# 2003 SUMMARY REPORT
# of
# MCDONALD WOODS LAKES

## Lake County, Illinois

*Prepared by the*

**LAKE COUNTY HEALTH DEPARTMENT**
**ENVIRONMENTAL HEALTH SERVICES**
**LAKES MANAGEMENT UNIT**
3010 Grand Avenue
Waukegan, Illinois 60085

**Christina L. Brant**
Mary Colwell
Michael Adam
Joseph Marencik
Mark Pfister

February 2005

# TABLE OF CONTENTS


EXECUTIVE SUMMARY 3

LAKE IDENTIFICATION AND LOCATION 4

LIMNOLOGICAL DATA
- Water Quality
  - McDonald Lake 1 6
  - McDonald Lake 2 12
- Aquatic Plant Assessment 17
- Shoreline Assessment 19
- Wildlife Assessment 21

EXISTING LAKE QUALITY PROBLEMS AND MANAGEMENT SUGGESTIONS 23

TABLES AND FIGURES
- Figure 1. Approximate watershed of McDonald Lakes, based on 2002 aerial photograph, topographic data and stormwater maps. 5
- Figure 2. 2003 water quality sampling sites and access locations on McDonald Lakes 1 & 2. 7
- Figure 3. TP concentrations vs. N:P ratio for MC1, May-September 2003. 9
- Figure 4. TSS vs. NVSS concentrations for MC1, May-September 2003. 10
- Figure 5. TSS vs. NVSS concentrations for MC2, May-September 2003. 13
- Figure 6. 1939 aerial photograph of McDonald Lakes. 16
- Table 3. Aquatic and shoreline plants on MC1, May-September 2003. 17
- Table 5. Aquatic and shoreline plants on MC2, May-September 2003. 18
- Figure 7. 2003 shoreline types on McDonald Lakes 1 & 2. 20
- Table 7. Wildlife species observed at McDonald Lakes, May-September 2003. 21

APPENDIX A. DATA TABLES FOR MCDONALD WOODS LAKES.
- Table 1. 2003 water quality data for McDonald Lakes.
- Table 2. Lake County average TSI phosphorus ranking 1999-2003.
- Table 4. Aquatic vegetation sampling results for MC1, May-September 2003.
- Table 6. Aquatic vegetation sampling results for MC2, May-September 2003.

APPENDIX B. METHODS FOR FIELD DATA COLLECTION AND LABORATORY ANALYSES.

APPENDIX C. 2003 MULTIPARAMETER DATA FOR MCDONALD WOODS LAKES.

# EXECUTIVE SUMMARY

McDonald Lakes 1 and 2, located in unincorporated Lake Villa Township, are wetland marshes, created by installing a spillway between the two lakes and damming the outlet of McDonald Lake 2. The lakes are entirely within the McDonald Woods Forest Preserve, owned and maintained by the Lake County Forest Preserve District, and are surrounded by extensive wetland and woodland. McDonald Lake 1 (MC1) has a surface area of 8.6 acres with mean and maximum depths of 1.5 and 3.0 feet, respectively. McDonald Lake 2 (MC2) has a surface area of 21.2 acres with mean and maximum depths of 1.3 and 2.7 feet, respectively. However, surface areas and depths of the lakes vary from year to year, depending on water levels. The watershed of McDonald Lakes is approximately 567 acres. The lakes receive water from residential areas surrounding Waterford, Potomac and Spring Ledge Lakes, as well as wetland areas.

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. MC1 was mixed all summer, but epilimnetic oxygen concentrations were relatively low due to potentially high BOD. The total phosphorus (TP) concentration was nearly three times higher than the county median and it appears that the TP concentrations are related to the dieback of curly leaf pondweed and the amount of available nitrogen in the water. Total suspended solid (TSS) levels were high all summer (over twice the county median value) and, as a result, Secchi depths (water clarity) were low from May-July. MC1 was nitrogen limited throughout the summer. Conductivity was much higher than the county median and is thought to be related to springtime runoff, evaporation and loss of water volume by the end of the summer. MC2 was also mixed all summer and had higher DO concentrations than MC1. TP levels were four times higher and TSS levels were ten times higher than the county median, indicating severely degraded water quality. As a result, Secchi depth was very low. MC2 was also slightly nitrogen limited and displayed high conductivity levels throughout the summer. Although conductivity levels in MC2 did not appear to be related to spring runoff, there was an increase near the end of the summer that, as in MC1, appears to be related to evaporation and loss of water volume.

Aquatic plants were heavy in MC1 and nearly absent in MC2. MC1 was surrounded entirely by wetland and MC2 was surrounded by mostly wetland and a small amount of woodland. Both lakes displayed no erosion. Invasive plant and tree species, including common buckthorn, purple loosestrife, honeysuckle, reed canary grass, Canada thistle, and Queen Anne's lace were present to some extent along 100% of both shorelines. Steps should be taken to rid the lakes of these plant species, as they do not provide quality wildlife habitat or erosion control. As a result of the dominance of wetland habitat around the lakes, an extremely high number of wildlife species were observed around McDonald Lakes. It is, therefore, very important that the shoreline areas currently present around the lake be maintained to provide appropriate habitat for birds and other animals into the future.

# LAKE IDENTIFICATION AND LOCATION

**Lake Name:** McDonald Lakes 1 & 2

**State:** IL

**County:** Lake

**Nearest Municipality:** Lindenhurst

**Township/Range:** T 46N, R 10E, S 36

**Basin Name:** Des Plaines River Watershed

**Subbasin Name:** North Mill Creek Watershed

**Major Tributaries:** Mill Creek

**Receiving Water Bodies:** None

**Surface Area:** MC1: 8.6 acres; MC2: 21.2 acres

**Shoreline Length:** MC1: 0.48 miles; MC2: 1.65 miles

**Maximum Depth:** MC1: 3.0 feet; MC2: 2.7 feet

**Mean Depth:** MC1: 1.5 feet: MC2: 1.3 feet (both estimated by LCHD)

**Storage Capacity:** MC1: 12.89 acre-feet; MC2: 27.51 acre-feet (estimated LCHD)

**Lake Type:** Marsh

McDonald Lakes 1 and 2, (MC1 & MC2) located in unincorporated Lake Villa Township, are wetland marshes, created by installing a spillway between the two lakes and damming the outlet of MC2. The lakes are entirely within the McDonald Woods Forest Preserve, owned and maintained by the Lake County Forest Preserve District, and are surrounded by extensive wetland and woodland. The McDonald Woods Forest Preserve is open from sunrise to sunset and used by approximately 10,000 people per year. There is a walking trail that runs between the two lakes and entirely around MC2. The watershed of McDonald Lakes is approximately 567 acres. MC2 receives water from Potomac, Waterford and Spring Lakes, as well as some surrounding wetland. MC1 receives water from wetlands to the south and west (Figure 1). The watershed to lake ratio is high (19:1), but may not be related to the poor water quality in both lakes. The lakes are located in the North Mill Creek sub basin, within the Des Plaines River watershed.

# LIMNOLOGICAL DATA – WATER QUALITY: MC1

Water samples collected from MC1 were analyzed for a variety of water quality parameters (See Appendix B for methodology). Samples were collected just below the surface from the deepest area of the lake (Figure 2). MC1 remained mixed as a result of its shallow morphometry and the effects of wind and wave action across the lake. The surface waters of MC1 were well oxygenated only during May and July. Dissolved oxygen (DO) concentrations fell below 5.0 mg/l (a level below which many aquatic organisms become stressed) in June, August and September. The primary reason for these low DO concentrations was a massive amount of organic material (plants) in the water column and the time of sampling. When a high density of organic material is present, the biological oxygen demand (BOD) in a water body can be very high. A high BOD means that, regardless of the amount of oxygen present, the demand for that oxygen by living organisms (especially bacteria that decompose organic matter such as plants) is very high, and a decrease in DO may occur for a period of time. Photosynthesis does not occur during the night to replace oxygen being taken up by respiration, and oxygen levels often decline overnight and into the early morning before rebounding by mid-morning with the sun. This is especially true in nutrient enriched lakes, such as MC1, with large amounts of plant matter and a potentially high BOD.

Phosphorus is a nutrient that can enter lakes through runoff or be released from or attached to suspended lake sediment, and high levels of phosphorus typically trigger algal blooms or produce high plant density. The average phosphorus concentration in MC1 was 0.172 mg/l, nearly three times higher than the Lake County median of 0.059 mg/l (Table 1, Appendix A). Total phosphorus (TP) concentrations increased throughout the summer until September, when the concentration dropped to less than half of August's concentration. Soluble reactive phosphorus (SRP), a dissolved form of phosphorus that is readily available for uptake by algae and duckweed, was also very high in MC1 (0.070 mg/l). It appears that fluctuations in the TP and SRP concentrations are related to the dieback of curly leaf pondweed and to the amount of available nitrogen in the water column. During the summer of 2003, MC1 was nitrogen limited. 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. MC1 had an average TN:TP ratio of 9:1. This indicates that the lake is nitrogen limited, which means that, at times, there was not enough N in the water column to sustain plant or (in this specific case) duckweed growth. Although there was very little algae in MC1, duckweed was very dense. This plant is not rooted and, like algae, receives its nutrients from the water column. If duckweed is not growing, it will not take up and utilize either N or P from the water. However, as the duckweed in the water dies, SRP will be released

from those cells, resulting in a build-up of unused P in the water. This appears to be what was happening in MC1 during the summer of 2003. In May, the N:P ratio was 18:1, indicating P limitation. TP and SRP during May were low as compared to the rest of the summer as both nitrogen and phosphorus were being utilized by plants and duckweed in the lake. Curly leaf pondweed, which was very dense in MC1, naturally dies back in late June and early July. The dieback results in a release of phosphorus into the water column as the plant material decomposes. As a result of this flux of phosphorus in the water column in June, the N:P ratio dropped to 11:1 in June and then to 5:1 in July and August. Without a sufficient source of N, the duckweed in the lake was not able to use all of the P for growth. This resulted in an even higher increase in the P concentration as the unused P that had been released from the curly leaf pondweed built up in the water column in July and August. TP decreased substantially from August to September, when the N:P ratio increased to 17:1 and nitrogen was again available to duckweed in the lake (Figure 3; Table 1, Appendix A).

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 TSS concentration in MC1 (13.7 mg/l) was nearly twice the median value for Lake County lakes (7.5 mg/l). TSS and TP were not correlated during the summer, indicating that the high TSS concentrations were not driven by high algae densities. Average calculated NVSS, a measure of inorganic particles in the water column, such as sediment and soil, made up 81% of average TSS. Additionally, NVSS and TSS were closely related with regard to increases and decreases throughout the summer (Figure 4). This is a strong indication that the source of TSS in MC1 was resuspended sediment.

As a result of high TP and TSS concentrations throughout the summer, Secchi depth (water clarity) in MC1 was low during May, June and July, and reached a minimum of 0.95 feet in June (Table 1, Appendix A). However, Secchi depth reached the lake bottom in August and September. The increase in water clarity was the result of high plant density in the lake. Plant density was high throughout the summer. However, during June and July, curly leaf pondweed was dying and decomposing throughout the lake increasing the amount of organic material (TSS) in the water column. This resulted in higher TSS values and low Secchi depths. Once the curly leaf decomposition was no longer occurring and the amount of organic material in the lake decreased, the remaining plants promoted high water clarity. A diverse community of aquatic plants is beneficial to a lake in many ways, including stabilizing sediment to prevent resuspension, competing with planktonic algae for resources and providing habitat and a food base for a healthy fish community.

Phosphorus levels can also be used to indicate the trophic state (productivity level) of a lake. The Trophic State Index (TSI) uses phosphorus, chlorophyll *a* (algae biomass) 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=40-49) 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=50-69) 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. MC1 had an average phosphorus TSI (TSIp) value of 78.4, indicating hypereutrophic conditions. This means that the lake is a highly enriched system with relatively poor quality. The lake ranked 115$^{th}$ out of 130 lakes studied in Lake County since 2000 (Table 2, Appendix A).

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, and 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. Average 2003 conductivity in MC1 (1.0376 mS/cm) was much higher than the county median of 0.7503 mS/cm). Conductivity was highest in May and decreased throughout the summer until it increased again in September. Typically, when road salt is the only cause of an increase in conductivity, levels will be very high in May and June, when spring runoff brings a large amount of salt-laden water into the lake and then decreases throughout the summer. This appears to be the trend in MC1. The increase in conductivity in September is likely the result of evaporation and a decrease of water volume. Very little rain fell during the month of July and the water level of MC1 dropped by six inches from August to September. This decrease in total water volume likely consolidated the chemical ions present in the lake, causing an increase in conductivity levels. Although the high conductivity levels are cause for concern, there may not be much that can be done about them. Non-point runoff, which picks up road salt and enters the lake during rain events, is very difficult to control. Additionally, without a change in lake level or inflows, the low volume of water entering the lake and high evapotranspiration rate in the lake will continue to contribute to high conductivity levels.

Most of the water quality parameters just discussed can be used to analyze the water quality of MC1 based on use impairment indices established by the Illinois Environmental Protection Agency (IEPA). According to this index, MC1 provides *Full* support of aquatic life and *Nonsupport* of swimming and recreational activities (such as boating) as a result of high TP and NVSS concentrations in the water column, and extremely high plant coverage. The lake provides *Partial* overall use.

# LIMNOLOGICAL DATA – WATER QUALITY: MC2

Water samples collected from MC2 were analyzed for a variety of water quality parameters (See Appendix B for methodology). Samples were collected just below the surface, from the deepest area of the lake (Figure 2). MC2 remained mixed as a result of its shallow morphometry and the effects of wind and wave action across the lake. The surface waters of MC2 were well oxygenated except during July. Dissolved oxygen (DO) concentrations remained above 5.0 mg/l (a level below which many aquatic organisms become stressed) all months except July. The primary reason for the low DO concentration in July is not known.

Phosphorus is a nutrient that can enter lakes through runoff or be released or attached to suspended lake sediment, and high levels of phosphorus typically trigger algal blooms or produce high plant density. The average phosphorus concentration in MC2 was 0.271mg/l, over four times higher than the Lake County median of 0.059 mg/l (Table 1, Appendix A). Total phosphorus (TP) concentrations increased throughout the summer. Because TP concentrations did not correlate to rainfall amounts, the source of phosphorus is thought to be internal. Sediment resuspension due to carp activity and wind action on the lake may be releasing or resuspending phosphorus back into the water column. This is further supported by the TSS data discussed below.

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 TSS concentration in MC2 (70.1 mg/l) was nearly ten-fold higher than the median value for Lake County lakes (7.5 mg/l). TSS and TP were not correlated during the summer, indicating that the high TSS concentrations were not driven by high algae densities. Average NVSS, a measure of inorganic particles in the water column, such as sediment and soil, made up 78% of average TSS. Additionally, NVSS and TSS were closely related with regard to increases and decreases throughout the summer (Figure 5). This is a strong indication that the source of TSS in MC2 was resuspended sediment.

As a result of extremely high TP and TSS concentrations throughout the summer, Secchi depth (water clarity) on MC2 was lower than one foot all summer (Table 1, Appendix A). The absence of plants in the lake contributed to the high TSS and low Secchi depth.

Nitrogen is also an important nutrient for plant and algae growth. Sources of nitrogen to a lake vary widely, ranging from fertilizer and animal wastes, to human waste from sewage treatment plants or failing septic systems, to groundwater, air and rainfall. As a result, it is very difficult to control or reduce nitrogen inputs to a lake. Average Total

Kjeldahl Nitrogen (TKN) in MC2 (2.79 mg/l) was over double the Lake County median of 1.220 mg/l. TKN started high in the spring and did not increase or decrease substantially over the course of the summer. Fluctuations in TKN did not appear to be related to rainfall amounts and the source is likely from algal biomass. Despite high nitrogen concentrations, MC2 was still slightly nitrogen limited because of the extremely high TP concentrations in the lake (see next paragraph).

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. MC2 had an average TN:TP ratio of 10.5:1. This indicates that the lake is slightly nitrogen limited, which means that, at times, there was not enough N in the water column to promote algae growth.

Phosphorus levels can also be used to indicate the trophic state (productivity level) of a lake. The Trophic State Index (TSI) uses phosphorus, chlorophyll *a* (algae biomass) 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=40-49) 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=50-69) to hypereutrophic (TSI $\geq$70) lake conditions, typically characterized by high nutrient concentrations, high algal biomass, low DO levels, a rough fish population, and low water clarity. MC2 had an average phosphorus TSI (TSIp) value of 85.0, indicating hypereutrophic conditions. This means that the lake is a highly enriched system with poor water quality. The lake ranked 126$^{th}$ out of 130 lakes studied in Lake County since 2000 (Table 2, Appendix A).

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, and 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. Average 2003 conductivity in MC2 (1.1532 mS/cm) was much higher than the county median of 0.7503 mS/cm). Conductivity increased from May-July and was the highest in September (Table 1, Appendix A). Typically, when road salt is the only cause of an increase in conductivity, levels will be very high in May and June, when spring runoff brings a large amount of salt-laden water into the lake and then decreases throughout the summer. This does not appear to be the trend in MC2,

suggesting that the primary source of high conductivity may be more closely related to in-lake processes. The increase in conductivity in September is likely the result of evaporation and a decrease of water volume. Very little rain fell during the month of July and the water level of MC2 dropped by six inches from August to September. This decrease in total water volume likely consolidated the chemical ions present in the lake, causing an increase in conductivity levels. Although MC2 receives water from Potomac, Waterford and Spring Ledge Lakes, which are surrounded by heavily residential areas (27% of the total watershed), neither Potomac nor Waterford have exceptionally high conductivity levels. It is likely that high conductivity levels in MC1 and MC2 are related to internal processes. Regardless, without a change in lake level or inflows, the low volume of water entering the lake and high evapotranspiration rate in the lake will continue to contribute to high conductivity levels.

Most of the water quality parameters just discussed can be used to analyze the water quality of MC2 based on use impairment indices established by the Illinois Environmental Protection Agency (IEPA). According to this index, MC2 provides *Partial* support of aquatic life and *Nonsupport* of swimming and recreational activities (such as boating) as a result of high TP and NVSS concentrations in the water column, and the virtual absence of plant coverage. The lake's overall index is *Nonsupport*.

Although the overall assessment of water quality in both McDonald Lakes is very poor, it is not unusual given the morphology and origin of the lakes. Both lakes were originally wetlands in a vast expanse of farm fields (Figure 6). The west side of those low areas was dammed sometime during the mid 1900's to form the two connected marshes. The lakes are not more than three feet deep and their sediment started out as very rich, fertilized farm soil that has probably been releasing phosphorus and nitrogen into the water column since the lakes were created. The poor water quality of the McDonald Lakes is also not unique. Of the 16 lowest ranking lakes in Lake County (Table 2, Appendix A), all but one are very shallow systems, five are marshes and eight are flow through systems that are online with poor quality streams. Three of the lakes have been degraded by unique human impacts.

# 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 one-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. Based on 1% light level, MC1 could have and did support plants across the entire bottom of the lake (Appendix C). Coontail dominated the plant community and *Elodea* was also found in high density. The only exotic species present was curly leaf pondweed, which also dominated the plant community in May and June, before naturally dying back in late July and August. Duckweed and watermeal covered the surface of MC1 in the later part of the summer (Tables 3 & 4). Although the plant density reached nuisance levels throughout the lake, making it hard to canoe efficiently, the plant community was relatively diverse and, given that boating is prohibited on the lake, it is recommended that no management of the plant community be conducted in MC1.

**Table 3. Aquatic and shoreline plants on MC1, May-September 2003.**

| | |
|---|---|
| *Aquatic Plants* | |
| Chara | *Chara* sp. |
| Coontail | *Ceratophyllum demersum* |
| Elodea | *Elodea canadensis* |
| Duckweed | *Lemna minor* |
| Curlyleaf Pondweed^ | *Potamogeton crispus* |
| Small Pondweed | *Potamogeton pusillus* |
| White Water Crowsfoot | *Ranunculus longirostris* |
| Sago Pondweed | *Potamogeton pectinatus* |
| Flatstem Pondweed | *Potamogeton zosterifomis* |
| Giant Duckweed | *Spirodella polyrhiza* |
| Watermeal | *Wollfia columbiana* |
| | |
| *Shoreline Plants* | |
| Canada Thistle^ | *Cirsium arvense* |
| Queen Anne's Lace^ | *Daucus carota* |
| Daisy Fleabane | *Erigeron annuus* |
| Reed Canary Grass^ | *Phalaris arundinacea* |
| Common Cattail | *Typha latifolia* |
| Blue Vervain | *Verbena hastata* |

^Exotic plant or tree species

Based on 1% light level, MC2 could have also supported plants across the entire bottom of the lake (Appendix C). However, almost no rooted aquatic plants are present in MC2.

Sago pondweed was found in only 2% of the sampling locations throughout the summer. Coontail, duckweed and watermeal, which are floating plants, were found more often, but in no more than 11% occurrence (Tables 5 & 6). One possible reason for the lack of plants in MC2 is the flocculent sediment present. Often, rooted plants will not grow well if the sediment is not stable enough to hold them in place against wind and wave action threatening to uproot them. Despite the near absence of aquatic plants in MC2, a large number of upland plant and tree species were observed along the shoreline. These plants provide very valuable habitat for a large number of birds and other wildlife species and should be preserved and maintained as much as possible.

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. MC1 has an FQI of 17.7, while MC2 has an FQI of 12.0.

**Table 5. Aquatic and shoreline plants on MC2, May-September 2003.**

| | |
|---|---|
| *Aquatic Plants* | |
| Coontail | *Ceratophyllum demersum* |
| Small Duckweed | *Lemna minor* |
| Sago Pondweed | *Potamogeton pectinatus* |
| Giant Duckweed | *Spirodella polyrhiza* |
| Watermeal | *Wollfia columbiana* |
| | |
| *Shoreline Plants* | |
| Lamb's Quarters^ | *Chenopodium album* |
| Chicory^ | *Cichorium intybus* |
| Bulb-bearing Hemlock | *Cicuta bulbifera* |
| Canada Thistle^ | *Cirsium arvense* |
| Queen Anne's Lace^ | *Daucus carota* |
| Daisy Fleabane | *Erigeron annuus* |
| Jewelweed | *Impatiens pallida* |
| Purple Loosestrife^ | *Lythrum salicaria* |
| White Sweet Clover^ | *Melilotus alba* |

^Exotic plant or tree species

**Table 5. Aquatic and shoreline plants on MC2, May-September 2003 (cont'd).**

| | |
|---|---|
| *Shoreline Plants* | |
| Yellow Sweet Clover^ | *Melilotus officinalis* |
| Reed Canary Grass^ | *Phalaris arundinacea* |
| Swamp Smartweed | *Polygonum coccineum* |
| Common Arrowhead | *Sagittaria latifolia* |
| Softstem Bulrush | *Scirpus validus* |
| Common Cattail | *Typha latifolia* |
| Blue Vervain | *Verbena hastate* |
| Wild Grape | *Vitis* sp. |
| | |
| *Trees/Shrubs* | |
| Shagbark Hickory | *Carva ovata* |
| Black Walnut | *Juglans nigra* |
| Honeysuckle^ | *Lonicera* sp. |
| Northern Red Oak | *Quercus borealis* |
| Common Buckthorn^ | *Rhamnus cathartica* |
| Staghorn Sumac | R*hus typhina* |
| Sandbar Willow | *Salix interior* |
| Elderberry | *Sambucus* sp. |
| Basswood | *Tilia americana* |

^Exotic plant or tree species

## LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted at McDonald Lakes on August 1 and 6, 2003. The shoreline was assessed for a variety of criteria (See Appendix B for methods), and based on these assessments, several important generalizations could be made. No part of either lake is developed. All of MC1's and 94% of MC2's shorelines are comprised of wetland. There is no erosion occurring on either lake but exotic species are scattered along the entire length of both shorelines. Approximately 6% of MC2's shoreline is woodland along the south shore of the eastern arm (Figure 7). These shorelines are ideal for both preventing erosion and providing quality wildlife habitat. They should be maintained as much as possible.

Invasive plant and tree species, including Canada thistle, purple loosestrife, Queen Anne's lace, reed canary grass, chicory, lamb's quarters, honeysuckle and buckthorn were present along some part of 100% of both shorelines. Although the plants and trees were scattered and only at a moderate density, they are extremely invasive and can exclude native plants from the areas they inhabit. Buckthorn and honeysuckle provide poor shoreline stabilization and may lead to increasing erosion problems in the future. Reed canary grass and purple loosestrife inhabit wetland areas and can easily outcompete native plants. Additionally, they do not provide the quality wildlife habitat or shoreline

stabilization that native plants provide. Steps to eliminate invasive plant and tree species should be carried out in order to reduce competition with native species and enhance the wildlife habitat already present around the McDonald Lakes.

## LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT: MC1 & MC2

A fish survey by the Illinois Department of Natural Resources (IDNR) has never been conducted on the McDonald Lakes and no fish stocking of any kind has been carried out.

Wildlife observations were made on a monthly basis during water quality and plant sampling activities (See Appendix B for methodology). As a result of the dominance of wetland around the McDonald Lakes, an enormous number of wildlife species were observed, including the state endangered osprey and the state threatened pied-billed grebe (Table 7). It is, therefore, very important that the wetland areas around the lake be maintained to provide the appropriate habitat for birds and other animals now and into the future.

**Table 7. Wildlife species observed at McDonald Lakes, May-September 2003.**

| *Birds* | |
|---|---|
| Pied-billed Grebe[+] | *Podilymbus podiceps* |
| Mute Swan | *Cygnus olor* |
| Canada Goose | *Branta canadensis* |
| Mallard | *Anas platyrhnchos* |
| Northern Shoveler | *Anas clypeata* |
| Blue-winged Teal | *Anus discors* |
| Great Egret | *Casmerodius albus* |
| Great Blue Heron | *Ardea herodias* |
| Green Heron | *Butorides striatus* |
| Solitary Sandpiper | *Tringa solitaria* |
| Cooper's Hawk | *Accipiter cooperii* |
| Osprey* | *Pandion haliaetus* |
| Common Flicker | *Colaptes auratus* |
| Red-bellied Woodpecker | *Melanerpes carolinus* |
| Eastern Kingbird | *Tyrannus verticalis* |
| Eastern Pewee | *Contopus virens* |
| Willow Flycatcher | *Empidonax trailii* |
| Barn Swallow | *Hirundo rustica* |
| Tree Swallow | *Iridoprocne bicolor* |
| Rough-winged Swallow | *Stelgidopteryx ruficollis* |
| Bank Swallow | *Riparia riparia* |
| American Crow | *Corvus brachyrhynchos* |

[+]Threatened in Illinois
*Endangered in Illinois

**Table 7. Wildlife species observed at McDonald Lakes, May-September 2003 (cont'd).**

| | |
|---|---|
| *Birds* | |
| Blue Jay | *Cyanocitta cristata* |
| Black-capped Chickadee | *Peocile atricapillus* |
| House Wren | *Troglodytes aedon* |
| Marsh Wren | *Cistothrorus palustris* |
| Catbird | *Dumetella carolinensis* |
| American Robin | *Turdus migratorius* |
| Cedar Waxwing | *Bombycilla cedrorum* |
| Red-eyed Vireo | *Vireo olivaceus* |
| Yellow-rumped Warbler | *Dendroica coronata* |
| Palm Warbler | *Dendroica palmarum* |
| Yellow Warbler | *Dendroica petechia* |
| Common Yellowthroat | *Geothlypis trichas* |
| Red-winged Blackbird | *Agelaius phoeniceus* |
| Eastern Meadowlark | *Sturnella magna* |
| 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* |
| Savanna Sparrow | *Passerculus sandwichensis* |
| *Mammals* | |
| White-tailed Deer | *Odocoileus virginianus* |
| *Amphibians* | |
| Bull Frog | *Rana catesbeiana* |
| Green Frog | *Rana clamitans melanota* |
| Western Chorus Frog | *Pseudacris triseriata triseriata* |

[+]Threatened in Illinois
*Endangered in Illinois

# EXISTING LAKE QUALITY PROBLEMS AND MANAGEMENT SUGGESTIONS

Highpoints of the lakes:

A. Relatively diverse plant species in MC1
B. Wetland areas dominate the shoreline
C. No erosion present along shoreline

- *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 includes intensive treatments, such as fish stocking, dredging, chemical application or aeration. Morphometric data, such as depth, surface area, volume, etc., obtained in the creation of a bathymetric map are necessary for calculation of equations for correct application of these types of techniques. Maps can be created by the Lake County Health Department – Lake Management Unit or other agencies for costs that vary from $3,000-$10,000, depending on lake size.

- *Invasive Shoreline Plant Species*

Purple loosestrife is responsible for the "sea of purple" seen along roadsides and in wetlands during summer. It can quickly dominate a wetland or shoreline. Due in part to an extensive root system, large seed production (estimates range from 100,000 to 2.7 million seeds per plant), and high seed germination rate, purple loosestrife spreads quickly. 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. Purple loosestrife, buckthorn and reed canary grass, as well as several other exotic plant and tree species are present along the shorelines of McDonald Lakes. 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, exotic species can perform many of the original functions that they were brought here for. One isolated plant along a shoreline will probably not create a problem by itself. However, problems arise when plants are left to spread, many times to the point where treatment is difficult or cost prohibitive. A monitoring program should be established, problem areas identified, and control measures taken when appropriate. This

is particularly important in remote areas of lake shorelines where the spread of exotic species may go unnoticed for some time.

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 beetles (*Galerucella pusilla* and *G. calmariensis*) and two weevils (*Hylobius transversovittatus* and *Nanophyes marmoratus*) have offered some hope to control purple loosestrife by natural means. These insects feed on either the leaves or juices of purple loosestrife, eventually weakening or killing the plant. In large stands of loosestrife, the beetles and weevils naturally reproduce and in many locations, significantly retard plant densities. The insects are host specific, meaning that they will attack no other plant but purple loosestrife. The Lake County Forest Preserve District has taken steps to address the purple loosestrife problem in several areas of the county by introducing the bio-control beetle and may want to consider this action around McDonald Lakes. No costs were associated with purchase of the beetles for other projects, as the Forest Preserve District obtained the beetles from the Illinois Natural History Survey at no charge.

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, this may be unacceptable if native plants are found in the proposed treatment area. Herbicides are often used in conjunction with other methods, such as cutting or mowing, to achieve the best results.

- *Lack of Information on Fish Community*

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<br>Adult | Electrofishing<br>Trap nets | Gill nets, trawls, seine<br>Gill nets, electrofishing (F) |
| Lake trout | YOY<br>Adult | Electrofishing (F)<br>Trap nets (F) | Seine (F), trawls |
| Pike, pickerel, muskellange | YOY<br>Adult | Seine (Su)<br>Trap nets (S), gill nets (S,F) | |
| Catfish, bullheads | YOY<br>Adult | Seine<br>Gill nets, trap nets[b] | Baited traps<br>Slat nets, angling |
| Bass, sunfish, crappie | YOY<br>Adult | Seine, electrofishing<br>Electrofishing | <br>Trap nets, angling |
| Minnows, carp, dace, chub, shiners | YOY<br>Adult | Electrofishing<br>Electrofishing | Seine<br>Seine |
| Yellow perch | YOY<br>Adult | Seine (Su), electrofishing<br>Gill net, trap net | Trawls (S) |
| Walleye | YOY<br>Adult | Seine (S), electrofishing<br>Trap nets (S), gill nets (S, F), electrofishing (S, F) | Trawls (S) |

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