoff Management**. Agricultural runoff is the largest contributor of nutrient inputs to Lake Tomah. Agricultural nutrient inputs can be minimized by managing soil phosphorus levels to optimum levels for crop production, using conservation practices which minimize stormwater runoff and soil erosion, and managing manure to minimize nutrient losses in stormwater runoff. The Monroe County Land Conservation Department will conduct a watershed assessment of all agricultural lands which are currently uninventoried to determine where nutrient and sediment inputs can be reduced. The WDNR will provide grant funding to the Monroe County Land Conservation Department through lake planning grants or an EPA 319 grant to conduct this inventory.

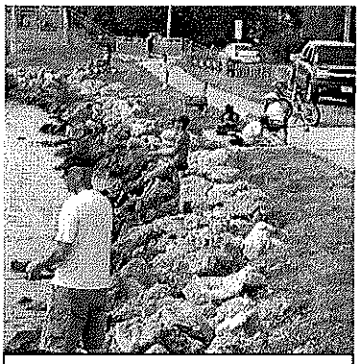
The Lake Tomah watershed is comprised mostly of agricultural land

4) **Sediment Trap Maintenance**. The maintenance of the sediment trap is critical to protect the lake from excessive sedimentation. The sediment trap controls approximately 70% of suspended sediment entering the lake from the watershed (Peterson 1997). The new lake map indicates that sediment trap is effectively trapping sediments from entering the lake. The City of Tomah and the Lake Committee will conduct annual inspections of the sediment trap. When the depth measured 200 feet in from the outlet of the sediment trap is 6.5 feet or less the sediment trap needs to be dredged (Peterson 1997). The City of Tomah is responsible for maintaining the sediment trap. The City has a operation and maintenance account to fund the dredging of the sediment trap. The sediment trapping efficiency would be enhanced by directing the inlet to the west end of the trap (Peterson 1997).

The City should consider this management activity the next time the sediment trap is dredged.

Goal III Protect and restore healthy stable lake and shoreland habitats.

Maintaining and restoring shoreland habitats and aquatic plant growth is critical to restoring the fishery and enhancing the wildlife and aquatic life of Lake Tomah. Aquatic plants provide the most important fishery and wildlife habitat in the lake. The goal of Lake Tomah is to restore aquatic plant growth to a depth of 3 feet, restore the islands in the south end of the lake and install 10 or more shore land buffers at private residences on the lake and restore eroding shorelines.



Riprap is a common shore protection practice

OBJECTIVES

1) **Drawdown.** Maintaining a partial drawdown of 3 feet in the summer of 2010 will stimulate the growth of emergent aquatic plants in the near shore area of the lake. Carp eradication and improving water clarity will be critical to enable aquatic plants to recolonize the lake. The lake level will be returned to 3 foot below normal lake level in the spring of 2010 and maintained at this level until mid to late summer when lake level will be restored to normal. DNR will conduct pre- and post-aquatic plant community surveys. The City of Tomah will operate the dam to insure the drawdown lake level is maintained.

2) **Island and Shoreland Buffer Restoration**. Restoring shoreland buffers and the islands will restore habitat for water dependent wildlife and natural beauty for lake users. The Lake Committee, Monroe County Land Conservation and WDNR will develop a shoreland buffer and island restoration plan in 2008. The City of Tomah will apply for a lake protection shoreland restoration grant by May 1, 2009. The island restoration and shoreline erosion restoration will be completed while the lake is drawn down in 2009 and 2010.

Goal IV Provide safe and enjoyable multifaceted recreational opportunities for all lake users.

Being on or near Lake Tomah is a favorite family and social activity for many lake users in the Tomah community. Recreational uses of the lake will continue to increase as population increases and lake improvements are achieved. Lake Tomah, the adjacent public parks and spaces will be managed to provide safe, enjoyable and accessible outdoor experiences for all who come to enjoy the lake.

OBJECTIVES

1) **Boating Ordinance**. The City of Tomah will adopt the currently proposed lake use ordinance in 2008. The ordinance will be the tool which will protect shallow water habitat and a no wake boating area on the south end of the lake. The ordinance will create a 97 acre no wake area. This no wake area will protect this critical shallow water habitat from disturbance from boating induced wave action which would resuspend bottom sediments and impair the growth of aquatic plants in shallow water habitats.

2) **Boat Launch Improvements**. DNR fisheries and regional construction staff have inspected the Lake Tomah boat launches and have estimated approximately $20,000 worth of maintenance work. Regional DNR Staff will pursue Department funding to upgrade the boat landings in fiscal year 2010-2012 with construction repair work scheduled during the lake drawdown.

3) **Handicap Pier Improvements**. The City of Tomah will apply for grant funds from the department of natural resources for repair and/or new construction of handicap fishing piers. Grant funds may be awarded for 100% cost-sharing, but projects with local contributions (50% or 75%) rank higher for funding consideration.

4) **Supplement Dam Inspection**. DNR Dam safety engineers will conduct a supplemental dam safety inspection during the partial drawdown and provide finding to the City.

Goal V Prevent the introduction and limit the expansion of aquatic invasive species.

Many families and lake users enjoy the fishery and natural beauty of Lake Tomah. The lake will be highly susceptible to be colonized by aquatic invasive species as natural populations of fish, aquatic plants and aquatic life recolonize the lake immediately after the restoration project. It is critical to prevent aquatic invasive species from colonizing the lake. An introduced aquatic invasive species would likely out compete native species and could prevent the lake restoration project from being successful.

OBJECTIVES

1) The Lake Committee and the City of Tomah will place educational signs that clearly identify the threats of aquatic invasive species and associated regulations at all boat launches. The signage will be in place by early 2010. The Lake Committee working with WDNR and UWEX will develop educational materials or newspaper articles explaining the importance of preventing aquatic invasive species from colonizing the lake. The WDNR will provide an aquatic invasive species grant to assist in paying for the signage and community educational materials. The City of Tomah and volunteer labor will be used for the 25% cost share portion of the grant.

2) The Lake Committee will become citizen lake monitors and begin to monitor the lake for aquatic invasive species especially zebra mussels, Eurasian water milfoil, and purple loosestrife. Monitoring will begin in 2010. WDNR will provide an aquatic invasive species grant to fund the monitoring and UWEX and WDNR will provide training and equipment to conduct the monitoring. The City of Tomah and volunteer labor will be used for the 25% cost share portion of the grant.

3) The Lake Committee will initiate a Clean Boats Clean Waters program for Lake Tomah in 2010. Boats and boat trailers are the most likely way the aquatic invasive species will be introduced into the lake. UWEX and WDNR will provide the training, equipment and grant monies to conduct the Clean Boats Clean Waters program. The City of Tomah will apply for an aquatic invasive species grant in 2009 to provide funding for the Clean Boats Clean Waters program, signage and educational materials and the invasive species monitoring program to begin in 2010.

Chapter
3

Information Analysis and Summary

Several studies, surveys and projects have been conducted to assess the health, condition and restoration potential of Lake Tomah. The Lake Committee completed a comprehensive community survey in 2007, water quality studies have been conducted from the mid 1970's to present, fishery assessments have been conducted since 2000, aquatic plant assessments where conducted in 1994, 1999, 2005 and 2006, watershed management was conducted from 1993 through 2003 and water quality modeling was conducted in 2008.

Lake Tomah Community Survey 2007

The Lake Committee surveyed the community of Tomah to assess the value of the lake to the community and the interest in committing to maintaining and improving the lake. Approximately 3200 surveys went out to the citizens of Tomah and the number returned was 1088 or 34%. This was considered a very good to excellent return. Seven questions were asked on the survey, which centered on usage of the lake, water quality, future status of the lake, and support of a restoration project. It would be safe to say that the community of Tomah showed concern for the lake and its future.

The first question asked about lake use and 53% of the respondents used the lake more than 3 times per year with 83% used the lake at least one time per year. The second question asked does the lake have value to the community as a resource and 65% felt the lake is a good to very good resource to the city while 35% feel it is fair to poor. The third question asked how residents see water quality in the lake and 80% see water quality as fair to poor and 20% feel water quality is good to very good. Question 4 asked those that had visited the lake in the past year how the felt water quality has changed in the past 5 years and 88% feel water quality has remained the same or worsened. The fifth question asked the community what they think will happen to the lake if the management of the lake remains the same and 60% felt the lake will worsen. Question 6 asked if making lake restoration improvements now will enhance the recreational opportunities for the future and 70% feel restoration management activities will improve the recreational uses of the lake. The seventh question asked the residents if they would support a restoration project to improve the fishery, water quality and recreational use that would involve a drawdown of the lake. The response was in favor by 2 to 1 or over 66%.

The survey indicated that Lake Tomah is a valuable community resource and the community supports continued stewardship of the lake to enhance its condition for recreational use.

Lake Tomah Priority Lake Project 1993 – 2003

The Lake Tomah 30 square mile (19,000 acre) watershed was designated as a "Priority Lake Project" in 1990 to be included the Wisconsin Nonpoint Source Water Pollution Abatement Program". The goal of the Priority Lake Project was to control sedimentation in Lake Tomah. Excessive erosion from stream banks, gullies and cropland had contributed large amounts of sediment to Lake Tomah. The "Nonpoint Source Control Plan for the Lake Tomah Priority Lake Project" was approved in 1993 and published in 1994 with the project being completed by 2003. The land owners of the Lake Tomah Watershed working with the technical assistance of the Monroe County Land Conservation Department and cost-sharing financial assistance from the State of Wisconsin were very successful in controlling watershed erosion. Cropland erosion achieved 147% of goal, stream bank/shoreline erosion achieved 177% of goal and gully erosion achieved 206% of goal all combined reduced soil erosion by 3,373 tons from the watershed. The project was also very successful in conducting the Information and Education component by working with land owners in the watershed to increase awareness

of nonpoint pollution issues. A very successful youth program was also conducted within the Tomah schools providing awareness of watershed management needs through field trips and activities utilizing Lake Tomah.

Lake Tomah Fishery

According to the Surface Water Resources of Monroe County, in 1969, the Lake Tomah fishery consisted of carp, northern pike, largemouth bass, yellow perch, bluegill, pumpkinseed and black crappie. At this time the water was characterized as turbid. Subsequent surveys in 1990, 1994, 1996 (creel), and 1998 showed all of the above species to be present with the addition of walleye, white sucker, bullhead, golden shiner and flathead catfish. During carp removal surveys in 2005 and 2006 fisheries crews observed few game fish of harvestable size. Estimated carp biomass is >80% of the total fish biomass in Lake Tomah.

Water Quality

The water quality of Tomah Lake has degraded over the last few decades and is considered to be poor to very poor. For the period 2005 – 2007, Average summer water clarity (measured with a Secchi Disk) was 1.3 feet (Figure 1), while the state water clarity standard for swimmable waterbodies is 3.0 feet. Algae blooms frequent Tomah Lake and the poor water clarity is partly a result of the high chlorophyll-a levels. Summer surface chlorophyll-a levels averaged 130 ug/l for the period of 2004 – 2007. Some improvement in chlorophyll-a levels were observed in 2007 and the average summer surface chlorophyll-a level was 40 ug/l (Figure 2). In general, chlorophyll-a levels greater than 20 or 25 ug/l can cause nuisance algae blooms and degraded water clarity.

Phosphorus Loading

Generally, for shallow lakes less than 10 feet deep, poor water quality and excessive algae blooms are caused by excessive phosphorus levels and suspended sediment caused by internal processes like wind resuspension or resuspension by carp. For the period of 2005 – 2007, surface water phosphorus levels observed in Tomah Lake ranged between 88 ug/l (micrograms/liter or ppb) and 286 ug/l, with a summer average of 161 ug/l and an annual average of 142 ug/l (Figure 3). For shallow lakes without excessive rough fish and with a healthy aquatic plant community, an ideal phosphorus level is less than 100 ug/l (Scheffer et al. 1993).

One source of phosphorus is internally generated phosphorus from the in-lake sediments. This phosphorus is released from the sediments by bio-chemical mechanisms and, more importantly in shallow lakes, resuspended by the activity of rough fish (carp) or wind. Another source of phosphorus is delivered to the lake from the watershed from both urban and agricultural land types. Other sources of phosphorus include atmosphere deposition and discharges from point sources (e.g. sewer treatment plant, industrial discharge). There are no point source dischargers upstream of Tomah Lake and atmospheric deposition is estimated to be very small percentage (> 1%). Nutrient runoff from the Lake

Tomah Watershed was evaluated in 1995 (Peterson 1997). This study found very high levels of nutrients being delivered to the lake from the watershed in stormwater runoff. Average stream runoff concentrations ranged from 100 ug/l in the winter to 655 ug/l in the summer. These levels are very high and are a major factor causing the high algae levels in the lake.

The estimated annual phosphorus load to Tomah Lake of approximately 12,000 lbs P/year was derived by using the observed in-lake phosphorus to back-calculate the annual phosphorus to the lake using a shallow lakes (Vollenweider, 1992) empirical model (WDNR 2007). The estimated external annual phosphorus load of approximately 9,900 lbs P/year was calculated using most-likely area loading rates for different land-use types within the watershed (Figure 4). Considering there was a priority watershed project and many cropland and barnyard best management practices were implemented within the watershed, the estimated external annual phosphorus load could be less. The external phosphorus load is 5,000 lbs P/year if based upon low area loading rates

The different of 2100 lbs P/year between the estimated total load and the estimated watershed load is attributed to internal loading primarily caused by carp and wind resuspension. If the watershed has successfully reduced the external phosphorus loading to low area loading rates, then the external load could be as low as 5,000 lbs P/yr and the internal load could be as high as 7,000 lbs P/year.

Percent reductions in the amount of phosphorus loaded from internal and external sources can be shown on a response curve (Figure 5). The graphs demonstrates three different senerios. The top line represents reductions in the annual phosphorus load if only the internal load is controlled by specific percentages. The middle line represents the reductions in the annual phosphorus load if only the external load is controlled and the line represents the most likely scenario of controlling 75% of the internal load combined with specific reductions in the external watershed load.

The projected reductions in annual phosphorus loads can be used to predict improvements in water quality indicators, that is phosphorus, secchi disk and chlorophyll-a (Figure 6). Based upon average conditions and a number of model assumptions, phosphorus levels are expected to improve between 10% and 50%; secchi disk readings between 40% and 60% and chlorophyll-a between 60% and 70%.

Aquatic Plants

Aquatic plants provide critical fishery, aquatic life and wildlife habitats in Lake Tomah. The dredging project completed in 1993 had a goal to sustain aquatic plant communities in the shallow areas of the lake especially in the southern and southwestern portion of the lake. Native aquatic plant communities provide food and cover for all life stages of sport fish and water dependent wildlife, improve water quality by stabilizing shorelines and lake bottoms, and resist colonization by invasive species. Aquatic plant studies were conducted by WDNR in 1994 (Borman 1996) and 1999 (Konkel 2000) in Lake Tomah.

The 1994 aquatic plant study was conducted to assess which types of aquatic plants and where plants would grow in the lake after completion of the dredging project in 1993. Aquatic plants successfully recolonized Lake Tomah in 1994. Nineteen species of aquatic plants were found commonly growing from 0 to 5 foot of depth with a maximum rooting depth of 6 feet. Aquatic plants were found a 45% of all sampling points. There were 7 emergent, 2 free-floating and 10 submergent species found in the lake. The distribution of aquatic plants was concentrated in the southern and southwestern portion of the lake. Many of the species found in 1994 provide valuable habitat for fish, aquatic life and wildlife (Borman 2000).

The aquatic plant community declined dramatically from 1994 to 1999 (Konkel 2000). The decline included loss of species diversity, decrease in frequency of vegetation, decrease in density of plants, and decrease in the distribution of aquatic plants. The maximum rooting depth decreased to a depth of 1 foot in 1999. Abundant carp were observed in the shallow areas of Lake Tomah during the 1999 aquatic plant survey (Konkel 2000).

Carp exclosure studies were conducted by the lake committee in the southern portion of Lake Tomah during 2005 and 2006. Small exclosures were constructed to exclude carp. The goal of the studies was to determine if aquatic plants would grow in shallow areas if carp were excluded. These studies found limited success as maintenance of the exclosures was found to be difficult due to weather and wave action.

Figure 1. Secchi Disk Readings from Tomah Lake

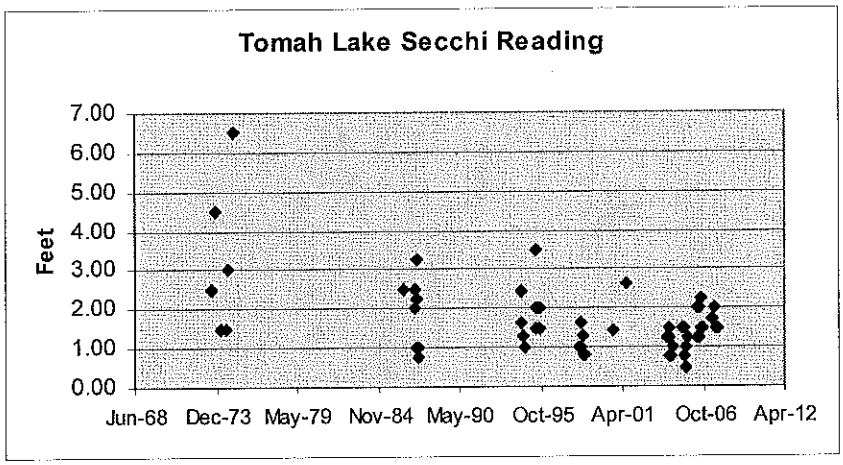


Figure 2. Chlorophyll-a Levels in Tomah Lake

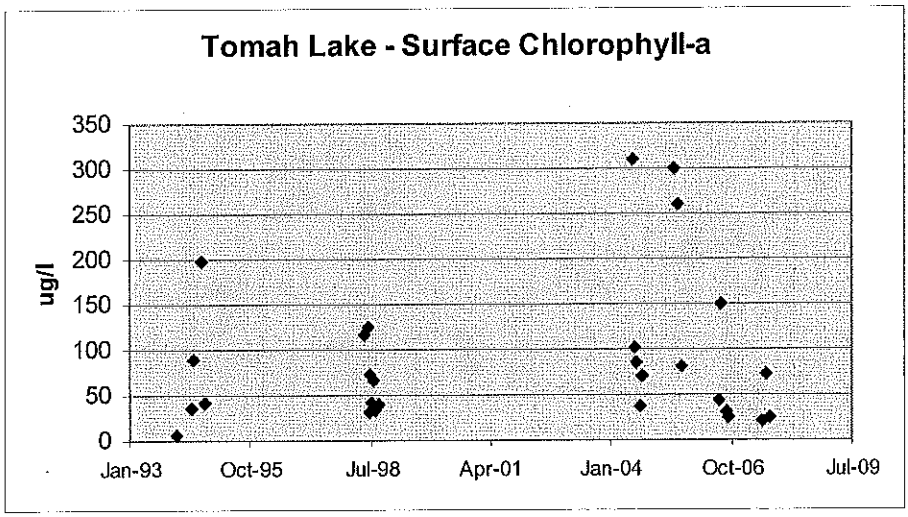


Figure 3. Surface Total Phosphorus Levels in Tomah Lake

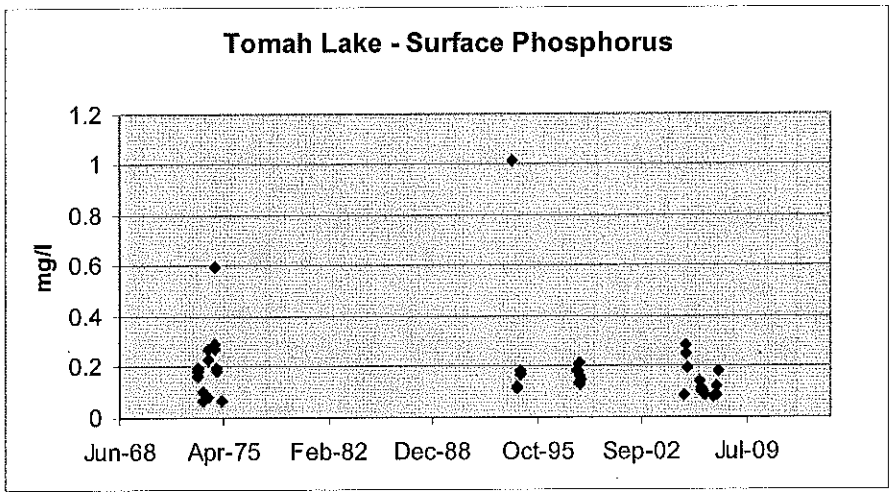


Figure 4. Landuse and Watershed Phosphorus Loading

Estimated Phosphorus Loading for the Lake Tomah Watershed				
Land Use Type [1]	Acres	Loading Rate (lbs/ac/yr)	Load (lbs/yr)	Percent of Total Load
Row Cropland	9392	0.89	8365	84.4
Mixed Cropland	427	0.71	304	3.1
Pasture/Grassland	808	0.27	216	2.2
High Density Urban	78	1.34	104	1.1
Middle Density Urban	0	0.45	0	0.0
Rural Residential	182	0.09	16	0.2
Wetlands	1050	0.09	94	1.0
Forest	5150	0.08	413	4.2
Transportation	734	0.45	327	3.3
Open Water	27	0.27	7	0.1
Lake Surface	245	0.27	65	0.7
Total	18093		9911	
(1) – From 1992 Wiscland Information				

Hydrologic and Morphometric Data for Lake Tomah		
Tributary Drainage Area	17850 acres	
Total Unit Runoff	8.00 inches/year	
Annual Runoff Volume	11,900 acre-ft	
Lake Surface Area	245 acre	
Lake Volume	1225 acre-ft	
Lake Mean Depth	5.0 feet	
Precipitation – Evaporation	2.0 inches/year	
Hydraulic Loading	11,941 acre-ft/year	
Area Water Load	48.7 ft/year	
Lake Flushing Rate	9.75 times/year	
Water Residence Time	0.10 year	

Figure 5. Phosphorus Load Response Estimates

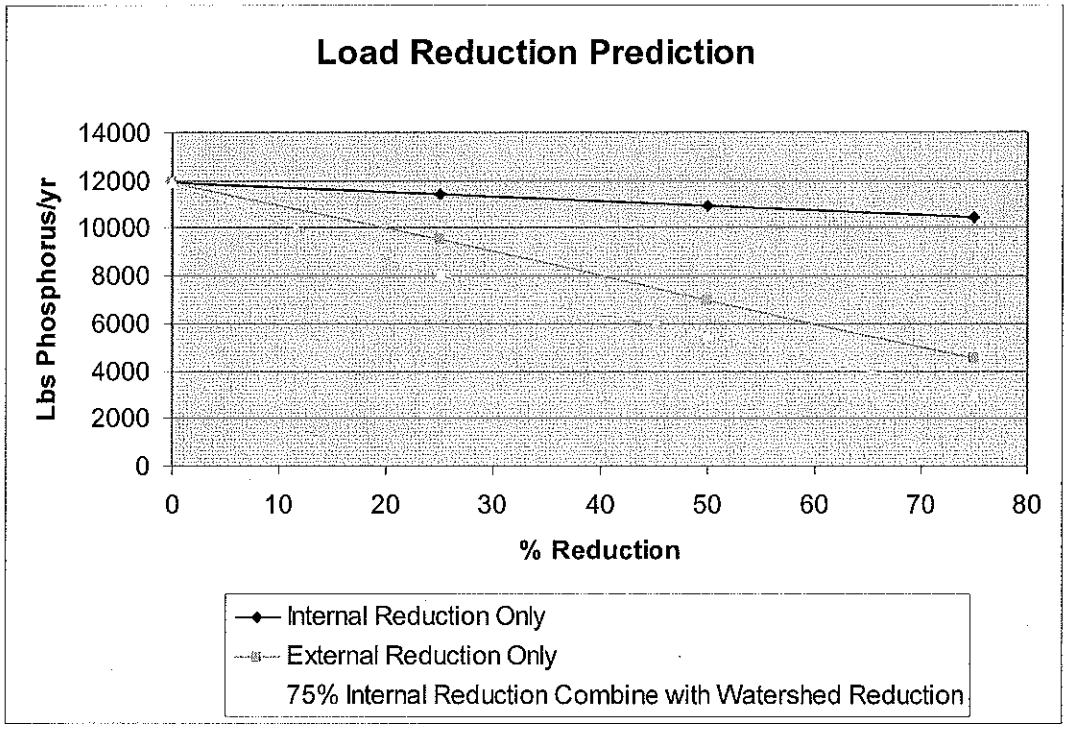
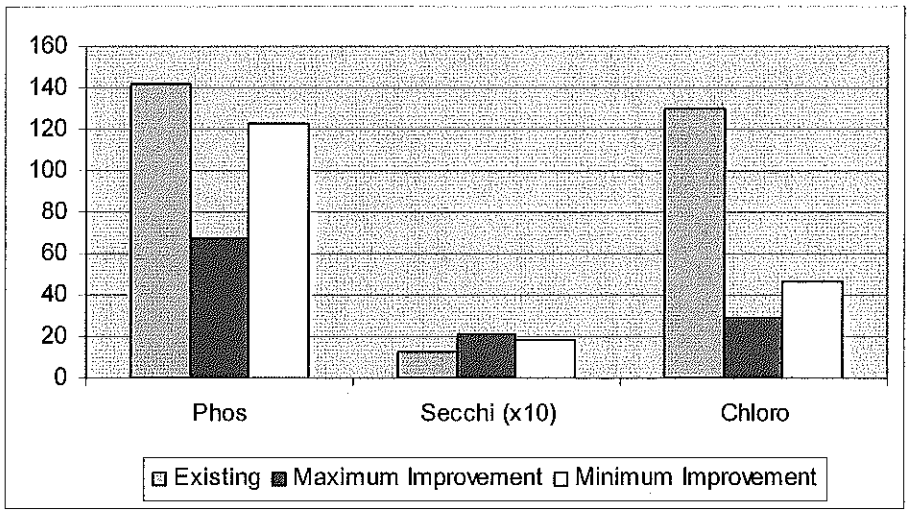


Figure 6. Estimated Responses in Water Quality



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