2003 SUMMARY REPORT
of
LAKE LOUISE

Lake County, Illinois

Prepared by the

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EXECUTIVE SUMMARY

Lake Louise is a private lake in the Village of Barrington. It is part of the Flint Creek drainage of the Fox River watershed. Lake Louise encompasses approximately 37.8 acres and has a shoreline length of 2.24 miles. The current maximum depth was determined to be 10 feet, as measured in August 2003 at the eastern end of the lake.

Lake Louise's water quality is very poor. Water clarity, as measured by Secchi disk transparency readings, at the inlet sample site averaged 1.95 feet for the season, which is well below the county median of 3.41 feet. The poor readings were due to the shallow nature of the lake, the abundant carp population present, and the lack of aquatic vegetation. The 2003 Secchi average is down slightly from the 1998 average of 2.26 feet. The poor Secchi disk transparencies were due to the high concentrations of total suspended solids (TSS). The 2003 averages for the inlet and outlet sites were 18.6 mg/L and 24.4 mg/L, respectively. These values are significantly higher than the county median for near surface samples of 7.5 mg/L. The 2003 TSS inlet average has increased 25% from 1998 when the average concentration was 14.9 mg/L. Total phosphorus (TP) concentrations at both the inlet and outlet of Lake Louise were also very high. The 2003 average TP concentrations were 0.162 mg/L at the inlet and 0.192 mg/L at the outlet, which are well above the county median for near surface samples of 0.059 mg/L.

The 2003 averages for TDS were 535 mg/L at the inlet and 531 mg/L at the outlet, which are higher than the county median for near surface samples of 451 mg/L. The 2003 TDS concentrations at the inlet represent a 23% increase from the 1998 average of 435 mg/L. Similarly, the 2003 average conductivity readings were 0.9385 milliSiemens/cm at the inlet, which is 25% higher as the county median for near surface samples of 0.7503 milliSiemens/cm. The 2003 conductivity average is 21% higher than the 1998 average of 0.7768 milliSiemens/cm. The possible sources for these high TDS concentrations and conductivity readings are stormwater inputs, streambank erosion from Flint Creek upstream, and road salt used in winter road maintenance.

Aquatic plants were scarce in Lake Louise, due to the poor water clarity in the lake. Sago pondweed was found in only three samples. Duckweed (a free floating plant), curlyleaf pondweed, and elodea were all found only once. Algae blooms were common in Lake Louise during the season.

Approximately 15% or 1,665 feet of the shoreline of Lake Louise was classified as slightly eroding. Moderate erosion was found along 204 feet or 2% of the shoreline. No severe erosion was found around Lake Louise. The moderately eroded areas should be remediated immediately to prevent additional loss of shoreline and prevent continued degradation of the water quality through sediment inputs.

Several exotics were found growing along the shoreline, including buckthorn, honeysuckle, purple loosestrife, and multiflora rose. Removal or control of exotic species is recommended.

LAKE IDENTIFICATION AND LOCATION

Lake Louise (T43N, R10E, Section 31) is a private lake located north of County Line Road and west of Ela Road in the Village of Barrington (Ela Township). It is part of the Flint Creek drainage of the Fox River watershed. The Flint Creek drainage is large (approximately 27.6 square miles) and originates in Cook County. Flint Creek is the main inlet that enters at the southwestern end of the lake. The lake also receives large amounts of stormwater from the surrounding watershed. The outlet is a spillway structure at the northwest end of the lake. Flint Creek eventually flows into the Fox River.

Lake Louise encompasses approximately 37.8 acres and has a shoreline length of 2.24 miles. The current maximum depth was determined to be 10 feet, as measured in August 2003 at the eastern end of the lake. Since no bathymetric (depth contour) map of Lake Louise is known to exist, the volume of the lake was estimated based on data from lakes with known depths and volumes. Mean depth was obtained by multiplying the maximum depth by 0.5. Volume was obtained by multiplying the mean depth by the lake surface area. Based on these calculations, Lake Louise has an estimated mean depth of five feet and volume of 189 acre-feet. Lake elevation is approximately 850 feet above sea level.

BRIEF HISTORY OF LAKE LOUISE

Lake Louise was created in 1967 during the construction of the Fox Point Subdivision. A spillway dam was installed to control water levels. Figure 1 shows the area in a 1939 aerial photograph. It was reported to have a maximum depth of 15 feet shortly after creation. The lake was partially dredged in 1996 when approximately 25,000 cubic yards were removed.

SUMMARY OF CURRENT AND HISTORICAL LAKE USES

Lake Louise is used primarily for the aesthetics of the homeowners around the lake. No motorboats are allowed on the lake, but fishing is allowed. The lake bottom is owned by the Fox Point Homeowners Association, which also owns a park on the northwest shoreline. This park has a private launch and an area where nonmotorized boats are stored in the summer. The park is private and for the use of Association members. The lake has no public access.

The lake is treated several times a year for algae, both filamentous and planktonic. Details of these treatments will be discussed in the **Aquatic Plant Assessment** section.

We conducted a water quality study on Lake Louise in 1998 in addition to this year. We have also conducted studies on several lakes in the area. Information on other recent lake reports can be found on our internet site (www.co.lake.il.us/health/ehs/lakes.asp).

Figure 1. 1939 aerial.

LIMNOLOGICAL DATA – WATER QUALITY

Water samples were collected monthly from May - September at the center of the lake near the Flint Creek inlet and at the outlet near the spillway (Figure 2). See Appendix B for water sampling methods.

Lake Louise's water quality is very poor (Table 1 in Appendix A). Many of the water quality parameters measured were above the averages or medians (where 50% of the lakes are above and below this value) of other lakes that we have monitored. Several important findings were noted.

Water clarity, as measured by Secchi disk transparency readings, at the inlet sample site averaged 1.95 feet for the season, which is well below the county median of 3.41 feet. The readings were deepest in June (2.92 feet) and shallowest in July (1.05 feet). The poor readings were due to the shallow nature of the lake, the abundant carp population present, and the lack of aquatic vegetation. The carp activity in the shallow water resuspends sediment from the lake bottom decreasing clarity and exacerbating other water quality problems. Also, stormwater runoff from the surrounding urban area likely contributed to the poor clarity as this water often contains sediment, nutrients, and pollutants. The 2003 Secchi average is down slightly from the 1998 average of 2.26 feet. To track future water quality trends, it is recommended that the lake become enrolled in the Volunteer Lake Monitoring Program (VMLP), which trains a volunteer to measure the Secchi disk readings bimonthly from April to October. For more information see **Objective II: Illinois Volunteer Lake Monitoring Program.**

The poor Secchi disk transparencies were due to the high concentrations of total suspended solids (TSS). The 2003 averages for the inlet and outlet were 18.6 mg/L and 24.4 mg/L, respectively. These values are significantly higher than the county median for near surface samples of 7.5 mg/L. The highest TSS concentrations correspond to the poorest Secchi readings, because more solids present in the water reduced the Secchi disk visibility (Figure 3). The 2003 inlet average has increased 25% from 1998 when the average concentration was 14.9 mg/L.

Total phosphorus (TP) concentrations at both the inlet and outlet of Lake Louise were very high. The 2003 average TP concentrations were 0.162 mg/L at the inlet and 0.192 mg/L at the outlet, which are well above the county median for near surface samples of 0.059 mg/L. Coupled with the high TP concentrations, Lake Louise had high concentrations of soluble reactive phosphorus (SRP). Aquatic organisms usually utilize SRP as it becomes available. However, aquatic organisms were not able to assimilate all the available SRP since the lake was nitrogen-limited for most of the season.

High nutrient concentrations are usually indicative of water quality problems. Algae need light and nutrients, most importantly carbon, nitrogen (N) and phosphorus (P), to grow. Light and carbon are not normally in short supply (limiting). This means that nutrients (N&P) are usually the limiting factors in algal growth. Nitrogen, as well as

Figure 2. Sample location

Figure 3. TSS and Secchi

carbon, naturally occur in high concentrations and come from a variety of sources (soil, air, etc.) that are more difficult to control than sources of phosphorus. To compare the availability of these nutrients, a ratio of total nitrogen to total phosphorus is used (TN: TP). Ratios < 10:1 indicate nitrogen is limiting. Ratios of >15:1 indicate phosphorus is limiting. Ratios >10:1, <15:1 indicate that there is enough of both nutrients for excessive algal growth. The average ratio between total nitrogen and total phosphorus for Lake Louise in 2003 was 11:1, indicating a nitrogen-limited system. The 1998 ratio was 12:1. Most lakes in Lake County are phosphorus-limited. Due to the high concentrations of TP in Lake Louise, it is not surprising that it is a nitrogen-limited system. Lakes that are phosphorus-limited may be easier to manage, since controlling phosphorus is more feasible than controlling nitrogen or carbon.

This is due to the high concentrations of TP in the lake. Most lakes in the county are phosphorus-limited. The 2003 average TP concentration at the inlet was 14% higher than the 1998 average of 0.142 mg/L. Lake Louise has high TP concentrations due to several factors, including the stormwater that enters the lake, but also from internal sources such as carp activity and algae populations.

Both TSS and TP concentrations increased substantially after June at both sample locations in 2003 and in the 1998 inlet samples. The most plausible explanation for the 2003 findings is that the water levels in the lake dropped considerably (approximately 9 inches from June to July; no 1998 data was available). Further evidence for this drop in water level was the observation of minimal water flow over the spillway in July and no flow in August and September. This lack of flow, coupled with the decline in water volume in the lake, resulted in nutrients and solids becoming concentrated in the lake. The problem is exacerbated by the carp activity, which resuspend nutrients and sediments in the shallow water. While stormwater is a threat to the water quality of Lake Louise, the flow of water from Flint Creek and stormwater pipes around the lake may help “flush” many of the nutrients and solids out of the lake during high water levels. However, the external inputs from stormwater may negate the advantages of the “flushing effect”. Another threat to the lake is probably fertilizer (which often contains phosphorus) applied to the lawns near the lake. It is recommended that homeowners use a no-phosphorus fertilizer on their lawns.

The 2003 seasonal average concentration for total Kjeldahl nitrogen (TKN), which is a measurement of the organic nitrogen in the water, was 1.78 mg/L at the inlet and 1.87 mg/L at the outlet, which are above the county median of 1.22 mg/L. The 1998 average concentration was 1.55 mg/L. This nutrient followed a similar pattern as TSS and TP concentrations, increasing as the season progressed and as the water levels declined.

One positive finding in 2003 was the reduced concentrations of nitrate nitrogen (NO_3-N) in the water, compared to 1998. The 1998 average concentration was 0.090 mg/L, while in 2003, only the May sample had this form of nitrogen in detectable concentrations. However, the May concentration was quite high 0.699 mg/L.

Lake Louise's average concentrations of total dissolved solids (TDS) and conductivity readings were higher than the county medians. These two parameters are correlated as the TDS concentrations become higher conductivity readings increase. The 2003 averages for TDS were 535 mg/L at the inlet and 531 mg/L at the outlet, which are higher than the county median for near surface samples of 451 mg/L. The 2003 TDS concentrations at the inlet represent a 23% increase from the 1998 average of 435 mg/L. Similarly, the 2003 average conductivity readings were 0.9385 milliSiemens/cm at the inlet (conductivity readings were not taken at the outlet), which is 25% higher than the county median for near surface samples of 0.7503 milliSiemens/cm. The 2003 conductivity average is 21% higher than the 1998 average of 0.7768 milliSiemens/cm. The cause for these high TDS concentrations and conductivity readings in Lake Louise is input from dissolved solids washed into the lake from storm events in the watershed. Streambank erosion from the Flint Creek upstream may also be a source. One of the most common dissolved solids is road salt used in winter road maintenance. Because of the high conductivity readings, one additional parameter, chloride, was calculated based on a formula created with known chloride and TDS concentrations and conductivity readings. Chloride concentrations help determine road salt presence since most road salt is sodium chloride, calcium chloride, potassium chloride, magnesium chloride or ferrocyanide salts. The seasonal average for calculated chloride in Lake Louise in 2003 was 167 mg/L at the inlet, a 50% increase from the 1998 calculated chloride concentration of 111 mg/L. The IEPA standard for chloride is 500 mg/L. Once values exceed this standard the water body is deemed to be impaired, thus impacting aquatic life. It appears that the road salt is compounding in many lakes in the county, including Lake Louise. Some lakes in the county have seen a doubling of conductivity readings in the past 5-10 years. In a study by Environment Canada (equivalent to our USEPA), it was estimated that 5% of aquatic species such as fish, zooplankton and benthic invertebrates would be affected at chloride concentrations of about 210 mg/l. Additionally, shifts in algae populations in lakes were associated with chloride concentrations as low as 12 mg/l.

Due to the shallow nature of the lake, a thermocline was never established. Dissolved oxygen (DO) concentrations in Lake Louise remained stable during the season. Generally concern arises when DO concentrations fall below 5 mg/L in the epilimnion. In 2003, all DO concentrations near the surface were above 5 mg/L at the inlet. The lake only experienced anoxic conditions (where DO concentrations drop below 1 mg/L) once (below five feet in August) during our study. Wind and wave action keep this lake well mixed.

As mentioned previously, water levels influenced the water quality in Lake Louise. Rain events probably contribute additional sediment or nutrients (like phosphorus) to a lake. Rain occurred within 48 hours prior to water sampling in May (0.36 inches), June (0.54 mg/L), and July (0.14 inches) as recorded at the Lake County Stormwater Management Commission rain gage in Lake Zurich. Not surprisingly, May and June were the months when the water level in the lake was the highest.

Based on data collected in 2003, standard classification indices compiled by the Illinois Environmental Protection Agency (IEPA) were used to determine the current condition of Lake Louise. A general overall index that is commonly used is called a trophic state index or TSI. The TSI index classifies the lake into one of four categories: oligotrophic (nutrient-poor, biologically unproductive), mesotrophic (intermediate nutrient availability and biological productivity), eutrophic (nutrient-rich, highly productive), or hypereutrophic (extremely nutrient-rich productive). This index can be calculated using TP values obtained at or near the surface. The TSIp for Lake Louise in 2003, based on the average TP at the outlet, classified it as a hypereutrophic lake (TSIp = 80.1). Eutrophic lakes are the most common types of lakes throughout the lower Midwest, and they are particularly common among manmade lakes. See Table 2 in Appendix A for a ranking of average TSIp values for Lake County lakes (Lake Louise is currently #118 of 130). This ranking is only a relative assessment of the lakes in the county. The current rank of a lake is dependent upon many factors including lake origin, water source, nutrient loads, and morphometric features (volume, depth, substrate, etc.). Thus, it would be difficult for a small shallow manmade lake with high nutrient loads to achieve a high ranking even with intensive management.

In Lake Louise, the IEPA aquatic life impairment index was low, indicating a full degree of support for all aquatic organisms in the lake. However, due to the poor water clarity, the swimming index indicated only a degree of partial support. The recreation use index showed a partial impairment, also due to poor water clarity. The overall use index for the lake was partial support.

Removal of carp, dredging the lake, and establishing a native aquatic plant population would be the three most effective means to improve the water quality. However, removal of carp would require using a fish poison to kill all the fish in the lake and it is likely that carp would quickly recolonize the lake due to their presence upstream and downstream (i.e., Flint Creek). Dredging is generally cost prohibitive due to the expense of removing the sediment and identifying a disposal site. Costs range from \$5-30/yd^3. Deepening the entire lake bottom of Lake Louise by one foot would require the removal of almost 300,000 yd^3, at a cost of \$1-9 million. In addition, the dredging may be short-lived due to the sediment inputs coming into the lake from Flint Creek and stormwater inputs.

In addition to the in-lake issues that would need to be addressed, the source of the high nutrient and solid concentrations coming from upstream sources could render any in-lake management futile. Reduction in the stormwater that enters the lake and the improvement of the quality of that water would also benefit the lake. The area upstream and surrounding Lake Louise is highly developed and includes many land uses. As mentioned previously, streambank erosion may be a source of these solids and nutrients.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

Aquatic plant species presence and distribution in Lake Louise were assessed monthly from May through September 2003 (see Appendix B for methods). Only four aquatic plant species and several emergent shoreline plants were found (see Table 3, below). Terrestrial shoreline plants were also noted, but not quantified.

Aquatic plants were scarce in Lake Louise, due mostly to the poor water clarity in the lake and previous herbicide treatments. Sago pondweed was found in only three samples. Duckweed (a free floating plant), curlyleaf pondweed, and elodea were all found only once. Curlyleaf pondweed is an exotic species and can be problematic in some lakes in the county, but at the present time is not a concern in Lake Louise.

In 1998, a fluridone treatment was conducted on the lake to reduce the aquatic plant populations that were viewed as being at nuisance levels. The treatment was conducted at a target concentration of 15 parts per billion. The treatment resulted in a change in the lake from a plant-dominated lake to an algae dominated one. Since this fluridone treatment, the lake has had few submersed plants and is annually treated for algae. In lakes in which this switch has occurred, it is difficult to change the lake back to one dominated by plants, since algae and sediment reduce the light penetration needed for plant growth.

The 1% light level (the point where plant photosynthesis ceases) was at the bottom of the lake in all months except August when the 1% light level was found at four feet. As mentioned previously, the water sampling site (and hence the site where the light levels were recorded) was not at the deepest point in the lake. However, since the light levels at the bottom of the lake at the sample point (5-6 feet deep) ranged from 0-4% during the season, it is unlikely that the available light levels penetrated much deeper than this at the deep hole location. This parameter is critical to aquatic plant growth and is probably the limiting factor in Lake Louise. Unless water clarity is improved, it is unlikely that aquatic plants can become established in the lake. However, it is recommended that aquatic plants are allowed to grow and expand where possible. Establishing aquatic plant populations in the lake will help improve water quality (by utilizing available nutrients, thus, competing with algae), stabilize the bottom sediment, and provide habitat for fish and wildlife. Aquatic plants could even be planted in certain areas to encourage growth. The area around the island would be a good location since the residents around the lake do not heavily use this area.

Because of the lack of aquatic plants and the high concentrations of nutrients in the lake, algae blooms were common in Lake Louise. Both planktonic and filamentous algae were seen during the season and were part of the reason the Secchi disk readings were so poor. The Association hires a commercial applicator to treat the algae during the season. In 2003, copper sulfate treatments were made on seven occasions. Most of these treatments were either along the perimeter of the lake or in the isolated bays where algae was most noticeable.

Floristic quality index (FQI; Swink and Wilhelm 1994) is an assessment tool designed to evaluate the closeness that the flora of an area is 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. Each aquatic plant in a lake is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). This is done for every floating and submersed plant species found in the lake. These numbers are averaged and multiplied by the square root of the number of species present to calculate an FQI. 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 counted in the FQI calculations for Lake County lakes. In 2003, Lake Louise had a FQI of 7.5 (#97 of 118 lakes). The median FQI of lakes that we have studied from 2000-2003 is 14.0.

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

Aquatic Plants	
American Elodea	*Elodea canadensis*
Small Duckweed	*Lemna minor*
Curlyleaf Pondweed[#]	*Potamogeton crispus*
Sago Pondweed	*Stuckenia pectinatus*
Shoreline Plants	
Water Plantain	*Alisma plantago-aquatica*
Swamp Milkweed	*Asclepias incarnata*
Queen Anne's Lace[#]	*Daucus carota*
Spikerush	*Eleocharis* sp.
Joe-Pye Weed	*Eupatorium maculatum*
Sneezeweed	*Helenium autumnale*
Jewelweed	*Impatiens pallida*
Blue Flag Iris	*Iris hexagona*
Honeysuckle[#]	*Lonicera* sp.
Purple Loosestrife[#]	*Lythrum salicaria*
Smartweed	*Polygonum* sp.
Buckthorn[#]	*Rhamnus cathartica*
Multiflora Rose[#]	*Rosa multiflora*
Common Arrowhead	*Sagittaria latifolia*
Willow	*Salix* sp.
Elderberry	*Sambucus* sp.
Hardstem Bulrush	*Scirpus acutus*
Prairie Cordgrass	*Spartina pectinata*
Blue Vervain	*Verbena hastata*

[#] **Exotic species**

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted in July 2003 to determine the condition of the lake shoreline (see Appendix B for methods). Of particular interest was the condition of the shoreline at the water/land interface.

Approximately 76% of the shoreline of Lake Louise was classified as developed, with the only undeveloped area being the island. The most common shoreline type was riprap, which comprised 42% of the shoreline (Figure 5). Shrub and beach were the next most common types at 21% and 16%, respectively. Seawall (9%), lawn (5%), buffer (4%), and wetland (3%) habitat made up the remaining shoreline types. The buffer habitat (which is a strip of unmowed vegetation preferably consisting of native plants located at the water's edge) should be expanded since the buffers benefit the lake by filtering nutrients and pollutants before they enter the lake and by creating habitat for fish and wildlife. Buffers are also not preferred habitat of Canada geese.

The shoreline was assessed for the degree and type of shoreline erosion. Approximately 15% or 1,665 feet of the shoreline of Lake Louise was classified as slightly eroding (Figure 6). Moderate erosion was found along 204 feet or 2% of the shoreline. No severe erosion was found around Lake Louise. The moderate erosion was occurring in two locations, a 91-foot section on the eastern end of the island, and a 113-foot section on the northern shoreline. The moderately eroded areas should be remediated immediately to prevent additional loss of shoreline and prevent continued degradation of the water quality through sediment inputs. More information can be found in **Objective III: Shoreline Erosion Control**. When possible, the shorelines should be repaired by using native plantings. Riprap and seawalls are considered less preferable.

Several exotics were found growing along the shoreline, including buckthorn, honeysuckle, purple loosestrife, and multiflora rose. Similar to aquatic exotics, these terrestrial exotics are detrimental to the native plant ecosystems around the lake. Removal or control of exotic species is recommended. More information can be found in **Objective IV: Eliminate or Control Exotic Species**.

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Good numbers of wildlife, particularly birds, were noted on and around Lake Louise. See Appendix B for methods. Several of the species listed in Table 5 were seen during spring or fall migration and were assumed not to be nesting around the lake. Habitat around Lake Louise was rated as fair due to the residential areas around the lake. Additional habitat may be created around the lake, such as erecting birdhouses. More information can be found in **Objective V: Enhance Wildlife Habitat Conditions**.

One wildlife problem that was identified was the large numbers of resident Canada geese that were seen throughout the season. Resident geese contribute large amounts of feces to

Figure 5. Shoreline types.

Figure 6. Shoreline erosion.

the surrounding landscape. The nutrient-rich feces eventually washes into the lake, which can exacerbate problems in the lake, including excessive algae blooms. Controlling resident geese can be difficult and in some cases, permits are required by the Illinois Department of Natural Resources. Growing buffer strips around the lake will help discourage geese from using lawns and allowing the lake to completely freeze in the winter will potentially encourage geese to move away from the lake. More information can be found in **Objective VI: Canada Goose Management.**

We did not conduct any fish surveys of Lake Louise in 2003. However, numerous carp were seen throughout the season. As mentioned previously, carp reduce the water quality of the lake significantly by stirring up the lake bottom sediment, which is also detrimental to fish and wildlife habitat in the lake. Elimination of carp from Lake Louise would be difficult since they inhabit areas throughout Flint Creek.

Table 5. Wildlife species observed on Lake Louise, April – September 2003.

Birds	
Double-crested Cormorant	*Phalacrocorax auritus*
Mute Swan	*Cygnus olor*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhnchos*
Great Egret	*Casmerodius albus*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides striatus*
Unknown Sandpiper	*Calidris* sp.
Turkey Vulture	*Cathartes aura*
Mourning Dove	*Zenaida macroura*
Eastern Kingbird	*Tyrannus tyrannus*
Willow Flycatcher	*Empidonax traillii*
Tree Swallow	*Iridoprocne bicolor*
Rough-wing Swallow	*Stelgidopteryx ruficollis*
Chimney Swift	*Chaetura pelagica*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
Black-capped Chickadee	*Poecile atricapillus*
Catbird	*Dumetella carolinensis*
American Robin	*Turdus migratorius*
Rock Dove	*Columba livia*
Yellow Warbler	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Red-winged Blackbird	*Agelaius phoeniceus*
Common Grackle	*Quiscalus quiscula*
House Sparrow	*Passer domesticus*
Northern Cardinal	*Cardinalis cardinalis*
House Finch	*Carpodacus mexicanus*

Table 5. Wildlife species observed on Lake Louise, April – September 2003 (cont'd).

American Goldfinch	*Carduelis tristis*
Song Sparrow	*Melospiza melodia*
Mammals	
None noted.	
Amphibians	
None noted.	
Reptiles	
Painted Turtle	*Chrysemys picta*
Fish	
Common Carp	*Cyprinus carpio*

EXISTING LAKE QUALITY PROBLEMS

- *Lack of a Quality Bathymetric Map*

  A bathymetric (depth contour) map is an essential tool for effective lake management since it provides critical information on the morphometric features of the lake (i.e., acreage, depth, volume, etc.). This information is particularly important when intensive management techniques (i.e., chemical treatments for plant or algae control, aeration, dredging, fish stocking, etc.) are part of the lake's overall management plan. Currently, no bathymetric map of Lake Louise is known to exist.

- *Poor Water Clarity*

  Lake Louise had an average Secchi disk transparency reading of 1.95 feet, which is well below the county median of 3.41 feet. Poor clarity was attributed to the extensive carp activity, algae blooms, nutrient and sediment inputs from Flint Creek, and lack of aquatic plants. Clarity readings have decline since 1998 when the average was 2.26 feet.

- *High Nutrient Concentrations*

  The lake had high concentrations of total phosphorus (TP), soluble reactive phosphorus (SRP) as well as total Kjeldahl nitrogen (TKN). High nutrient concentrations, particularly TP and SRP, contribute to the algae blooms and poor water clarity. While the source of the nutrients may be from upstream sources or the surrounding watershed, many of the nutrients are likely internally recycled in the lake. TP, SRP, and TKN concentrations have all increased in the lake since 1998.

- *High Concentrations of Total Suspended Solids (TSS)*

  Lake Louise had high TSS concentrations at both the inlet and outlet. The average concentrations at the inlet (18.6 mg/L) and outlet (24.4 mg/L) were significantly higher than the county median (7.5 mg/L). The high concentrations in the lake were due mostly to the carp activity, as well as wind action, in the shallow water, which resuspended sediment into the water column. Streambank erosion from Flint Creek may also be a source.

- *High Conductivity Readings and Concentrations of Total Dissolved Solids (TDS)*

  The average concentrations of TDS and conductivity readings were higher than the county medians. The 2003 averages for TDS were 535 mg/L at the inlet and 531 mg/L at the outlet, compared to the county median for near surface samples of 451 mg/L. Similarly, the 2003 average conductivity reading at the inlet was 0.9385 milliSiemens/cm, compared to the county median for near surface samples of 0.7503 milliSiemens/cm. Both TDS concentrations and conductivity readings have increased since 1998, by 23% and 21%, respectively. A possible cause for these high TDS concentrations and conductivity readings is input from dissolved solids (i.e., road salt and streambank erosion) washed into the lake.

- *Limited Aquatic Vegetation*

  Aquatic plants were scarce in Lake Louise, due mostly to the poor water clarity and past herbicide treatments in the lake. Sago pondweed was only found at three sites, while duckweed, curlyleaf pondweed, and elodea were found only once. Unless the water clarity in the lake is improved, the aquatic vegetation in the lake will remain depressed. However, it is recommended that aquatic vegetation be allowed to grow and expand to help improve the water quality and fish and wildlife habitat.

- *Shoreline Erosion*

  Fluctuating water levels on Lake Louise may be one cause of the shoreline erosion. Approximately 15% or 1,665 feet of the shoreline of Lake Louise was classified as slightly eroding. Moderate erosion was found along 204 feet or 2% of the shoreline. No severe erosion was found around Lake Louise. The moderate erosion was occurring in two locations, a 91-foot section on the eastern end of the island, and a 113-foot section on the northern shoreline. The moderately eroded areas should be remediated immediately to prevent additional loss of shoreline and prevent continued degradation of the water quality through sediment inputs.

- *Invasive Shoreline Plant Species*

  Numerous exotic plant species (i.e., honeysuckle, purple loosestrife, buckthorn, and multiflora rose) were found on the shores of Lake Louise. These plants are particularly problematic as they outcompete native plants and offers little value in terms of shoreline stabilization or wildlife habitat. Plants should be removed and replaced with native shoreline plants.

- *Canada Geese*

  Numerous resident Canada geese were observed throughout the season on lawns surrounding the lake. Geese can be problematic since they contribute large amounts of feces to the surrounding landscape. The nutrient-rich feces eventually washes into the lake, exacerbating the nutrient problems in the lake, which can lead to excessive algae blooms. Growing buffer habitat along the shoreline and allowing the lake to completely freeze during the winter will aid in the management of this bird species.

POTENTIAL OBJECTIVES FOR THE LAKE LOUISE MANAGEMENT PLAN

I. Create a Bathymetric Map Including a Morphometric Table
II. Illinois Volunteer Lake Monitoring Program
III. Shoreline Erosion Control
IV. Eliminate or Control Exotic Plant Species
V. Enhance Wildlife Habitat Conditions
VI. Canada Goose Management

OPTIONS FOR ACHIEVING THE LAKE MANAGEMENT PLAN OBJECTIVES

Objective I: Create a Bathymetric Map Including a Morphometric Table

A bathymetric map (depth contour) 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. 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: Participate 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 lake shore 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.

Currently the number of volunteers in the six county northeast Illinois region has reached its limit with regard to how many volunteers NIPC can handle. New lakes wishing to be part of the VLMP will be taken on and trained by the Lake County Health Department Lakes Management Unit (LMU). If you would like to be placed on this training list or would simply like more information, contact the Lakes Management Unit Local Coordinator:

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

Objective III: Shoreline Erosion Control

Erosion is a potentially serious problem to lake shorelines and occurs as a result of wind, wave, or ice action or from overland rainwater runoff. While some erosion to shorelines is natural, human alteration of the environment can accelerate and exacerbate the problem. Erosion not only results in loss of shoreline, but negatively influences the lake's overall water quality by contributing nutrients, sediment, and pollutants into the water. This effect is felt throughout the food chain since poor water quality negatively affects everything from microbial life to sight feeding fish and birds to people who want to use the lake for recreational purposes. The resulting increased amount of sediment will over time begin to fill in the lake, decreasing overall lake depth and volume and potentially impairing various recreational uses.

Because the topography around Lake Louise is relatively flat, the areas of shoreline erosion could be corrected using **Option 4: Create a Buffer Strip** or **Option 6: Install Biolog, Fiber Roll, or Straw Blanket with Plantings.** In addition, the entire shoreline of the lake would benefit by installing buffer strips between the lake and manicured lawns.

Option 1: No Action

Pros

There are no short-term costs to this option. However, extended periods of erosion may result in substantially higher costs to repair the shoreline in the future.

Eroding banks on steep slopes can provide habitat for wildlife, particularly bird species (e.g., kingfishers and bank swallows) that need to burrow into exposed banks to nest. In addition, certain minerals and salts in the soils are exposed during the erosion process, which are utilized by various wildlife species.

Cons

Taking no action will most likely cause erosion to continue and subsequently may cause poor water quality due to high levels of sediment or nutrients entering a lake. This in turn may retard plant growth and provide additional nutrients for algal growth. A continual loss of shoreline is both aesthetically unpleasing and may potentially reduce property values. Since a shoreline is easier to protect than it is to rehabilitate, it is in the interest of the property owner to address the erosion issue immediately.

Costs

In the short-term, cost of this option is zero. However, long-term implications can be severe since prolonged erosion problems may be more costly to repair than if the problems were addressed earlier. As mentioned previously, long-term erosion may cause serious damage to shoreline property and in some cases lower property values.

Option 2: Install a Seawall

Seawalls are designed to prevent shoreline erosion on lakes in a similar manner they are used along coastlines to prevent beach erosion or harbor siltation. Today, seawalls are generally constructed of steel, although in the past seawalls were made of concrete or wood (frequently old railroad ties). Concrete seawalls cracked or were undercut by wave action requiring routine maintenance. Wooden seawalls made of old railroad ties are not used anymore since the chemicals that made the ties rot-resistant could be harmful to aquatic organisms. A new type of construction material being used is vinyl or PVC. Vinyl seawalls are constructed of a lighter, more flexible material as compared to steel. Also, vinyl seawalls will not rust over time as steel will.

Pros

If installed properly and in the appropriate areas (i.e., shorelines with severe erosion) seawalls provide effective erosion control. Seawalls are made to last numerous years and have relatively low maintenance.

Cons

Seawalls are disadvantageous for several reasons. One of the main disadvantages is that they are expensive, since a professional contractor and heavy equipment are needed for installation. Any repair costs tend to be expensive as well. If any fill material is placed in the floodplain along the shoreline, compensatory storage may also be needed. Compensatory storage is the process of excavating in a portion of a property or floodplain to compensate for the filling in of another portion of the floodplain. Permits and surveys are needed whether replacing and old seawall or installing a new one (see costs below).

Wave deflection is another disadvantage to seawalls. Wave energy not absorbed by the shoreline is deflected back into the lake, potentially causing sediment disturbance and resuspension, which in turn may cause poor water clarity and problems with nuisance algae, which use the resuspended nutrients for growth. If seawalls are installed in areas near channels, velocity of run-off water or channel flow may be accelerated. This may lead to flooding during times of high rainfall and run-off, shoreline erosion in other areas of the lake, or a resuspension of sediment due to the agitation of the increased wave action or channel flow, all of which may contribute to poor water quality conditions throughout the lake. Plant growth may be limited due to poor water clarity, since the photosynthetic zone where light can penetrate, and thus utilized by plants, is reduced. Healthy plants are important to the lake's overall water clarity since they can help filter some of the incoming sediment, prevent resuspension of bottom sediment, and compete with algae for nutrients. However, excessive sediment in the water and high turbidity may overwhelm these benefits.

Finally, seawalls provide no habitat for fish or wildlife. Because there is no structure for fish, wildlife, or their prey, few animals use shorelines with seawalls. In addition, poor water clarity that may be caused by resuspension of sediment from deflected wave action contributes to poor fish and wildlife habitat, since sight feeding fish and birds (i.e., bass, herons, and kingfishers) are less successful at catching prey. This may contribute to a lake's poor fishery (i.e., stunted fish populations).

Costs

Depending on factors such as slope and shoreline access, cost of seawall installation ranges from $85-100 per linear foot for steel and $95-110 per linear foot for vinyl. A licensed contractor installs both types of seawall. Additional costs may occur if the shoreline needs to be graded and backfilled, has a steep slope, or poor accessibility. Price does not include the necessary permits required. Additional costs will be incurred if compensatory storage is needed. Prior to the initiation of work, permits and/or surveys from the appropriate government agencies need to be obtained. For seawalls, a site development permit and a building permit are needed. Costs for permits and surveys can be $1,500-2,000 for installation of a seawall. Contact the Army Corps of Engineers, local municipality, or the Lake County Planning and Development Department.

Around Lake Louise, the costs to install a seawall along the moderately eroded shoreline (204 feet) would cost approximately $17,340 – 20,400 for steel and $19,380 – 22,440 for vinyl, excluding permits.

Option 3: Install Rock Rip-Rap or Gabions

Rip-rap is the term for using rocks to stabilize shorelines. Size of the rock depends on the severity of the erosion, distance to rock source, and aesthetic preferences. Generally, four to eight inch diameter rocks are used. Gabions are wire cages or baskets filled with rock. They provide similar protection as rip-rap, but are less prone to displacement. They can be stacked, like blocks, to provide erosion control for extremely steep slopes. Both rip-rap and gabions can be incorporated with other erosion control techniques such as plant buffer strips. If any plants will be growing on top of the rip-rap or gabions, fill will probably be needed to cover the rocks and provide an acceptable medium for plants to grow on. Prior to the initiation of work, permits and/or surveys from the appropriate government agencies need to be obtained (see costs below).

Pros

Rip-rap and gabions can provide good shoreline erosion control. Rocks can absorb some of the wave energy while providing a more aesthetically pleasing appearance than seawalls. If installed properly, rip-rap and gabions will last for many years. Maintenance is relatively low, however, undercutting of the bank can cause sloughing of the rip-rap and subsequent shoreline. Areas with severe erosion problems may benefit from using rip-rap or gabions. In all cases, a filter fabric should be installed under the rocks to maximize its effectiveness.

Fish and wildlife habitat can be provided if large boulders are used. Crevices and spaces between the rocks can be used by a variety of animals and their prey.

Small mammals, like shrews can inhabit these spaces in the rock above water and prey upon many invertebrate species, including many harmful garden and lawn pests. Also, small fish may utilize the structure underwater created by large boulders for foraging and hiding from predators.

Cons

A major disadvantage of rip-rap is the initial expense of installation and associated permits. Installation is expensive since a licensed contractor and heavy equipment are generally needed to conduct the work. Permits are required if replacing existing or installing new rip-rap or gabions and must be acquired prior to work beginning. If any fill material is placed in the floodplain along the shoreline, compensatory storage may also be needed. Compensatory storage is the process of excavating in a portion of a property or floodplain to compensate for the filling in of another portion of the floodplain.

While rip-rap and gabions absorb wave energy more effectively than seawalls, there is still some wave deflection that may cause resuspension of sediment and nutrients into the water column.

Small rock rip-rap is poor habitat for many fish and wildlife species, since it provides limited structure for fish and cover for wildlife. As noted earlier, some small fish and other animals will inhabit the rocks if boulders are used. Smaller rip-rap is more likely to wash away due to rising water levels or wave action. On the other hand, larger boulders are more expensive to haul in and install.

Rip-rap may be a concern in areas of high public usage since it is difficult and possibly dangerous to walk on due to the jagged and uneven rock edges. This may be a liability concern to property owners.

Costs

Cost and type of rip-rap used depend on several factors, but average cost for installation (rocks and filter fabric) is approximately $35-50 per linear foot. Costs for gabions are approximately $70-100 per linear foot when filled with rocks. The steeper the slope and severity of erosion, the larger the boulders that will need to be used and thus, higher installation costs. In addition, costs will increase with poor shoreline accessibility and increased distance to rock source. Costs for permits and surveys can be $1,500-2,000 for installation of rip-rap or gabions, depending on the circumstances. Additional costs will be incurred if compensatory storage is needed. Contact the Army Corps of Engineers, local municipalities, and the Lake County Planning and Development Department.

Around Lake Louise, the costs to install riprap along the moderately eroded shoreline (204 feet) would cost approximately $7,140 – 10,200, excluding permits.

<u>Option 4: Create a Buffer Strip</u>

Another effective method of controlling shoreline erosion is to create a buffer strip with existing or native vegetation. Native plants have deeper root systems than turfgrass and thus hold soil more effectively. Native plants also provide positive aesthetics and good wildlife habitat. Cost of creating a buffer strip is quite variable, depending on the current state of the vegetation and shoreline and whether vegetation is allowed to become established naturally or if the area needs to be graded and replanted. Allowing vegetation to naturally propagate the shoreline would be the most cost effective, depending on the severity of erosion and the composition of the current vegetation. Non-native plants or noxious weedy species may be present and should be controlled or eliminated.

Stabilizing the shoreline with vegetation is most effective on slopes no less than 2:1 to 3:1, horizontal to vertical, or flatter. Usually a buffer strip of at least 25 feet is recommended, however, wider strips (50 or even 100 feet) are recommended on steeper slopes or areas with severe erosion problems. Areas where erosion is severe or where slopes are greater than 3:1, additional erosion control techniques may have to be incorporated such as biologs, A-Jacks®, or rip-rap.

Buffer strips can be constructed in a variety of ways with various plant species. Generally, buffer strip vegetation consists of native terrestrial (land) species and emergent (at the land and water interface) species. Terrestrial vegetation such as native grasses and wildflowers can be used to create a buffer strip along lake shorelines. A table in Appendix A gives some examples, seeding rates and costs of grasses and seed mixes that can be used to create buffer strips. Native plants and seeds can be purchased at regional nurseries or from catalogs. When purchasing seed mixes, care should be taken that native plant seeds are used. Some commercial seed mixes contain non-native or weedy species or may contain annual wildflowers that will have to be reseeded every year. If purchasing plants from a nursery or if a licensed contractor is installing plants, inquire about any guarantees they may have on plant survival. Finally, new plants should be protected from herbivory (e.g., geese and muskrats) by placing a wire cage over the plants for at least one year.

A technique that is sometimes implemented along shorelines is the use of willow posts, or live stakes, which are harvested cuttings from live willows (*Salix* spp.). They can be planted along the shoreline along with a cover crop or native seed mix. The willows will resprout and begin establishing a deep root structure that secures the soil. If the shoreline is highly erodible, willow posts may have to be used in conjunction with another erosion control technique such as biologs, A-Jacks ®, or rip-rap.

Emergent vegetation, or those plants that grow in shallow water and wet areas, can be used to control erosion more naturally than seawalls or rip-rap. Native emergent vegetation can be either hand planted or allowed to become established on its own over time. Some plants, such as native cattails (*Typha* sp.), quickly spread and help stabilize shorelines, however they can be aggressive and may pose a problem later. Other species, such as those listed in a table in Appendix A should be considered for native plantings.

Pros

Buffer strips can be one of the least expensive means to stabilize shorelines. If no permits or heavy equipment are needed (i.e., no significant earthmoving or filling is planned), the property owner can complete the work without the need of professional contractors. Once established (typically within 3 years), a buffer strip of native vegetation will require little maintenance and may actually reduce the overall maintenance of the property, since the buffer strip will not have to be continuously mowed, watered, or fertilized. Occasional high mowing (1-2 times per year) for specific plants or physically removing other weedy species may be needed.

The buffer strip will stabilize the soil with its deep root structure and help filter run-off from lawns and agricultural fields by trapping nutrients, pollutants, and sediment that would otherwise drain into the lake. This may have a positive impact on the lake's water quality since there will be less "food" for nuisance algae. Buffer strips can filter as much as 70-95% of sediment and 25-60% of nutrients and other pollutants from runoff.

Another benefit of a buffer strip is potential flood control protection. Buffer strips may slow the velocity of flood waters, thus preventing shoreline erosion. Native plants also can withstand fluctuating water levels more effectively than commercial turfgrass. Many plants can survive after being under water for several days, even weeks, while turfgrass is intolerant of wet conditions and usually dies after several days under water. This contributes to increased maintenance costs, since the turfgrass has to be either replanted or replaced with sod. Emergent vegetation can provide additional help in preserving shorelines and improving water quality by absorbing wave energy that might otherwise batter the shoreline. Calmer wave action will result in less shoreline erosion and resuspension of bottom sediment, which may result in potential improvements in water quality.

Many fish and wildlife species prefer the native shoreline vegetation habitat. This habitat is an asset to the lake's fishery since the emergent vegetation cover may be used for spawning, foraging, and hiding. Various wildlife species are even dependent upon shoreline vegetation for their existence. Certain birds, such as marsh wrens (*Cistothorus palustris*) and endangered yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) nest exclusively in emergent vegetation like cattails and bulrushes. Hosts of other wildlife like waterfowl, rails, herons, mink, and frogs to mention just a few, benefit from healthy stands of shoreline vegetation. Dragonflies, damselflies, and other beneficial invertebrates can be found thriving in vegetation along the shoreline as well. Two invertebrates of particular importance for lake management, the water-milfoil weevils (*Euhrychiopsis lecontei* and *Phytobius leucogaster*), which have been shown to naturally reduce stands of exotic Eurasian water-milfoil (*Myriophyllum spicatum*). Weevils need proper over wintering habitat such as leaf litter and mud which are typically found on naturalized shorelines or shores with good buffer strips. Many species of amphibians, birds, fish, mammals, reptiles, and invertebrates have suffered precipitous declines in recent years primarily due to habitat loss. Buffer strips may help many of these species and preserve the important diversity of life in and around lakes.

In addition to the benefits of increased fish and wildlife use, a buffer strip planted with a variety of native plants may provide a season long show of various colors from flowers, leaves, seeds, and stems. This is not only aesthetically pleasing to people, but also benefits wildlife and the overall health of the lake's ecosystem.

Cons
There are few disadvantages to native shoreline vegetation. Certain species (i.e., cattails) can be aggressive and may need to be controlled occasionally. If stands of shoreline vegetation become dense enough, access and visibility to the lake may be compromised to some degree. However, small paths could be cleared to provide lake access or smaller plants could be planted in these areas.

Costs
If minimal amount of site preparation is needed, costs can be approximately $15 per linear foot, plus labor. Cost of installing willow posts is approximately $20-25 per linear foot. The labor that is needed can be completed by the property owner in most cases, although consultants can be used to provide technical advice where needed. This cost will be higher if the area needs to be graded. If grading is necessary, appropriate permits and surveys are needed. If filling is required, additional costs will be incurred if compensatory storage is needed. The permitting process is costly, running as high as $1,500-2,000 depending on the types of permits needed.

Option 5: Install A-Jacks®

A-Jacks® are made of two pieces of pre-cast concrete when fitted together resemble a child's playing jacks. These structures are installed along the shoreline and covered with soil and/or an erosion control product. Native vegetation is then planted on the backfilled area. They can be used in areas where severe erosion does not justify a buffer strip alone.

Pros
The advantage to A-Jacks® is that they are quite strong and require low maintenance once installed. In addition, once native vegetation becomes established the A-Jacks® can not be seen. They provide many of the advantages that both rip-rap and buffer strips have. Specifically, they absorb some of the wave energy and protect the existing shoreline from additional erosion. The added benefit of a buffer strip gives the A-Jacks® a more natural appearance, which may provide wildlife habitat and help filter run-off nutrients, sediment, and pollutants. Less run-off entering a lake may have a positive effect on water quality.

Cons
The disadvantage is that installation cost can be high since labor is intensive and requires some heavy equipment. A-Jacks® need to be pre-made and hauled in from the manufacturing site. These assemblies are not as common as rip-rap, thus only a limited number of contractors may be willing to do the installation.

Costs
The cost of installation is approximately $50-75 per linear foot, but does not include permits and surveys, which can cost $1,500-2,000 and must be obtained prior to any work implementation. Additional costs will be incurred if compensatory storage is needed.

To repair the moderately eroding areas (204 feet) on Lake Louise with A-Jacks® would cost approximately $10,200 – 15,300.

Option 6: Install Biolog, Fiber Roll, or Straw Blanket with Plantings
These products are long cylinders of compacted synthetic or natural fibers wrapped in mesh. The rolls are staked into shallow water. Once established, a buffer strip of native plants can be planted along side or on top of the roll (depending if rolls are made of synthetic or natural fibers). They are most effective in areas where plantings alone are not effective due to already severe erosion. In areas of severe erosion, other techniques may need to be employed or incorporated with these products.

This is the preferred option to repair the eroded area around Lake Louise. Since the slope grade is relatively flat, this technique may be effective at controlling future erosion as well as providing needed habitat.

Pros
Biologs, fiber rolls, and straw blankets provide erosion control that secure the shoreline in the short-term and allow native plants to establish which will eventually provide long-term shoreline stabilization. They are most often made of biodegradable materials, which break down by the time the natural vegetation becomes established (generally within 3 years). They provide additional strength to the shoreline, absorb wave energy, and effectively filter run-off from terrestrial sources. These factors help improve water quality in the lake by reducing the amount of nutrients available for algae growth and by reducing the sediment that flows into a lake.

Cons
These products may not be as effective on highly erodible shorelines or in areas with steep slopes, as wave action may be severe enough to displace or undercut these products. On steep shorelines grading may be necessary to obtain a 2:1 or 3:1 slope or additional erosion control products may be needed. If grading or filling is needed, the appropriate permits and surveys will have to be obtained.

Costs
Costs range from $40 to $45 per linear foot of shoreline, including plantings. This does not include the necessary permits and surveys, which may cost $1,500 – 2,000 depending on the type of earthmoving that is being done. Additional costs may be incurred if compensatory storage is needed.

To repair the moderately eroding areas (204 feet) on Lake Louise with this option would cost approximately $8,160 – 9,180.

Objective IV: 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.

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. Control of purple loosestrife, 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. 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.

Option 1: No Action

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. A table 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.

<u>Option 2: Biological Control</u>

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.

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 4: 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 V: 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).

Option 1: No Action

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 (see the table in 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 the table in 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.

Objective VI: Canada Goose Management

Canada geese (*Branta canadensis*) are migratory waterfowl common throughout North America. Geese in urban areas can be undesirable primarily due to the large amount of feces they leave behind. Recreational activities on lawns and parks are impeded due to goose feces. Large amounts of feces may end up in the water, either directly from geese on the water or rainwater runoff from lawns where feces have accumulated. Goose feces are high in organic phosphorus. High nutrient levels, particularly phosphorus, can contribute to excessive algae growth in lakes. This may inhibit other recreational activities such as boating or swimming, as well as create poor habitat for fish and wildlife, and possibly bad odors when the algae decays.

Geese become problematic for many reasons. They seek locations that have open water, adequate food supplies, and safety from predators. If these factors are present, geese may not migrate. Since geese exhibit a high level of site fidelity, they return to (or stay at) the same area each year. Thus, adults will likely come back to the same area year after year to nest. If conditions remain optimal, one pair of geese can quickly multiply causing additional problems. Increased development in Lake County has inadvertently created ideal habitat for goose populations. Manicured lawns mowed to the edge of lakes and detention ponds provide geese with open areas with ample food and security. Other conditions that encourage goose residency include open water during winter (primarily the result of aerators in lakes and ponds), mild winters, and people feeding birds with bread or similar human food.

Large populations of geese pose a potential disease threat both to resident and wild populations of waterfowl. This problem may be more serious in residential populations since these birds stay in one area for long periods of time are more likely to transmit any disease to neighboring groups of geese. There is no threat of disease transmission to humans or domestic dogs and cats since most of the diseases are specific to birds.

Option 1: No Action

Pros

This option has no costs, however, increasing numbers of geese will most likely exacerbate existing problems and probably create new ones, which in the future may cost more than if the problems are addressed immediately.

Cons

If current conditions continue and no action is taken, numbers of Canada Geese and problems associated with them will likely increase. An increase of goose feces washed into a lake will increase the lake's nutrient load and eventually may have a detrimental impact on water quality through excessive algae growth. One study (Manny et al. 1975) documented that each goose excretes 0.072 lbs of feces per day. This may not seem like a significant amount, but if 100 geese are present (many lakes in the county can experience 1,000 or more at a time) that equates to over 7 lbs of feces per day! Algae blooms may negatively impact recreational uses such as swimming, boating, and fishing. In addition, when algae dies, odor problems and depleted oxygen levels in the water occur. Increased numbers of geese may also result in overgrazed areas of grass.

Costs

There are a few short-term financial costs with this option. Costs of cleaning feces off lawns or piers are probably more psychological or physical than financial. Long-term costs may be more indirect, including increased nutrient deposition into lakes which may promote excessive algae and plants. Costs incurred may include money needed to control algae with algaecides.

Option 2: Removal

Since Canada Geese are considered migratory waterfowl, both state and federal laws restrict taking or harassing geese. Under the federal Migratory Bird Treaty Act, it is illegal to kill or capture geese outside a legal hunting season or to harass their nests without a permit. If removal of problematic geese is warranted or if nest and egg destruction is an option, permits need to be obtained from the Illinois Department of Natural Resources (217- 782-6384) and the U.S. Fish and Wildlife Service (217-241-6700).

Hunting is one of the most effective techniques used in goose management. However, since many municipalities have ordinances prohibiting the discharge of firearms, reduction of goose numbers by hunting in urban areas (i.e., lakes, ponds, and parks) may not be an option. Hunting does occur on many lakes in the county, but certain regulations apply (e.g., 100 yard minimum distance from any residential property). Contact the Illinois Department of Natural Resources for dates and regulations regarding the waterfowl hunting seasons. Also, contact local and county law enforcement agencies regarding any ordinances concerning hunting within municipal boundaries.

Egg addling, or destroying the egg by shaking, piercing, or freezing, can be used to reduce or eliminate a successful clutch. Eggs should be returned to the nest so the hen goose does not re-lay another clutch. However, if no eggs hatch, she may still lay another clutch. Leaving one or two eggs unaltered and allowing them to hatch may prevent another clutch from being laid and reduces the total year’s reproduction. Egg addling requires a state and federal permit.

The capture and relocation of geese is no longer a desirable option. First, relocated geese may return to the same location where they were captured. Second, there is a concern over potential disease transmission from relocated geese to other goose populations. Finally, since goose numbers in Illinois are already high there is no need to supplement other populations in the area.

Pros

Removing a significant portion of a problem goose population can have a positive effect on the overall health of a lake. Reduction of feces on lawns and parks is beneficial to recreation users of all types. Less feces in the water means less phosphorus available for nuisance plant and algae growth. Thus, the overall water quality of the lake may be improved by this reduction in phosphorus.

Cons
If the habitat conditions still exist, more geese will likely replace any that were removed. Thus, money and time used removing geese may not be well spent unless there is a change in habitat conditions.

Costs
A Illinois residential waterfowl hunting license (including state and federal waterfowl stamps) is $39.00 for the 2002-2003 hunting season. For depredation permits, there is a $25 fee for the federal permit. Once the federal permit is issued the state permit can be obtained at no charge.

Option 3: Dispersal/Repellent Techniques
Several techniques and products are on the market that claim to disperse or deter geese from using an area. These techniques can be divided into two categories: harassment and chemical. With both types of techniques it is important to implement any action early in the season, before geese establish territories and begin nesting. Once established, the dispersal/repellant techniques may be less effective and geese more difficult to coerce into leaving.

The goal with harassment techniques is to frighten geese from an area using sounds or objects. Various products are available that simulate natural predators (i.e., plastic hawks and owls) or otherwise make geese nervous (i.e., balloons, shiny tape, and flags). Other products emit noises, such as propane cannons, which can be set on a timer to go off at programmed intervals (e.g., every 20-30 seconds), or recorded goose distress calls which can be played back over a loudspeaker or tape player. Over time these techniques may be ineffective, since geese become acclimated to these devices. Most of these products are more effective when used in combination with other techniques.

Another technique that has become popular is using dogs or swans to harass geese. Dogs can be used primarily in the spring and fall to keep birds from using an area by herding or chasing geese away from a particular area. Any dogs used for this purpose should be well trained and under the owners control at all times. Professional trainers can be contracted to use their dogs for this purpose. Dogs should not be used during the summer when geese are unable to fly due to molting. Swans are used because they are naturally aggressive in defending their territory, including chasing other waterfowl away from their nesting area. Since wild swans cannot be used for this technique, non-native mute swans are used. However, mute swans are not as aggressive and in some case are permissive of geese. Again, using a combination of techniques would be most effective.

Chemical repellents can be used with some effectiveness. New products are continually coming out that claim to rid an area of nuisance geese. Several products (ReJeX-iT® and GooseChase™) are made from methyl-anthranilate, a natural occurring compound, and can be sprayed on areas where geese are feeding. The spray makes the grass distasteful and forces geese to move elsewhere to feed. Another product, Flight Control™, works similarly, but has the additional benefit of absorbing ultra violet light making the grass appear as if it was not a food source. The sprays need to be reapplied every 14-30 days, depending upon weather conditions and mowing frequency.

Pros

With persistence, harassment and/or use of repellants can result in reduced or minimal usage of an area by geese. Fewer geese may mean less feces and cleaner yards and parks, which may increase recreational uses along shorelines. If large numbers of geese were once present, the reduction of fecal deposits into the lake may help minimize the amount of phosphorus entering the water. Less phosphorus in the water means less "food" available for plant and algae growth, which may have a positive effect of water quality. Finally, any areas overgrazed by geese may have a chance to recover.

Cons

The effectiveness of harassment techniques is reduced over time since geese will adapt to the devices. However, their effectiveness can be extended if the devices are moved to different locations periodically, or used in conjunction with other techniques.

Use of dogs can be time consuming, since the dog must be trained and taken care of. Dogs must also be used frequently in the beginning of the season to be effective at deterring geese. This requires time of the dog owner as well. Dogs (frequently herding dogs, like border collies) that are effective at harassing or herding geese are typically may not be the best pets for the average homeowner. They are bred as working dogs and consequently have high levels of energy that requires the owner's attention.

Repelling or chasing away geese from an area only solves the goose problem for that area and most likely moves the geese (and the problem) to another area. As long as there is suitable habitat nearby, the geese will not wander very far.

Costs

Costs for the propane cannons are approximately $660 ($360 for the cannon, $300 for a timer), not including the propane tank. The cost of ReJeX-iT® is $80/gallon, GooseChase™ is $95/gallon, and Flight Control™ costs $200/gallon. One gallon covers one acre of turf using ReJeX-iT® and, GooseChase™, and two acres using Flight Control™.

<u>Option 4: Exclusion</u>

Erecting a barrier to exclude geese is another option. In addition to a traditional wood or wire fence, an effective exclusion control is to suspend netting over the area where geese are unwanted. Geese are reluctant to fly or walk into the area. A similar deterrent that is often used is a single string or wire suspended a foot or so above the ground along the length of the shoreline.

Pros

Depending on the type of barrier used, areas of exclusion will have less fecal mess and may have higher recreational uses. Vegetation that was overgrazed by geese may also be able to recover.

Cons

This technique will not be effective if the geese are using a large area. Also, use of the area by people is severely limited if netting is installed. Fences can also limit recreational uses. The single string or wire method may be effective at first, but geese often learn to go around, over, or under the string after a short period of time. Finally, excluding geese from one area will force them to another area on a different part of the same lake or another nearby lake. While this solves one property owners problem, it creates one (or makes one worse) for another. Also, problems associated with excess feces entering the lake (i.e., increased phosphorus levels) will continue.

Costs

The costs of these techniques are minimal, unless a wood or wire fence is constructed. String, wire, or netting can be purchased or made from materials at local stores.

Option 5: Habitat Alteration

One of the best methods to deter geese from using an area is through habitat alteration. Habitats that consist of mowed turfgrass to the edge of the shoreline are ideal for geese. Low vegetation near the water allows geese to feed and provides a wide view with which to see potential predators. In general, geese do not favor habitats with tall vegetation. To achieve this, create a buffer strip (approximately 10-20 feet wide) between the shoreline and any mowed lawn. Planting natural shoreline vegetation (i.e., bulrushes, cattails, rushes, grasses, shrubs, and trees, etc.) or allowing the vegetation to establish naturally can create buffer strips. A table in Appendix A has a list of native plants, seeding rates, and approximate costs that can be used when creating buffer strips.

Geese prefer ponds and lakes that have shorelines with gentle slopes to ones with steep slopes. While this alone will not prevent geese from using an area, steeper slopes used along with other techniques will be more effective. This option may not be practical for existing lake shorelines since any grading and/or filling would require permits and surveys, which would drive up the costs of redoing the shoreline considerably.

Aeration systems that run into the fall and winter prevent the lake from freezing, thus not forcing geese to migrate elsewhere. To alleviate this problem, turn aerators off during fall and early winter. Once the lake freezes over and the geese have left, wait a few weeks before turning the aerators on again if needed.

Pros
Altering the habitat in an area can not only make the habitat less desirable for geese, but may be more desirable for many other species of wildlife. A buffer strip has additional benefits by filtering run-off of nutrients, sediments, and pollutants and protecting the shoreline from erosion from wind, wave, or ice action. Finally, the more of the area that is in natural vegetation, the less turfgrass that needs to be constantly manicured and maintained.

Cons
Converting a portion or all of an area to tall grass or shrub habitat may reduce the lake access or visibility. However, if this occurs, a small path can be made to the lake or shorter plants may be used at the access location in the buffer strip.

Costs
If minimal amount of site preparation is needed to create a buffer strip, costs can be approximately $10 per linear foot, plus labor. The labor that is needed can be completed by the property owner in most cases, although consultants can be used to provide technical advice where needed. This cost will be higher if the area needs to be graded. If grading is necessary, appropriate permits and surveys are needed. If filling is required, additional costs will be incurred if compensatory storage is needed. Compensatory storage is the process of excavating in a portion of a property or floodplain to compensate for the filling in of another portion of the floodplain. The permitting process is costly, running as high as $1,000-2,000 depending on the types of permits needed.

Once established, a buffer strip of native plants needs little maintenance. If aerators are not run for several months, there will be a reduction in electrical costs.

<u>Option 6: Do Not Feed Waterfowl!</u>
There are few “good things”, if any, that come from feeding waterfowl. Birds become dependent on handouts, become semi-domesticated, and do not migrate. This causes populations to increase and concentrate, which may create additional problems such as diseases within waterfowl populations. The nutritional value in many of the “foods” (i.e., white bread) given to geese and other waterfowl are quite low. Since geese are physiologically adapted to eat a variety of foods, they can actually be harmed by filling-up on human food. Geese that are accustom to hand feeding may become aggressive toward other geese or even the people feeding the geese.

Costs
There are no costs to this option, except the public education that is needed to encourage people not to feed waterfowl. In some cases, signs could be posted to discourage waterfowl feeding.

Reference:

Manny, B. A., R. G. Wetzel, and W. C. Johnson. 1975. Annual contribution of carbon, nitrogen, and phosphorus by migrant Canada geese to a hardwater lake. Verh. Internat. Verein. Limnol. 19:949-951.