2003 SUMMARY REPORT
of
LAKE MILTMORE

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

Lake Miltmore, located in Lake Villa Township, is a glacial lake, created over 10,000 years ago by receding glaciers. Settlement of the land around the lake began in the 1830's, and included settlement by Aaron Miltmore, for whom the lake is named. After the construction of the Wisconsin Central Railway in 1877, summer cottages began popping up around the lake. Large-scale settlement began in the 1920's and continued through the 1940's. The Lake Miltmore Property Owner's Association was formed in the 1980's and still exists today. Lake Miltmore has a surface area of 84.4 acres and a mean depth of 9.6 feet. It has a very small watershed (220 acres) that is primarily residential. The lake can be used by the general public for swimming, boating and fishing and is managed by the property owner's association and Lake Villa Township.

Water quality parameters, such as nutrients, suspended solids, oxygen, temperature and water clarity were measured and the plant community was assessed each month from May-September 2003. Lake Miltmore was stratified from June-August. Total phosphorus (TP) concentrations were low throughout the summer, and the most likely source of phosphorus was internal loading and release from the sediment and decomposing plants. Total suspended solid (TSS) concentrations were also low, although the concentration increased each month. Water clarity was not as high as expected and decreased throughout the summer with an increase in TSS. The concentrations of many parameters in Lake Miltmore have changed only slightly in the past 5-10 years. This is exceptional, as it is unusual for a lake in Lake County, where residential and commercial land use is so prevalent, to maintain its TP, TSS and Secchi depth levels over that period of time.

Eurasian watermilfoil (EWM) dominated the plant community in 2003. However, including EWM, twelve different plant species were found in Lake Miltmore over the course of the summer. This relatively healthy plant community provided Lake Miltmore with low TP and TSS concentrations by reducing sediment resuspension in shallow areas and competed with planktonic algae for nutrients. The current herbicide program began in 2003 and will continue in 2004, when an expansion of the treatment area will likely occur. A fall/winter whole-lake treatment of fluridone is one possibility as a future treatment option. The milfoil weevil was stocked in Lake Miltmore in a very limited quantity, but did not have the desired effects and does not appear to be controlling the EWM at this time.

Approximately 83% of the Lake Miltmore shoreline consisted of residential parcels. However, 1/3 of the total shoreline was made up of wetland and buffer. These shoreline types should be maintained and buffer strips should be added to residential areas as much as possible. Although very little erosion was occurring around Lake Miltmore, Queen Anne's lace, buckthorn, purple loosestrife, chicory, multiflora rose and reed canary grass were present at 55% of the shoreline locations. These are exotic plant species that out-compete native vegetation and provide poor habitat for wildlife. A relatively large number of waterfowl and bird species were observed during the summer, despite the residential nature of the shoreline on Lake Miltmore.

LAKE IDENTIFICATION AND LOCATION

Lake Miltmore is located between Illinois State Route 132 (Grand Avenue) and Rollins Road in unincorporated Lake Villa Township (T 45N, R 10E, S 10, 11). Most of the homes on the lake remain on septic systems and residential subdivisions north and west of the lake (Venetian Village and West Miltmore) have been sources of untreated septic discharge to the lake in the recent past. Lake Miltmore has a surface area of 84.4 acres (GIS calculation) and mean and maximum depths of 9.6 feet and 21.0 feet, respectively. It has a volume of 798 acre-feet and a shoreline length of 1.62 miles (Figure 1, Appendix A). The watershed of Lake Miltmore encompasses approximately 220 acres, draining residential areas to the west and north.

The watershed to lake surface area ratio of 2.5:1 is very small and may help prevent serious water quality problems that often accompany a larger watershed to lake ratio (Figure 2). According to the most recent land use survey of the Lake Miltmore watershed, conducted in 2000, residential areas make up most of the watershed, with single family and transportation (roads) use encompassing 52% of the total area. Non-developed areas such as wetlands, pubic & private open space and forest & grasslands make up a small part of the watershed (10.5% combined). Water exits Lake Miltmore to the south and flows at a slight invert into Fourth Lake, although the two lakes are at the same elevation. The lake is located in the Mill Creek sub basin, within the Des Plaines River watershed.

BRIEF HISTORY OF LAKE MILTMORE

Lake Miltmore is of glacial origin, created over 10,000 years ago during the last ice age. Extensive historical information has been gathered by Norman Pischke, a 50-year resident of the lake, which records the first inhabitants, settlers and land owners in the area. In the early 1800’s, the area of Lake Villa was inhabited by the Potawatomi, Chippewa and Ottowa Indian tribes. These tribes were forced to move west of the Mississippi River by 1836. A treaty signed in 1829 had given them seven years to move, and no white men were permitted to settle their land until that time. However, white men and their families (mostly from the east coast) settled the land in 1834, before the treaty deadline. Aaron Miltmore settled in the area in 1839 and claimed 160 acres of land near the southwest corner of Fourth Lake (Rollins Road runs directly through the middle of Miltmore’s original property). Little to no residential settlement had occurred until the end of the 19th century. In 1877 the Wisconsin Central Railway was built and this opened the way for development. Lake Miltmore and other surrounding lakes became summer resort spots for city dwellers, and summer cottages began popping up around the lakes. In order to service the fishermen who flocked to the area, a boat launch was built on Lake Miltmore and a boathouse existed on Fourth Lake in the late 1800’s (Figure 3). At that time, Fourth Lake and Lake Miltmore were considered one in the same, with a distinct island separating the two. Large-scale settlement began in the 1920’s when J.B.

Williamson purchased the property now known as Venetian Village from Frank Fowler. The selling of lots on the north and east side of Lake Miltmore was not a successful

venture for Mr. Williamson, and when the Depression hit, building was at a standstill. In 1940, Mr. Williamson assigned N.H. Engle and Sons to sell the property for development. They were successful and homes began popping up (Figure 4). In 1940, the Venetian Village Civic Association (formerly the Venetian Village Protective Association, formed in 1928) was accepted officially by the state. They had the responsibility of maintaining the subdivision (roads, beaches, stormwater) until 1960, when the Lake Villa Township Road Commissioner took over road maintenance. After WWII, Mort Engle continued to expand Venetian Village to the west part of the lake. In 1952, this new part of the subdivision was named West Miltmore and a homeowner's association was formed. The Lake Miltmore Property Owner's Association (LMPOA) was formed in 1980 out of concern for the lake's deteriorating quality and still exists today. Lake Miltmore is managed by LMPOA and Lake Villa Township (which owns the entire lake bottom). Management is funded by key sales for the Township boat launch, which brings in approximately $3,000 per year. The township has provided additional funding in the past for special projects.

SUMMARY OF CURRENT AND HISTORICAL LAKE USES

Detailed records of historical lake management techniques on Lake Miltmore are limited. The control of Eurasian watermilfoil (EWM) has been at the forefront of management practices in recent years. A weed cutter was used for many years to open up areas for navigation. This method of plant control is a poor one, as the cutter actually promotes the spread of plants like EWM, which can colonize a new area of the lake through plant fragments. The cutter has not been used since the early to mid-90's. An attempt to control EWM with the milfoil weevil was made in 1998 and 1999, but did not yield sufficient results. Most recently, in 2003, 2,4-D herbicide spot treatments are being conducted to reduce the EWM density in front of the homes along the west side of the lake and some areas on the north end of the lake. Currently, access to Lake Miltmore is open to the general public through North Township Beach, Fourth Lake Resort and the Lake Villa Township Boat Launch (with the purchase of a key). Lake Miltmore Property Owner's Association (LMPOA) members have access to the lake through the three above-mentioned points, as well as through the West Township Beach (Figure 5).

Licensed beaches on Lake Miltmore (West Township Beach and Fourth Lake Resort) were sampled every two weeks by the Lake County Health Department to test for the presence of high *E. coli* counts. *E. coli* bacteria is found virtually everywhere, but is in very high numbers in the feces of warm-blooded animals, including humans. While most strains of *E. coli* are not harmful, the bacteria may indicate the presence of other pathogens such as *Giardia*, which can cause serious illness in humans. On June 26th, 1999, West Township Beach was closed after 26 individuals reported viral symptoms such as diarrhea and vomiting after swimming at the beach on June 24th. On June 29th, 1999 our staff found a small seep indicative of potential septic failure at the south end of the beach. By September 18th, 2000, 30 septic failures had been documented in the Lake

Miltmore area and the beach had remained closed for the rest of 1999 and all of 2000. As of August 5th, 2002, over 109 septic failures had been documented, and by the end of

2002, over 140 failures had been documented within the Lake Miltmore watershed. Currently, 70 have been repaired. The remaining failures continued to impact the beach during wet weather events, but not during dry weather. On August 5th, 2002, the Health Department revised their beach closure order for West Township Beach by allowing the beach to be open during dry weather, with the agreement that it must be immediately closed for a minimum of 48 hours after any quantity of precipitation.

In 2003, West Township Beach was closed once on August 12th. The high count is not believed to be rain related, as it had not rained since August 6th, and could have been caused by other things, including a large number of waterfowl or high wind and wave events. The presence of a high density of waterfowl in the vicinity of the beach area could cause problems because their feces contain *E. coli*. When these feces make their way into the water, they can raise *E. coli* counts. Wind events can increase *E. coli* counts because as waves wash up on the beach, they resuspend sand and sediment, which can contain a large number of *E. coli*. The *E. coli* are resuspended into the water column and can lead to elevated levels. The cause of the beach closing at West Township Beach is not known. However, despite the high concentration on August 12th, *E. coli* contamination does not appear to be a serious problem on Lake Miltmore beaches, as long as the agreement to close this particular beach after rain events is followed.

The lake's main uses are boating, swimming and fishing. Currently, the biggest management concerns expressed by the LMPOA are the growth of EWM, the poor quality fishery and needed improvements of the beaches and boat launches.

LIMNOLOGICAL DATA – WATER QUALITY

Water samples collected from Lake Miltmore were analyzed for a variety of water quality parameters (See Appendix B for methodology). Samples were collected at 3 foot and 16-17 foot depths (depending on site water depth) from the deep hole location in the lake (Figure 5). Lake Miltmore was thermally stratified from June-August. Thermal stratification occurs when a lake divides into an upper, warm water layer (epilimnion) and a lower, cold water layer (hypolimnion). When stratified, the epilimnetic and hypolimnetic waters do not mix, and the hypolimnion typically becomes anoxic (dissolved oxygen (DO) = 0 mg/l) by mid-summer. This phenomenon is a natural occurrence in Lake Miltmore and is not necessarily a bad thing if enough of the lake volume remains oxygenated. The surface waters of Lake Miltmore remained well oxygenated during the summer. Near surface DO concentrations remained above 5.0 mg/l (a level below which some aquatic organisms become stressed) for the entire summer. The lake became anoxic at depths below 16 feet in June and below 12 feet in July and August. Although a quality bathymetric map, created by us in 1987, does exist for Lake Miltmore, morphometric data for the lake is not available. As a result, the volume of water that remains oxygenated during the summer could not be calculated.

However, it does not appear that low oxygen concentrations posed a threat to aquatic life in the lake.

Phosphorus is a nutrient that can enter lakes through runoff or be released from lake sediment, and high levels of phosphorus typically cause algal blooms or produce high plant density. The 2003 average epilimnetic phosphorus concentration in Lake Miltmore was 0.028 mg/l (half of the Lake County median total phosphorus (TP) concentration of 0.054), while the average hypolimnetic phosphorus concentration was 0.054 mg/l (less than one third of the county median value of 0.186 mg/l)(Table 1, Appendix A). The hypolimnetic phosphorus concentration in 2003 was two times higher than the epilimnetic concentration. This is typical in a stratified lake, and the difference may be even more pronounced if stratification begins early in the summer. During stratification, oxygen is depleted in the hypolimnion, triggering chemical reactions at the sediment surface. These reactions result in the release of phosphorus from the sediment into the water column, and are known as internal loading. Typically, the hypolimnion is thermally isolated from the epilimnion during the summer and phosphorus builds up in the bottom waters, reaching the sunlit surface waters only during fall turnover. At this time, all of the hypolimnetic phosphorus is distributed throughout the water column. If the lake volume is large, the TP concentration will be diluted. However, even after dilution, the increase in phosphorus to the epilimnion can produce late season algae blooms. Because Lake Miltmore did not stratify until June and turned over prior to September sampling, the buildup of phosphorus in the hypolimnion was not high. Additionally, dilution of the hypolimnetic water throughout the water column appeared to prevent a large surge of phosphorus to the epilimnion and subsequent algae bloom (Table 1, Appendix A).

The average epilimnetic phosphorus concentration in 1999 (0.017 mg/l) was 40% lower than the 2003 concentration (Table 1, Appendix A). This appears to be the result of seasonal differences in the set up and breakdown of thermal stratification. Lake Miltmore was strongly stratified from May-July, 1999. TP concentrations in the epilimnion were very low during these months and the concentration was even below detection in July. However, in August 1999, the lake turned over and TP concentrations in the epilimnion rose slightly in August and September. With turnover in August, the hypolimnetic TP concentration decreased dramatically from the previous three months and then rose again in September when thermal stratification weakly occurred in the lake (Table 1, Appendix A). As a result of the unusual pattern of thermal stratification in 1999, TP concentrations were exceptionally low in both the epilimnion and the hypolimnion. It is noteworthy that the 1995 epilimnetic TP concentration was 0.024 mg/l and the hypolimnetic TP concentration was 0.039 mg/l (very similar to 2003). It is very unusual for a lake in Lake County, where residential and commercial development is so prevalent and has had detrimental impacts on many lakes, to maintain its epilimnetic and hypolimnetic TP levels over the course of 9 years. The glacial origin and deep morphometry of Lake Miltmore, as well as the small size of its watershed, is certainly contributing to this stability. However, the efforts to protect the lake ecosystem as much as possible by properly conducting herbicide treatment of the plant community and, to some degree, protecting the lake from over-development is an important factor in maintaining nutrient and suspended solid concentrations.

Total suspended solids (TSS) is a measure of the amount of suspended material, such as algae or sediment, in the water column. High TSS values are typically correlated with poor water clarity and can be detrimental to many aspects of the lake ecosystem, including the plant and fish communities. A large amount of material in the water column can inhibit successful predation by sight-feeding fish, such as bass and pike, or settle out and smother fish eggs. High turbidity caused by sediment or algae can shade out native aquatic plants, resulting in their reduction or disappearance from the littoral zone. This eliminates the benefits provided by plants, such as habitat for many fish species and stabilization of the lake bottom. The average 2003 epilimnetic TSS concentration in Lake Miltmore (4.7 mg/l) was below the median value for Lake County Lakes (7.5 mg/l). However, TSS concentrations increased each month to a high of 6.4 mg/l in September. While it is not entirely clear why TSS increased throughout the summer, the death and decomposition of EWM plants as a result of an herbicide treatment in June may be one source. Strong relationships did not exist between TSS and TP or TSS and total volatile solids (TVS, a measure of organic matter, such as algae, in the water column). This indicates that although some of the TSS was made up of decomposing plant material, the source of TSS in Lake Miltmore is primarily sediment. This is further supported by noting that the non-volatile suspended solids (NVSS-measure of inorganic matter such as sediment or soil particles) concentration made up 77% of TSS.

The average epilimnetic TSS concentration (4.7 mg/l) has increased by 42% when compared to 1999 (3.3 mg/l) (Table 1, Appendix A). This difference may be the result of several variables, including the difference in thermal stratification between the two years, a difference in plant density, which can cause an increase or decrease in resuspended sediment and decomposing plant material, or a difference in the frequency and density of boat traffic, which can stir up sediment in shallower areas of the lake. Additionally, as with TP, the TSS in 1995 (4.2 mg/L) was very similar to the 2003 concentration, indicating that Lake Miltmore has remained very stable and has not been substantially impacted by EWM management or activities in the watershed over the past decade.

Despite the relatively low TP concentrations throughout the summer, Secchi depth (water clarity) of Lake Miltmore was only slightly higher than the county median (3.41 feet) nearly every month during the summer of 2003 (slightly lower in September) (Table 1, Appendix A). Secchi depth decreased each month from May-September in accordance with an increase every month in TSS (Figure 6). The higher water clarity in May and June allowed a relatively healthy plant community to grow in Lake Miltmore and helped to prevent algae dominance. A higher average Secchi depth coincided with a lower average TSS concentration in 1999. Differences in Secchi depth from year to year can also result from differences in rainfall amounts, external phosphorus loading, plant density or water temperature (which affects algae growth).

Having accurate and consistent historical data is very important. This can be achieved through the Volunteer Lake Monitoring Program (VLMP). This Illinois Environmental Protection Agency (IEPA) program, organized and run by the Northeastern Illinois Planning Commission (NIPC), involves the collection of water quality data by a volunteer in the same sampling location and along the same time frame each year. Although the amount of data collected is often limited, it can provide valuable historical information on water clarity and, therefore, water quality on many Lake County lakes. This is especially true for a lake like Lake Miltmore. The water quality is currently very good and any changes in water clarity and quality that may occur from changes in the lake or watershed in the future can be tracked over time and can give early warning of problems. We may not perform a full water quality study on Lake Miltmore again until 2008. Having a quality VLMP in place in the meantime can help provide valuable information to lake managers who may be able to take action on certain issues before they become irreversible problems. VLMP data can also be used to give accurate historical data about the lake, water quality and management activities so that changes in different variables can be more readily and accurately explained.

Conductivity is the measure of different chemical ions in solution. As the concentration of these ions increases, conductivity increases. The conductivity of a lake is dependent on the lake and watershed geology, the size of the watershed flowing into the lake, the land uses within that watershed, evaporation and bacterial activity. Conductivity has been shown to be highly correlated (in urban areas) with chloride ions found in road salt mixtures. Water bodies most subject to the impacts of road salts are streams, wetlands or lakes draining major roadways and large parking lots. Average 2003 epilimnetic conductivity (0.9461 mS/cm) in Lake Miltmore had increased by 12% since sampling in 1999 when the epilimnetic average was 0.8434 mS/cm. The 2003 conductivities were also much higher than the county median (0.7503 mS/cm) throughout the summer. Epilimnetic total dissolved solids (TDS) concentrations, which have also been shown to be correlated with conductivity, were also above the county median (451 mg/l) during every month of the study (Table 1, Appendix A).

Conductivity changes can occur seasonally and even with depth, but over the long term, increased conductivity levels can be a good indicator of potential watershed or lake problems and an increase in pollutants entering the lake if the increasing trend is noted over a period of years. High conductivity levels (which often indicate an increase in sodium or potassium chloride) can eventually change the plant and algae community, as more salt tolerant plants and algae take over. Sodium, potassium and chloride ions can bind substances in the sediment, preventing their uptake by plants and reducing native plant densities. Additionally, juvenile aquatic organisms may be more susceptible to high chloride concentrations. The increase in conductivity levels in Lake Miltmore is most likely the result of a potentially heavier winter salting of the residential roads surrounding the lake (roads make up approximately 13% of all land use in the watershed). The high conductivity levels are cause for concern, but there may not be much that can be done about it. Non-point runoff, such as that which picks up road salt and enters the lake during rain events, is very difficult to control and it is unlikely that any control could be placed on the amount of road salt dispersed along major roadways each winter without policy changes in quantity or type of de-icer by the Lake Villa Township Roads Commission.

Typically, lakes are either phosphorus (P) or nitrogen (N) limited. This means that one of these nutrients is in short supply relative to the other and that any addition of phosphorus or nitrogen to the lake might result in an increase of plant or algal growth. Other resources necessary for plant and algae growth include light or carbon, but these are typically not limiting. Most lakes in Lake County are phosphorus limited, but to compare the availability of nitrogen and phosphorus, a ratio of total nitrogen to total phosphorus (TN:TP) is used. Ratios less than or equal to 10:1 indicate nitrogen is limiting. Ratios greater than or equal to 15:1 indicate that phosphorus is limiting. Ratios greater than 10:1, but less than 15:1 indicate that there are enough of both nutrients to facilitate excess algal or plant growth. Lake Miltmore had a 2003 average TN:TP ratio of 46:1. This indicates that the lake is highly phosphorus limited and that a small increase in phosphorus concentrations in the epilimnion could result in algae blooms in the future. Although the average epilimnetic total Kjeldahl nitrogen (TKN) concentration was the same as the majority of the lakes in Lake County, high nitrogen concentrations relative to phosphorus concentrations resulted in this high ratio. In highly nutrient-enriched lakes, phosphorus levels have often reached the point where either very large increases or very large decreases in phosphorus would be necessary to trigger changes in algae density. On the other hand, less enriched lakes, such as Lake Miltmore, are typically more sensitive to increases or decreases in phosphorus, and algae could become a problem with relatively small increases in TP. The 1999 TN:TP ratio was 59:1 as a result of a much lower TP concentration. Care should be taken to ensure that the nutrient concentrations (especially phosphorus) continue to remain low so that algae does not become a problem in the future.

Phosphorus concentrations can also be used to indicate the trophic state (productivity level) of a lake. The Trophic State Index (TSI) uses phosphorus concentrations, chlorophyll *a* (algae biomass) levels and Secchi depth to classify and compare lake trophic states using just one value. The TSI is set up so that an increase in phosphorus concentration is related to an increase in algal biomass and a corresponding decrease in Secchi depth. A moderate TSI value (TSI ≥40<50) indicates mesotrophic conditions, typically characterized by relatively low nutrient concentrations, low algae biomass, adequate DO concentrations and relatively good water clarity. High TSI values indicate eutrophic (TSI ≥50<70) to hypereutrophic (TSI ≥70) lake conditions, typically characterized by high nutrient concentrations, high algal biomass, low DO levels, a rough fish population, and low water clarity. Lake Miltmore had an average phosphorus TSI (TSIp) value of 52, indicating slightly eutrophic conditions. Although the lake falls into the eutrophic category, it does not exhibit many of the characteristics of eutrophic lakes mentioned above. This is likely the result of a relatively healthy plant community. Plants compete with algae for resources and prevent sediment resuspension, both of which help reduce TP levels in the water column. Water quality on Lake Miltmore is well above average and the lake ranked 25th out of 130 lakes studied in Lake County since 1999. Besides the dense plant community present, this may also be partly due to its glacial origin. Most man-made lakes in this geographical area fall into the eutrophic and hypereutrophic categories, while many of the glacial lakes rank higher (Table 2, Appendix A).

Most of the water quality parameters just discussed can be used to analyze the water quality of Lake Miltmore based on use impairment indices established by the Illinois Environmental Protection Agency (IEPA). According to this index, Lake Miltmore provides *Full* support of aquatic life and swimming, and *Partial* support of recreational activities (such as boating) as a result of the plant coverage. The lake provides *Full* overall use.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

Aquatic plant surveys were conducted every month for the duration of the study (See Appendix B for methodology). Shoreline plants of interest were also recorded. However, no quantitative surveys were made of these shoreline plant species and these data are purely observational. Light level was measured at two-foot intervals from the water surface to the lake bottom. When light intensity falls below 1% of the level at the water surface, plants are no longer able to grow. Using this information, as well as a bathymetric map, the lake area that has the potential to support aquatic plant growth can be determined. Depth of the percent light intensity varied from 16 feet in June to 10 feet in September (Appendix C). Since no morphometric data for Lake Miltmore is available, it is not possible to calculate percent plant cover in this way. However, in 2003 GPS satellite readings were taken in mid-June to determine the area of plant coverage based on visual observation of those plants growing to within approximately two feet of the water surface. Based on GPS data, approximately 35% of the lake surface area was covered with plants growing near the water surface (Figure 7). Twelve different plant species were present in Lake Miltmore during the summer of 2003 (Tables 3 & 4). Only two of the 12 species (Eurasian watermilfoil (EWM) and curly leaf pondweed) are exotic species. Although EWM dominates, Lake Miltmore’s plant community is good with regard to diversity of species and types of species found. This kept water clarity from being very low by reducing sediment resuspension in the littoral zone and competing with planktonic algae for resources.

Table 3. Aquatic and shoreline plants on Lake Miltmore, May-September 2003.

Aquatic Plants	
Chara	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Water Stargrass	*Heteranthera dubia*
Eurasian Watermilfoil^	*Myriophyllum spicatum*
Slender Naiad	*Najas flexilis*
Spatterdock	*Nuphar variegata*
White Water Lily	*Nymphaea tuberosa*
Curlyleaf Pondweed^	*Potamogeton crispus*
Illinois Pondweed	*Potamogeton illinoensis*
White Water Crowfoot	*Ranunculus longirostris*
Sago Pondweed	*Stuckenia pectinatus*
Eel Grass	*Vallisneria Americana*
Shoreline Plants	
Giant Ragweed	*Ambrosia trifida*
Swamp Milkweed	*Asclepias incarnata*
Common Milkweed	*Asclepias syriaca*
Oval-crested sedge	*Carex* sp.
Chicory^	*Cichorium intybus*
Queen Anne's Lace^	*Daucus carota*
Purple Coneflower	*Echinacea purpurea*
Purple Loosestrife^	*Lythrum salicaria*
Reed Canary Grass^	*Phalaris arundinacea*
Multiflora Rose^	*Rosa multiflora*
Chairmakers' Rush	*Scirpus pungens*
Softstem Bulrush	*Scirpus validus*
Common Cattail	Typha latifolia
Trees/Shrubs	
Buttonbush	*Cephalanthus occidentalis*
Common Buckthorn^	*Rhamnus cathartica*
Sandbar Willow	*Salix interior*

^Exotic plant or tree species

As mentioned before, EWM was the dominant plant in the lake in 2003, occurring at 62% of the plant sampling sites throughout the summer. This exotic plant species invaded Lake Miltmore many years ago and has been a dominant species in the plant community. In 1998, the LMPOA hired EnviroScience, Inc. to stock the milfoil weevil (*Euhrychiopsis lecontei*) in the lake. This very tiny insect serves as a biological control for EWM, and when present in large enough numbers, can cause significant damage to milfoil beds. It is not intended to eradicate the milfoil from a lake, but rather, to reduce the density to manageable levels. In 1998, 3,000 weevils were stocked in the EWM bed

in the center of the lake. The EWM beds on the north and south ends served as monitoring sites. By the end of the summer, the weevil population had increased and many EWM stems had been damaged. Four thousand more weevils were stocked in the same site in 1999. Quantitative analysis of the stocked site in June 1999 revealed that the weevils had successfully overwintered to some degree and were causing some damage to the EWM beds. By August 1999, weevil density had not increased in the stocked site, but plants were heavily damaged and the bed was narrower in size. A final survey was conducted in August 2000. Weevil density had decreased in the north monitoring site and in the stocked site from 1999 and very little weevil damage was observed in the stocked site, indicating that overwintering may not have been successful from 1999 to 2000. However, the plant density in the stocked plant bed was much more sparse than it had been the year before. The reasons for weevil success or failure in controlling EWM are still being researched and there are no definite answers at this time. Research has shown that approximately 1-2 weevils per stem are needed in order to see significant damage and decline of a EWM bed. Weevil density in Lake Miltmore never reached this level during the EnviroScience surveys. No weevil population survey has been conducted since 2000. Herbicide treatments can negatively impact the weevil population by destroying the EWM and forcing the weevils to search out healthy, newer stems. It is possible that in the future, the weevil population may increase in some areas that are not being treated, and these areas should be monitored and protected. But, at this time, the milfoil weevil stocking program does not appear to be successful.

One of the main concerns of Lake Miltmore residents is aquatic plant density in the lake, especially that of EWM. In 2003, the first known chemical treatment of EWM was carried out by Lake Villa Township. Eight hundred pounds of 2,4-D were used to treat approximately seven acres of EWM, coontail and curly leaf pondweed in June, (Figure 7). Due to the late timing of the application, treatment of EWM was not as effective as it could have been. Some plants did die back in the treatment areas, but other plants were left standing late into the season and continued to cause navigational problems. If the treatment had been conducted earlier in the spring, more of the plants may have been impacted and dropped to the lake bottom by late June, when boating and fishing was becoming more regular on the lake. In addition to the weevil stockings in 1998 and 1999, a weed cutter has also been used in the past to manage plant density in the lake. The use of this cutter was strongly discouraged by the Lakes Management Unit because it was not collecting the plants as it cut them (in the way current harvesters work). As a result, the cutter probably contributed to the spread of EWM throughout the lake, as the plant can become re-established in different areas of the lake through plant fragments created by the cutter.

Two options with regard to herbicide treatment are possible. Although spot treatment of plants in Lake Miltmore with 2,4-D (Navigate®) had some success in 2003, one option is that this method of plant treatment be continued. The treatment was most likely not as successful in 2003 because of a delay in the herbicide application. The most effective time to apply 2,4-D is in late spring, when water temperature has reached 60 degrees Fahrenheit and plant growth has not reached its peak. Plants will take up the herbicide quickly and begin to die back. Because there is not as much plant material at this time of the year, plants will typically fall to the lake bottom and begin decomposing within a week, freeing up the water column for recreational activities. It is recommended that herbicide treatment in Lake Miltmore be carried out in late spring 2004. The 2003 treatment area was approximately seven acres. Several homeowners on the southwest side of the lake felt that the treatment area should have extended farther south along the west shore to free up the areas in front of their docks. Lake Villa Township and the LMPOA should correspond regarding the size and location of the 2004 treatment area so the application can be to the satisfaction of as many people as possible. Regardless of where the treatment is carried out, as the size of the treatment area increases, the application of 2,4-D will become more expensive. If an additional two acres south of West Township Beach are treated, the cost of 2,4-D for 2004 will be $2,500 plus labor.

The other option is to conduct a fall/winter treatment or a low-concentration spring treatment using fluridone, which is sold under the brand names Sonar® or Avast®. Because the density and diversity of native aquatic plants was relatively high, it is very likely that these plants would grow and compete with EWM if given the opportunity (this was actually observed in 2003 on the east shore, where Illinois pondweed held back the expansion of EWM until August). EWM is one of the only aquatic plants that can survive during cold conditions and it is often seen growing under the ice during the winter. This gives it the advantage of already being established in the spring, and it can take over a lake very early in the season before the native plants have a chance to become established. A fall/winter fluridone treatment would kill the EWM before the spring, giving the native plants an opportunity to grow. By the time and if the EWM recovers, it will be competing with native plants for space and light, and will likely not reach nuisance levels throughout the summer. A healthy native plant community will likely improve the health of the fish community, which is not in very good condition at this time. The exact cost of this treatment cannot be determined without creating a new bathymetric (depth) map with morphometric data, which enables an applicator to calculate accurate concentrations. Water volume is essential for any fluridone treatment, as it is a whole lake treatment and overdosing can very easily occur without proper calculations. A bathymetric map created by our unit in 1987 does exist, but a new map is desirous. It is recommended that Lake Villa Township find the funding to have a bathymetric map created. If the current lake volume (based on the 1987 map) is used, the cost of a fluridone treatment would be $7,780, plus labor. However, it is very possible that Lake Miltmore could get two year EWM control with this treatment, bringing the annual cost to $3,890 for fluridone product.

Of the sixteen emergent plant and trees species observed along the shoreline of Lake Miltmore, six (Queen Anne's lace, purple loosestrife, reed canary grass, chicory, multiflora rose and buckthorn) are invasive species that do not provide ideal wildlife habitat and have the potential to dominate the emergent plant community. Their removal is always recommended.

FQI (Floristic Quality Index) is a rapid assessment tool designed to evaluate the closeness of the flora of an area to that of undisturbed conditions. It can be used to: 1) identify natural areas, 2) compare the quality of different sites or different locations within a single site, 3) monitor long-term floristic trends, and 4) monitor habitat restoration efforts (Nichols, 1999). Each floating or submersed aquatic plant is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). An FQI is calculated by multiplying the average of these numbers by the square root of the number of these plant species found in the lake. A high FQI number indicates that there are a large number of sensitive, high quality plant species present in the lake. Non-native species were also included in the FQI calculations for Lake County lakes. The average FQI for 2000-2003 Lake County lakes is 14.7. Lake Miltmore has an FQI of 18.4, the 33rd highest of all county lakes studied since 2000. Despite the dominance by EWM, the diversity of plant species places Lake Miltmore slightly above the average lake, by Lake County standards.

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted at Lake Miltmore on July 28, 2003. The shoreline was assessed for a variety of criteria (See Appendix B for methods), and based on this assessment, several important generalizations could be made. Approximately 83% of Lake Miltmore's shoreline is developed and the majority of the developed shoreline is comprised of seawall (27%), buffer (20%) and beach (19%) (Figure 8). The remainder of the developed shoreline consists of rip rap (9%), manicured lawn (6.5%) and shrub (1%). The undeveloped portions of the lake are made up of wetland and shrub. Seawall is not an ideal shoreline type unless used solely for erosion control. Seawalls do not provide any wildlife habitat and can often increase sediment resuspension as waves are reflected back into the lake by the seawall. Although rip rap is also not an ideal shoreline type with regard to wildlife habitat, it can also help to prevent shoreline erosion. Beaches will always erode into the water. This can change the composition of the bottom sediment in these areas and effect plant density and species type, as well as the aquatic organisms that utilize the area. Wetland and buffer are the most desirable shoreline types, providing wildlife habitat and, typically, protecting the shore from excessive erosion. The relatively high percentage of wetland (12.8%) and buffer shoreline along Lake Miltmore (combined, the shoreline types make up 1/3 of the total shoreline) is very encouraging, especially on such a highly residential lake. These areas should be protected from new development or degradation of any kind. As a result of the dominance of seawall, buffer and wetland shorelines, 97.8% of Lake Miltmore's shoreline exhibited no erosion. Slight to moderate erosion was occurring along beaches. Slight erosion occurred along manicured lawns, and a small area of seawalled shoreline was exhibiting moderate erosion. Wetland and buffer shorelines should be maintained or added as much as possible, and the addition of manicured lawns, seawalls and rip rap should be discouraged.

Although almost no erosion was occurring around Lake Miltmore, invasive plant species, including Queen Anne's lace, purple loosestrife, reed canary grass, chicory, multiflora rose and buckthorn were present along 55% of the shoreline. These plants are invasive and exclude native plants from the areas they inhabit. Buckthorn provides very poor shoreline stabilization and may lead to increasing erosion problems along already eroded

shoreline in the future. Reed canary grass and purple loosestrife inhabit mostly wetland areas and can easily outcompete native plants. Additionally, they do not provide the quality wildlife habitat or shoreline stabilization that native plants provide. Although most of the exotic plant occurrences were along non-developed wetland and buffered shoreline, many of the areas occurred along buffer and seawalled shorelines on residential property (Figure 9). Steps to eliminate these plants should be carried out by homeowners in order to improve the wildlife habitat and overall aesthetics of Lake Miltmore.

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

The Illinois Department of Natural Resources (IDNR) first conducted a fish survey on Lake Miltmore in 1966. Subsequent surveys include collection through electroshocking, gill nets and trap nets and occurred 1974 and 1995. In 1997, the IDNR investigated a large black crappie die-off on the lake. It appeared that the fish kill was the result of a species-specific blood parasite and did not affect any other fish species. In 1974, 165 fish comprising 13 species were collected. Common carp and yellow bass dominated the fish community, which was not healthy. Small sunfish species (bluegill, crappie), as well as largemouth bass and northern pike were collected in lesser numbers. In 1995, 155 fish were collected comprising 14 species. Similar to 1974 results, bluegill, yellow bass and common carp dominated the fish community. Largemouth bass were still found in small numbers, as were northern pike. We conducted a limited fish survey utilizing a bag seine on July 2, 2003 in order to determine if any state threatened or endangered fish species were present in Lake Miltmore. None were collected, but a total of 101 fish, comprising 12 species were sampled during the survey. The most dominant was bluegill, followed by largemouth bass, redear sunfish and bluntnose minnow. Other species present included brook silversides, green sunfish, Johnny darter, lake chubsucker, pumpkinseed, warmouth and yellow perch. It is recommended that another IDNR fish survey be conducted in 2004.

Wildlife observations were made on a monthly basis during water quality and plant sampling activities (See Appendix B for methodology). Because the moderate abundance of wildlife habitat in the form of wetland and buffer areas was relatively high around Lake Miltmore, a relatively large number of wildlife species were observed, including the state endangered osprey (non-nesting) (Table 5). Considering that Lake Miltmore is a highly developed lake, the number of wildlife species is encouraging. The maintenance of wetland and buffered shorelines and the establishment of additional buffer strips (especially along the shoreline of developed areas) is very important and strongly recommended to continue to provide the appropriate habitat for birds and other animals in the future.

Table 5. Wildlife species observed at Lake Miltmore, May – September 2003.

Birds	
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhnchos*
Wood Duck	*Aix sponsa*
Great Blue Heron	*Ardea herodias*
Osprey*	*Pandion haliaetus*
Common Flicker	*Colaptes auratus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Downy Woodpecker	*Picoides pubescens*
Barn Swallow	*Hirundo rustica*
Tree Swallow	*Iridoprocne bicolor*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
White-breasted Nuthatch	*Sitta carolinensis*
Marsh Wren	*Cistothorus palustris*
American Robin	*Turdus migratorius*
Cedar Waxwing	*Bombycilla cedrorum*
Red-eyed Vireo	*Vireo olivaceus*
Warbling Vireo	*Vireo gilvus*
Yellow-throated Vireo	*Vireo flavifrons*
Yellow Warbler	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Red-winged Blackbird	*Agelaius phoeniceus*
Starling	*Sturnus vulgaris*
Northern Oriole	*Icterus galbula*
House Sparrow	*Passer domesticus*
Northern Cardinal	*Cardinalis cardinalis*
American Goldfinch	*Carduelis tristis*
Chipping Sparrow	*Spizella passerina*
Swamp Sparrow	*Melospiza georgiana*
Song Sparrow	*Melospiza melodia*
Amphibians	
American Toad	*Bufo americanus*
Green Frog	*Rana clamitans melanota*

*Endangered in Illinois

EXISTING LAKE QUALITY PROBLEMS

- *Lack of a Quality Bathymetric Map*

A bathymetric (depth contour) map is an essential tool in effective lake management, especially if the long term lake management plan a fluridone application. Lake Miltmore currently has a bathymetric map, created by our unit in 1987. However, morphometric data associated with that map does not exist. In the past 14 years, technology has improved dramatically and a map created now would be much more accurate and would include the morphometric data necessary to calculate lake volume.

- *Lack of Participation in the Volunteer Lake Monitoring Program (VLMP)*

In 1981, the Illinois Volunteer Lake Monitoring Program (VLMP) was established by the Illinois Environmental Protection agency (Illinois EPA) to gather fundamental information on Illinois inland lakes, and to provide an educational program for citizens. Annually, approximately 165 lakes (out of 3,041 lakes in Illinois) are sampled by approximately 300 citizen volunteers. The volunteers are primarily lake shore residents, lake owners/managers, members of environmental groups, public water supply personnel, and citizens with interest in a particular lake. Lake Miltmore does not currently participate in the VLMP. The relatively high water quality of Lake Miltmore makes the existence of a consistent VLMP on the lake even more important. This will enable a water quality history beyond our data to be developed and tracked as time goes on and more development occurs.

- *Invasive Shoreline Plant Species*

Numerous exotic plant species have been introduced into our local ecosystems. Some of these plants are aggressive, quickly out-competing native vegetation and flourishing in an environment where few natural predators exist. The outcome is a loss of plant and animal diversity. Buckthorn and honeysuckle are aggressive shrub species that grow along lake shorelines as well as most upland habitats. They shade out other plants and are quick to become established on disturbed soils. Reed canary grass and common reed are present in wetland areas and can very quickly outcompete cattails and other native wetland plants. Honeysuckle, buckthorn, purple loosestife, Canada thistle, common reed and reed canary grass are present along 60% of the shoreline of Lake Miltmore and attempts should be made to control their spread.

- *Limited Wildlife Habitat*

Although a relatively large amount of shoreline is dominated by wetland and woodland, much of Lake Miltmore's shoreline is dominated by residential homes, which do not always encourage a diverse bird and animal community. Several of the residents along Lake Miltmore already have buffer strips in place along their shoreline property. However, many of the residents also have seawalls and beaches along their shoreline. It is recommended for residents that already have buffer to consider widening their strips to a width of at least 20 feet, and residents that do not have a buffer strip to consider planting 10-20 feet of native plants along their shoreline.

POTENTIAL OBJECTIVES FOR THE LAKE MILTMORE MANAGEMENT PLAN

I. Create a Bathymetric Map, Including a Morphometric Table
II. Participation in the Volunteer Lake Monitoring Program
II. Eliminate or Control Exotic Species
IV. Enhance Wildlife Habitat Conditions
V. Conduct a Fisheries Assessment

Objective I: Create a Bathymetric Map Including a Morphometric Table

A bathymetric (depth contour) map is an essential tool for effective lake management since it provides critical information about the physical features of the lake, such as depth, surface area, volume, etc. This information is particularly important when intensive management techniques (i.e., chemical treatments for plant or algae control, dredging, fish stocking, etc.) are part of the lake's overall management plan. Some bathymetric maps for lakes in Lake County do exist, but they are frequently old, outdated and do not accurately represent the current features of the lake. Lake Miltmore currently has a bathymetric map, but it lacks morphometric data that is essential in most calculations of volume, area and depth. Maps can be created by agencies like the Lake County Health Department - Lakes Management Unit or other companies. Costs vary, but can range from $3,000-10,000 depending on lake size.

Objective II: Participation in the Volunteer Lake Monitoring Program

In 1981, the Illinois Volunteer Lake Monitoring Program (VLMP) was established by the Illinois Environmental Protection agency (Illinois EPA) to gather fundamental information on Illinois inland lakes, and to provide an educational program for citizens. Annually, approximately 165 lakes (out of 3,041 lakes in Illinois) are sampled by approximately 300 citizen volunteers. The volunteers are primarily lakeshore residents, lake owners/managers, members of environmental groups, public water supply personnel, and citizens with interest in a particular lake.

The VLMP relies on volunteers to gather a variety of information on their chosen lake. The primary measurement is Secchi disk transparency or Secchi depth. Analysis of the Secchi disk measurement provides an indication of the general water quality condition of the lake, as well as the amount of usable habitat available for fish and other aquatic life.

Microscopic plants and animals, water color, and suspended sediments are factors that interfere with light penetration through the water column and lessen the Secchi disk depth. As a rule, one to three times the Secchi depth is considered the lighted or euphotic zone of the lake. In this region of the lake there is enough light to allow plants to survive and produce oxygen. Water below the lighted zone can be expected to have little or no dissolved oxygen. Other observations such as water color, suspended algae and sediment, aquatic plants, and odor are also recorded. The sampling season is May through October with volunteer measurements taken twice a month. After volunteers have completed one year of the basic monitoring program, they are qualified to participate in the Expanded Monitoring Program. In the expanded program, selected volunteers are trained to collect water samples that are shipped to the Illinois EPA laboratory for analysis of total and volatile suspended solids, total phosphorus, nitrate-nitrite nitrogen and ammonia nitrogen. Other parameters that are part of the expanded program include dissolved oxygen, temperature, and zebra mussel monitoring. Additionally, chlorophyll *a* monitoring has been added to the regiment of selected lakes. These water quality parameters are routinely measured by lake scientists to help determine the general health of the lake ecosystem.

If Lake Miltmore would like to be placed on this training list or would simply like more information, contact:

VLMP Regional Coordinator:
Holly Hudson
Northeastern Illinois Planning Commission
222 S. Riverside Plaza, Suite 1800
Chicago, IL 60606
(312) 454-0400

Objective III: Eliminate or Control Exotic Species

Numerous exotic plant species have been introduced into our local ecosystems. Some of these plants are aggressive, quickly out-competing native vegetation and flourishing in an environment where few natural predators exist. Plants such as purple loosestrife (*Lythrum salicaria*), buckthorn (*Rhamnus cathartica*), and reed canary grass (*Phalaris arundinacea*) are three examples. The outcome is a loss of plant and animal diversity. This section will address terrestrial shoreline exotic species.

Buckthorn is an aggressive shrub species that grows along lake shorelines as well as most upland habitats. It shades out other plants, its roots exude a chemical that discourages other plant growth, and it is quick to become established on disturbed soils. Reed canary grass is an aggressive plant species that was introduced as a shoreline stabilizer. It is found on lakeshores, stream banks, marshes and exposed moist ground. Although it does serve to stabilize shorelines to some extent, it has low food value and does not provide winter habitat for wildlife. It is very successful in taking over disturbed areas and, if left unchecked, will dominate an area, particularly a wetland or shoreline, in a short period of time. Since it begins growing early in the spring, it quickly out-competes native vegetation that begins growth later in the year. Control of buckthorn, and reed canary grass are discussed below. However, these control measures can be similarly applied to other exotic species such as garlic mustard (*Allilaria officianalis*) or honeysuckle (*Lonicera* spp.) as well as some aggressive native species, such as box elder (*Acer negundo*).

The presence of exotic species along a lakeshore is by no means a death sentence for the lake or other plant and animal life. If controlled, many exotic species can perform many of the original functions that they were brought here for. For example, reed canary grass was imported for its erosion control properties. It still contributes to this objective (offering better erosion control than commercial turfgrass), but needs to be isolated and kept in control. Many exotics are the result of garden or ornamental plants escaping into the wild. One isolated plant along a shoreline will probably not create a problem by itself, but its removal early on is best. Problems arise when plants are left to spread, many times to the point where treatment is difficult or cost prohibitive. The length of shoreline on Lake Miltmore inhabited by exotic species is 55% of the total shoreline. They occur mostly along wetland, shrub and buffered shorelines, and many areas are along developed parcels. The largest area is the wetland and buffered area along the southeast shore. A monitoring program should be established, problem areas specifically identified, and control measures taken. This is particularly important in remote areas of lake shorelines where the spread of exotic species has gone unmanaged for some time.

<u>Option 1: No Action</u>

No control will likely result in the expansion of the exotic species and the decline of native species. This option is not recommended if possible.

Pros

There are few advantages with this option. Some of the reasons exotics were brought into this country are no longer used or have limited use. However, in some cases having an exotic species growing along a shoreline may actually be preferable if the alternative plant is commercial turfgrass. Since turfgrass has shallow roots and is prone to erosion along shorelines, exotics like reed canary grass or common reed (*Phragmites australis*) will control erosion more effectively. Native plants should take precedent over exotics whenever possible. Table 6 in Appendix A lists several native plants that can be planted along shorelines.

Cons

Native plant and wildlife diversity will be lost as stands of exotic species expand. Exotic species are not under the same stresses (particularly diseases and predators) as native plants and thus can out-compete the natives for nutrients, space, and light. Few wildlife species use areas where exotic plants dominate. This happens because many wildlife species either have not adapted with the plants and do not view them as a food resource, the plants are not digestible to the animal, or their primary food supply (i.e., insects) are not attracted to the plants. The result is a monoculture of exotic plants with limited biodiversity.

Recreational activities, especially wildlife viewing, may be hampered by such monocultures. Access to lake shorelines may be impaired due to dense stands of non-native plants. Other recreational activities, such as swimming and boating, may not be affected.

Costs

Costs with this option are zeroing initially, however, when control is eventually needed, costs will be substantially more than if action was taken immediately. Additionally, the eventual loss of ecological diversity is difficult to calculate financially.

Option 2: Biological Control

Biological control (bio-control) is a means of using natural relationships already in place to limit, stop, or reverse an exotic species' expansion. In most cases, insects that prey upon the exotic plants in its native ecosystem are imported. Since there is a danger of bringing another exotic species into the ecosystem, state and federal agencies require testing before any bio-control species are released or made available for purchase.

Recently two leaf beetles (*Galerucella pusilla* and *G. calmariensis*) and two weevils, one a root-feeder (*Hylobius transversovittatus*) and one a flower-feeder (*Nanophyes marmoratus*) have offered some hope to control purple loosestrife by natural means. These insects feed on the leaves, roots, or flowers of purple loosestrife, eventually weakening and killing the plant or, in the case of the flower-feeder, prevent seeding. In large stands of loosestrife, the beetles and weevils naturally reproduce and in many locations, significantly reduce plant densities. The insects are host specific, meaning that they will attack no other plant but purple loosestrife. Currently, the beetles have proven to be most effective and are available for purchase. There are no designated stocking rate recommendations, since using bio-control insects are seen as an inoculation and it may take 3-5 years for beetle populations to increase to levels that will cause significant damage. Depending on the size of the infested area, it may take 1,000 or more adult beetles per acre to cause significant damage. The Lake County Forest Preserve District has stocked these beetles in the nearby Fourth Lake Fen and have had tremendous success. It is recommended that Lake Villa Township inquire with the Forest Preserve about obtaining beetles to address the wetland area along the southeast shore of Lake Miltmore.

Pros

Control of exotics by a natural mechanism is preferable to chemical treatments. Insects, being part of the same ecological system as the exotic plant (i.e., the beetles and weevils and the purple loosestrife) are more likely to provide long-term control. Chemical treatments are usually non-selective while bio-control measures target specific plant species. This technique is beneficial to the ecosystem since it preserves, even promotes, biodiversity. As the exotic plant dies back, native vegetation can reestablish the area.

Cons

Few exotics can be controlled using biological means. Currently, there are no bio-control techniques for plants such as buckthorn, reed canary grass, or a host of other exotics. One of the major disadvantages of using bio-control is the costs and labor associated with it.

Use of biological mechanisms to control plants such as purple loosestrife is still under debate. Similar to purple loosestrife, the beetles and weevils that control it are not native to North America. Due to the poor historical record of introducing non-native species, even to control other non-native species, this technique has its critics.

Costs

The New York Department of Natural Resources at Cornell University (email: bb22@cornell.edu, 607-255-5314, or visit the website: www.invasiveplants.net) sells overwintering adult leaf beetles (which will lay eggs the year of release) for $1 per beetle and new generation leaf beetles (which will lay eggs beginning the following year) at $0.25 per beetle. The root beetles are sold for $5 per beetle. Some beetles may be available for free by contacting the Illinois Natural History Survey (INHS; 217-333-6846). The INHS also conducts a workshop each spring at Volo Bog for individuals and groups interested in learning how to rear their own beetles.

Option 3: Control by Hand

Controlling exotic plants by hand removal is most effective on small areas (< 1 acre) and if done prior to heavy infestation. Some exotics, such as purple loosestrife and reed canary grass, can be controlled to some degree by digging, cutting, or mowing if done early and often during the year. Digging may be required to ensure the entire root mass is removed. Spring or summer is the best time to cut or mow, since late summer and fall is when many of the plant seeds disperse. Proper disposal of excavated plants is important since seeds may persist and germinate even after several years. Once exotic plants are removed, the disturbed ground should be planted with native vegetation and closely monitored since regrowth is common. Many exotic species, such as purple loosestrife, buckthorn, and garlic mustard are proficient at colonizing disturbed sites.

Pros

Removal of exotics by hand eliminates the need for chemical treatments. Costs are low if stands of plants are not too large already. Once removed, control is simple with yearly maintenance. Control or elimination of exotics preserves the ecosystem's biodiversity. This will have positive impacts on plant and wildlife presence as well as some recreational activities.

Cons

This option may be labor intensive or prohibitive if the exotic plant is already well established. Costs may be high if large numbers of people are needed to remove plants. Soil disturbance may introduce additional problems such as providing a seedbed for other non-native plants that quickly establish disturbed sites, or cause soil-laden run-off to flow into nearby lakes or streams. In addition, a well-established stand of an exotic like purple loosestrife or reed canary grass may require several years of intense removal to control or eliminate.

Costs

Cost for this option is primarily in tools, labor, and proper plant disposal.

Option 3: Herbicide Treatment

Chemical treatments can be effective at controlling exotic plant species. However, chemical treatment works best on individual plants or small areas already infested with the plant.   In some areas where individual spot treatments are prohibitive or impractical (i.e., large expanses of a wetland or woodland), chemical treatments may not be an option because in order to chemically treat the area, a broadcast application would be needed. Because many of the herbicides are not selective, meaning they kill all plants they contact, this may be unacceptable if native plants are found in the proposed treatment area.

Herbicides are commonly used to control nuisance shoreline vegetation such as buckthorn and purple loosestrife. Herbicides are applied to green foliage or cut stems. Products are applied by either spraying or wicking (wiping) solution on plant surfaces. Spraying is used when large patches of undesirable vegetation are targeted. Herbicides are sprayed on growing foliage using a hand-held or backpack sprayer. Wicking is used when selected plants are to be removed from a group of plants. The herbicide solution is wiped on foliage, bark, or cut stems using an herbicide-soaked device. Trees are normally treated by cutting off a ring of bark around the trunk (called girdling). Herbicides are applied onto the ring at high concentrations. Other devices inject the herbicide through the bark. It is best to apply herbicides when plants are actively growing, such as in the late spring/early summer, but before formation of seed heads. Herbicides are often used in conjunction with other methods, such as cutting or mowing, to achieve the best results. Proper use of these products is critical to their success. Always read and follow label directions.

Pros

Herbicides provide a fast and effective way to control or eliminate nuisance vegetation. Unlike other control methods, herbicides kill the root of the plant, which prevents regrowth. If applied properly, herbicides can be selective. This allows for removal of selected plants within a mix of desirable and undesirable plants.

Cons

Since most herbicides are non-selective, they are not suitable for broadcast application. Thus, chemical treatment of large stands of exotic species may not be practical. Native species are likely to be killed inadvertently and replaced by other non-native species. Off target injury/death may result from the improper use of herbicides. If herbicides are applied in windy conditions, chemicals may drift onto desirable vegetation. Care must also be taken when wicking herbicides as not to drip on to non-targeted vegetation such as native grasses and wildflowers. Another drawback to herbicide use relates to their ecological soundness and the public perception of them. Costs may also be prohibitive if plant stands are large. Depending on the device, cost of the application equipment can be high.

Costs

Two common herbicides, triclopyr (sold as Garlon ™) and glyphosate (sold as Rodeo®, Round-up™, Eagre™, or AquaPro™), are sold in 2.5 gallon jugs, and cost approximately $200 and $350, respectively. Only Rodeo® is approved for water use. A Hydrohatchet®, a hatchet that injects herbicide through the bark, is about $300.00. Another injecting device, E-Z Ject® is $450.00. Hand-held and backpack sprayers costs from $25-$45 and $80-150, respectively. Wicking devices are $30-40. A girdling tool costs about $150.

Objective IV: Enhance Wildlife Habitat Conditions

The key to increasing wildlife species in and around a lake can be summed up in one word: habitat. Wildlife need the same four things all living creatures need: food, water, shelter, and a place to raise their young. Since each wildlife species has specific habitat requirements, which fulfill these four basic needs, providing a variety of habitats will increase the chance that wildlife species may use an area. Groups of wildlife are often associated with the types of habitats they use. For example, grassland habitats may attract wildlife such as northern harriers, bobolinks, meadowlarks, meadow voles, and leopard frogs. Marsh habitats may attract yellow-headed blackbirds and sora rails, while manicured residential lawns attract house sparrows and gray squirrels. Thus, in order to attract a variety of wildlife, a mix of habitats are needed. In most cases quality is more important than quantity (i.e., five 0.1-acre plots of different habitats may not attract as many wildlife species than one 0.5 acre of one habitat type).

It is important to understand that the natural world is constantly changing. Habitats change or naturally succeed to other types of habitats. For example, grasses may be succeeded by shrub or shade intolerant tree species (e.g., willows, locust, and cottonwood). The point at which one habitat changes to another is rarely clear, since these changes usually occur over long periods of time, except in the case of dramatic events such as fire or flood.

In all cases, the best wildlife habitats are ones consisting of native plants. Unfortunately, non-native plants dominate many of our lake shorelines. Many of them escaped from gardens and landscaped yards (i.e., purple loosestrife) while others were introduced at some point to solve a problem (i.e., reed canary grass for erosion control). Wildlife species prefer native plants for food, shelter, and raising their young. In fact, one study showed that plant and animal diversity was 500% higher along naturalized shorelines compared to shorelines with conventional lawns (University of Wisconsin – Extension, 1999).

<u>Option 1: No Action</u>

This option means that the current land use activities will continue. No additional techniques will be implemented. Allowing a field to go fallow or not mowing a manicured lawn would be considered an action.

Pros

Taking no action may maintain the current habitat conditions and wildlife species present, depending on environmental conditions and pending land use actions. If all things remain constant there will be little to no effect on lake water quality and other lake uses.

Cons

If environmental conditions change or substantial land use actions occur (i.e., development) wildlife use of the area may change. For example, if a new housing development with manicured lawns and roads is built next to an undeveloped property, there will probably be a change in wildlife present.

Conditions in the lake (i.e., siltation or nutrient loading) may also change the composition of aquatic plant and invertebrate communities and thus influence biodiversity. Siltation and nutrient loading will likely decrease water clarity, increase turbidity, increase algal growth (due to nutrient availability), and decrease habitat for fish and wildlife.

Costs

The financial cost of this option may be zero. However, due to continual loss of habitats many wildlife species have suffered drastic declines in recent years. The loss of habitat affects the overall health and biodiversity of the lake's ecosystems.

Option 2: Increase Habitat Cover

This option can be incorporated with Option 3 (see below). One of the best ways to increase habitat cover is to leave a minimum 25-foot buffer between the edge of the water and any mowed grass. Allow native plants to grow or plant native vegetation along shorelines, including emergent vegetation such as cattails, rushes, and bulrushes (Table 6, Appendix A for costs and seeding rates). This will provide cover from predators and provide nesting structure for many wildlife species and their prey. It is important to control or eliminate non-native plants such as buckthorn, purple loosestrife, garlic mustard, and reed canary grass, since these species outcompete native plants and provide little value for wildlife.

Occasionally high mowing (with the mower set at its highest setting) may have to be done for specific plants, particularly if the area is newly established, since competition from weedy and exotic species is highest in the first couple years. If mowing, do not mow the buffer strip until after July 15 of each year. This will allow nesting birds to complete their breeding cycle.

Brush piles make excellent wildlife habitat. They provide cover as well as food resources for many species. Brush piles are easy to create and will last for several years. They should be place at least 10 feet away from the shoreline to prevent any debris from washing into the lake.

Trees that have fallen on the ground or into the water are beneficial by harboring food and providing cover for many wildlife species. In a lake, fallen trees provide excellent cover for fish, basking sites for turtles, and perches for herons and egrets.

Increasing habitat cover should not be limited to the terrestrial environment. Native aquatic vegetation, particularly along the shoreline, can provide cover for fish and other wildlife.

Pros

Increased cover will lead to increased use by wildlife. Since cover is one of the most important elements required by most species, providing cover will increase the chances of wildlife using the shoreline. Once cover is established, wildlife usually have little problem finding food, since many of the same plants that provide cover also supply the food the wildlife eat, either directly (seeds, fruit, roots, or leaves) or indirectly (prey attracted to the plants).

Additional benefits of leaving a buffer include: stabilizing shorelines, reducing runoff which may lead to better water quality, and deterring nuisance Canada geese. Shorelines with erosion problems can benefit from a buffer zone because native plants have deeper root structures and hold the soil more effectively than conventional turfgrass. Buffers also absorb much of the wave energy that batters the shoreline. Water quality may be improved by the filtering of nutrients, sediment, and pollutants in run-off. This has a "domino effect" since less run-off flowing into a lake means less nutrient availability for nuisance algae, and less sediment means less turbidity, which leads to better water quality. All this is beneficial for fish and wildlife, such as sight-feeders like bass and herons, as well as people who use the lake for recreation. Finally, a buffer strip along the shoreline can serve as a deterrent to Canada geese from using a shoreline. Canada geese like flat, open areas with a wide field of vision. Ideal habitat for them are areas that have short grass up to the edge of the lake. If a buffer is allowed to grow tall, geese may choose to move elsewhere.

Cons

There are few disadvantages to this option. However, if vegetation is allowed to grow, lake access and visibility may be limited. If this occurs, a small path can be made to the shoreline. Composition and density of aquatic and shoreline vegetation are important. If vegetation consists of non-native species such as or Eurasian water milfoil or purple loosestrife, or in excess amounts, undesirable conditions may result. A shoreline with excess exotic plant growth may result in a poor fishery (exhibited by stunted fish) and poor recreation opportunities (i.e., boating, swimming, or wildlife viewing).

Costs

The cost of this option would be minimal. The purchase of native plants can vary depending upon species and quantity. Based upon 100 feet of shoreline, a 25-foot buffer planted with a native forb and grass seed mix would cost between $165-270 (2500 sq. ft. would require 2.5, 1000 sq. ft. seed mix packages at $66-108 per package). This does not include labor that would be needed to prepare the site for planting and follow-up maintenance. This cost can be reduced or minimized if native plants are allowed to grow. However, additional time and labor may be needed to insure other exotic species, such as buckthorn, reed canary grass, and purple loosestrife, do not become established.

Option 3: Increase Natural Food Supply

This can be accomplished in conjunction with Option 2. Habitats with a diversity of native plants will provide an ample food supply for wildlife. Food comes in a variety of forms, from seeds to leaves or roots to invertebrates that live on or are attracted to the plants. Plants found in Table 6, Appendix A should be planted or allowed to grow. In addition, encourage native aquatic vegetation, such as water lily (*Nuphar* spp. and *Nymphaea tuberosa*), sago pondweed (*Stuckenia pectinatus*), largeleaf pondweed (*Potamogeton amplifolius)*, and wild celery (*Vallisneria americana*) to grow. Aquatic plants such as these are particularly important to waterfowl in the spring and fall, as they replenish energy reserves lost during migration.

Providing a natural food source in and around a lake starts with good water quality. Water quality is important to all life forms in a lake. If there is good water quality, the fishery benefits and subsequently so does the wildlife (and people) who prey on the fish. Insect populations in the area, including beneficial predatory insects, such as dragonflies, thrive in lakes with good water quality.

Dead or dying plant material can be a source of food for wildlife. A dead standing or fallen tree will harbor good populations of insects for woodpeckers, while a pile of brush may provide insects for several species of songbirds such as warblers and flycatchers.

Supplying natural foods artificially (i.e., birdfeeders, nectar feeders, corn cobs, etc.) will attract wildlife and in most cases does not harm the animals. However, “people food” such as bread should be avoided. Care should be given to maintain clean feeders and birdbaths to minimize disease outbreaks.

Pros

Providing food for wildlife will increase the likelihood they will use the area. Providing wildlife with natural food sources has many benefits. Wildlife attracted to a lake can serve the lake and its residents well, since many wildlife species (i.e., many birds, bats, and other insects) are predators of nuisance insects such as mosquitoes, biting flies, and garden and yard pests (such as certain moths and beetles). Effective natural insect control eliminates the need for chemical treatments or use of electrical “bug zappers” that have limited effect on nuisance insects.

Migrating wildlife can be attracted with a natural food supply, primarily from seeds, but also from insects, aquatic plants or small fish. In fact, most migrating birds are dependent on food sources along their migration routes to replenish lost energy reserves. This may present an opportunity to view various species that would otherwise not be seen during the summer or winter.

Cons

Feeding wildlife can have adverse consequences if populations become dependent on hand-outs or populations of wildlife exceed healthy numbers. This frequently happens when people feed waterfowl like Canada geese or mallard ducks.

Feeding these waterfowl can lead to a domestication of these animals. As a result, these birds do not migrate and can contribute to numerous problems, such as excess feces, which is both a nuisance to property owners and a significant contribution to the lake's nutrient load. Waterfowl feces are particularly high in phosphorus. Since phosphorus is generally the limiting factor for nuisance algae growth in many lakes in the Midwest, the addition of large amounts of this nutrient from waterfowl may exacerbate a lake's excessive algae problem. In addition, high populations of birds in an area can increase the risk of disease for not only the resident birds, but also wild bird populations that visit the area.

Finally, tall plants along the shoreline may limit lake access or visibility for property owners. If this occurs, a path leading to the lake could be created or shorter plants may be used in the viewing area.

Costs

The costs of this option are minimal. The purchase of native plants and food and the time and labor required to plant and maintain would be the limit of the expense.

Option 4: Increase Nest Availability

Wildlife are attracted by habitats that serve as a place to raise their young. Habitats can vary from open grasslands to closed woodlands (similar to Options 2 and 3).

Standing dead or dying trees provide excellent habitat for a variety of wildlife species. Birds such as swallows, woodpeckers, and some waterfowl need dead trees to nest in. Generally, a cavity created and used by a woodpecker (e.g., red-headed or downy woodpecker, or common flicker) in one year, will in subsequent years be used by species like tree swallows or chickadees. Over time, older cavities may be large enough for waterfowl, like wood ducks, or mammals (e.g., flying squirrels) to use. Standing dead trees are also favored habitat for nesting wading birds, such as great blue herons, night herons, and double-crested cormorants, which build stick nests on limbs. For these birds, dead trees in groups or clumps are preferred as most herons and cormorants are colonial nesters.

In addition to allowing dead and dying trees to remain, erecting bird boxes will increase nesting sites for many bird species. Box sizes should vary to accommodate various species. Swallows, bluebirds, and other cavity nesting birds can be attracted to the area using small artificial nest boxes. Larger boxes will attract species such as wood ducks, flickers, and owls. A colony of purple martins can be attracted with a purple martin house, which has multiple cavity holes, placed in an open area near water.

Bat houses are also recommended for any area close to water. Bats are voracious predators of insects and are naturally attracted to bodies of water. They can be enticed into roosting in the area by the placement of bat boxes. Boxes should be constructed of rough non-treated lumber and placed >10 feet high in a sunny location.

Pros

Providing places were wildlife can rear their young has many benefits. Watching wildlife raise their young can be an excellent educational tool for both young and old.

The presence of certain wildlife species can help in controlling nuisance insects like mosquitoes, biting flies, and garden and yard pests. This eliminates the need for chemical treatments or electric "bug zappers" for pest control.

Various wildlife species populations have dramatically declined in recent years. Since, the overall health of ecosystems depend, in part, on the role of many of these species, providing sites for wildlife to raise their young will benefit not only the animals themselves, but the entire lake ecosystem.

Cons

Providing sites for wildlife to raise their young have few disadvantages. Safety precautions should be taken with leaving dead and dying trees due to the potential of falling limbs. Safety is also important when around wildlife with young, since many animals are protective of their young. Most actions by adult animals are simply threats and are rarely carried out as attacks.

Parental wildlife may chase off other animals of its own species or even other species. This may limit the number of animals in the area for the duration of the breeding season.

Costs

The costs of leaving dead and dying trees are minimal. The costs of installing the bird and bat boxes vary. Bird boxes can range in price from $10-100.00. Purple martin houses can cost $50-150. Bat boxes range in price from $15-50.00. These prices do not include mounting poles or installation.

Option 5: Limit Disturbance

Since most species of wildlife are susceptible to human disturbance, any action to curtail disturbances will be beneficial. Limiting disturbance can include posting signs in areas of the lake where wildlife may live (e.g., nesting waterfowl), establish a "no wake" area, boat horsepower or speed limits, or establish restricted boating hours. These are examples of time and space zoning for lake usage. Enforcement and public education are needed if this option is to be successful. In some areas, off-duty law enforcement officers can be hired to patrol the lake.

Pros

Limiting disturbance will increase the chance that wildlife will use the lake, particularly for raising their young. Many wildlife species have suffered population declines due to loss of habitat and poor breeding success. This is due in part to their sensitivity to disturbance.

This option also can benefit the lake in other ways. Limited boat traffic may lead to less wave action to batter shorelines and cause erosion, which results in suspension of nutrients and sediment in the water column. Less nutrients and sediment in the water column may improve water quality by increasing water clarity and limiting nutrient availability for excessive plant or algae growth.

Recreation activities such as canoeing and paddleboating may be enhanced by the limited disturbance.

Cons
One of the strongest oppositions to this option would probably be from the powerboat users and water skiers. However, this problem may be solved if a significant portion of the daylight hours and the use of the middle part of the lake (assuming the lake is deep enough) are allowed for powerboating. For example, powerboating could be allowed between 9 AM and 6 PM within the boundaries established by “no wake” restricted area buoys.

Costs
The costs of this option include the purchase and placement of signs and public educational materials as well as enforcement. Off-duty law enforcement officers usually charge $25/hour to enforce boating laws or local ordinances.

Objective V: Conduct a Fisheries Assessment

Many lakes in Lake County have a fish stocking program in which fish are stocked every year or two to supplement fish species already occurring in the lake or to introduce additional fish species into the system. However, very few lakes that participate in stocking check the progress or success of these programs with regular fish surveys. Lake managers should have information about whether or not funds delegated to fish stocking are being well spent, and it is very difficult to determine how well stocked fish species are surviving and reproducing or how they are affecting the rest of the fish community without a comprehensive fish assessment. Lake Miltmore has not had a fishery assessment conducted since 1995. In order to determine the current status of the fishery, it is highly recommended that a fish assessment is carried out.

A simple, inexpensive way to derive direct information on the status of a fishery is to sample anglers and evaluate the types, numbers and sizes of fish caught by anglers actively involved in recreational fishing on the lake. Such information provides insight on the status of fish populations in the lake, as well as a direct measure of the quality of fishing and the fishing experience. However, the numbers and types of fish sampled by anglers are limited, focusing on game and large, catchable-sized fish. Thus, in order to obtain a comprehensive assessment of the fish community status, including non-game fish species, more quantitative methods must be employed. These include gill netting, trap netting, seining, trawling, angling (hook and line fishing) and electroshocking. Each method has its advantages and limitations, and frequently multiple gear and approaches are employed. The best gear and sampling methods depend on the target fish species and life stage, the types of information desired and the environment to be sampled. The table below lists examples of suitable sampling gear for collecting adults and young of the year (YOY) of selected fish species in lakes.

Typically, fish populations are monitored at least annually. The best time of year depends on the sampling method, the target fish species and the types of data to be collected. In many lakes and regions, the best time to sample fish is during the fall turnover period after thermal stratification breaks down and the lake is completely mixed because (1) YOY and age 1+ (one year or older) fish of most target species should be present and vulnerable to most standard collection gear, including seines, trap nets and electroshockers; (2) species that dwell in the hypolimnion during the summer may be more vulnerable to capture during fall overturn; and (3) lower water temperatures in the fall can help reduce sampling-related mortality. Sampling locations are also species-, life stage-, and gear-dependent. As with sampling methods and time, locations should be selected to maximize capture efficiency for the target species of interest and provide the greatest gain in information for the least amount of sampling effort.

The Illinois Department of Natural Resources (IDNR) will perform a fish survey at no charge on most public and some private water bodies. In order to determine if your lake is eligible for a survey by the IDNR, contact Frank Jakubecik, Fisheries Biologist at (815) 675-2319. If a lake is not eligible for an IDNR fish survey, or if a more comprehensive survey is desired, two known consulting firms have previously conducted fish surveys in Lake County: EA Engineering, Deerfield, IL, (847) 945-8010 and Richmond Fisheries, Richmond, IL, (815) 675-6545.

		GEAR[a]	
TAXON	**FISH LIFE STAGE**	**STANDARD**	**SUPPLEMENTAL**
Trout, salmon, whitefish, char (except lake trout)	YOY	Electrofishing	Gill nets, trawls, seine
	Adult	Trap nets	Gill nets, electrofishing (F)
Lake trout	YOY	Electrofishing (F)	Seine (F), trawls
	Adult	Trap nets (F)	
Pike, pickerel, muskellange	YOY	Seine (Su)	
	Adult	Trap nets (S), gill nets (S,F)	
Catfish, bullheads	YOY	Seine	Baited traps
	Adult	Gill nets, trap nets[b]	Slat nets, angling
Bass, sunfish, crappie	YOY	Seine, electrofishing	
	Adult	Electrofishing	Trap nets, angling
Minnows, carp, dace, chub, shiners	YOY	Electrofishing	Seine
	Adult	Electrofishing	Seine
Yellow perch	YOY	Seine (Su), electrofishing	Trawls (S)
	Adult	Gill net, trap net	
Walleye	YOY	Seine (S), electrofishing	Trawls (S)
	Adult	Trap nets (S), gill nets (S, F), electrofishing (S, F)	

[a]Letter codes indicate seasonal restrictions on gear use to the spring (S), summer (Su), or fall (F).
[b]Bullheads only.