2002 SUMMARY REPORT
of
TURNER LAKE

Lake County, Illinois

Prepared by the

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

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

March 2003

TABLE OF CONTENTS

LAKE IDENTIFICATION AND LOCATION

Lake Name: Turner Lake

County: Lake

Nearest Municipality: Spring Grove

Location: T46N, R9E, Section 21

Watershed: Fox River

Sub-Basin: Upper Chain O' Lakes

Major Tributaries: None

Receiving Water Body: Fox River

Surface Area: 45.6 acres

Shoreline Length: 4.7 miles

Maximum Depth: 10.0 feet

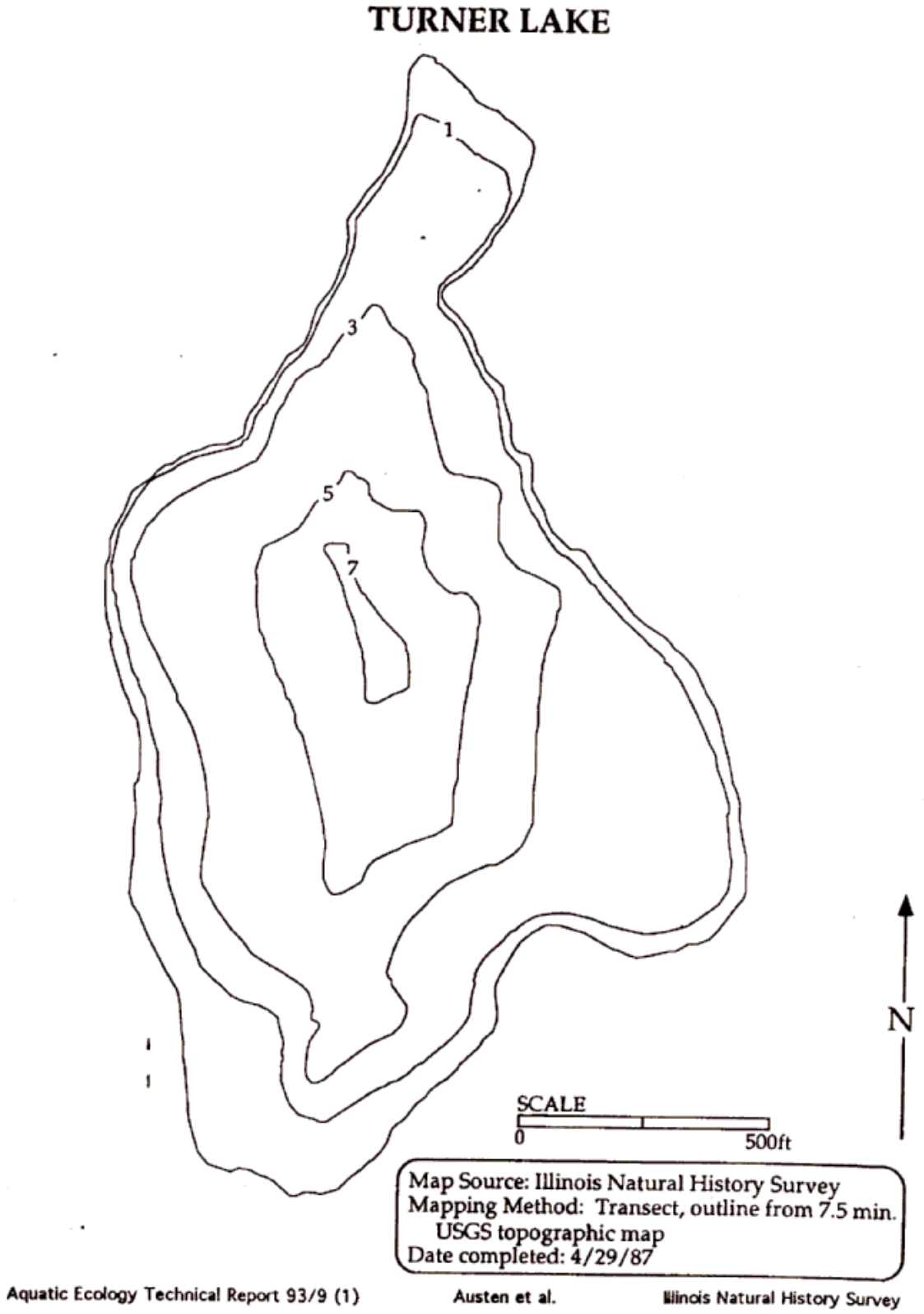
Mean Depth: 5.0 feet (estimated)

Volume: 228 acre-feet (estimated)

Lake Type: Glacial slough

Elevation: Approximately 760 feet above mean sea level

Figure 1. 1987 bathymetric map of Turner Lake.



LIMNOLOGICAL DATA – WATER QUALITY

Water samples were taken monthly from May - September at the deep-hole location (Figure 2). See Appendix B for water sampling methods.

Turner Lake's water quality is similar to many lakes in Lake County (Table 1 in Appendix A). Most of the water quality parameters measured were near the averages of other lakes that the Lake County Health Department (LCHD) has monitored since 1998. Several important findings were noted.

Water clarity, as measured by Secchi disk transparency readings, averaged 3.92 feet for the season, which is slightly above the county median (where 50% of the lakes are above and below this value) of 3.81 feet. Secchi disk readings were deepest in June (5.78 feet), then decreased as the season progressed with a low of 2.92 feet in September. The 2002 Secchi disk average increased from the 1997 average of 2.33 feet. IDNR records indicate that in 1992 the Secchi disk could be seen on the lake bottom, but subsequent readings in 1996-2001 were between 1.5 and 2.5 feet. It is unknown if these values represent averages or represent a single observation per year.

Correlated with the increase in clarity from 1997 to 2002 was the decrease in total suspended solids (TSS), since solids suspended in the water reduce the depth at which the Secchi disk can be seen. The 2002 epilimnetic average (6.0 mg/L) was at the county median (6.0 mg/L) and a significant improvement from the 1997 average of (14.6 mg/L). Similarly the hypolimnion average (7.0 mg/L) was lower than the 1997 average (19.6 mg/L).

Total dissolved solids (TDS) concentrations and conductivity readings increased from 1997 to 2002. Average TDS concentrations in the epilimnion for both years (250 mg/L in 1997 and 280 mg/L in 2002) were below the county median of 435 mg/L. Similarly, conductivity readings in the epilimnion for both years (0.4004 milliSiemens/cm in 1997 and 0.4609 milliSiemens/cm in 2002) were below the county median of 0.7389 milliSiemens/cm. The cause of these increases may be the result of the wetland restoration project that was conducted in 1998-99 when IDNR staff noted that some old farm tiles may have been broken causing more groundwater to flow into the lake. The groundwater may add dissolved solids to the water which would result in higher TDS concentrations and higher conductivity readings.

Total phosphorus (TP) concentrations in Turner Lake were near the county median. The 2002 average TP concentration was 0.046 mg/L in the epilimnion and 0.048 mg/L in the hypolimnion. The county median for oxic samples is 0.056 mg/L. TP average concentrations improved slightly from the 1997 means (0.051 mg/L, a 11% decrease, in the epilimnion and 0.054 mg/L, a 13% decrease, in the hypolimnion). Values above 0.03 mg/L in the epilimnion are considered sufficient enough to cause algae blooms.

Figure 2.

The average ratio between total nitrogen and total phosphorus for Turner Lake in 2002 was 31:1, indicating a phosphorus-limited system. This is down slightly from the 1997 ratio of 37:1. This decrease is mostly due to the higher nitrogen concentrations in 1997. Nitrogen, as well as 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. Lakes that are phosphorus-limited may be easier to manage, since controlling phosphorus is more feasible than controlling nitrogen or carbon.

Total alkalinity concentrations were high in Turner Lake, with an average of 228 mg/L $CaCO_3$ in the epilimnion and 227 mg/L $CaCO_3$ in the hypolimnion. The county median for oxic samples is 158 mg/L $CaCO_3$. The 2002 values were slightly higher than the 1997 average concentrations (189 mg/L $CaCO_3$ in the epilimnion and 191 mg/L $CaCO_3$ in the hypolimnion). The source of this alkalinity is unknown, however, this may be the result of groundwater infiltration from broken farm tiles as noted earlier.

The lake was not stratified during the May sampling date. A thermocline was established in June at 9 feet, and at 6 feet in July. By August the lake had turned over. The lake may experience polymictic tendencies, meaning stratification and turnover occur repeatedly over the year, due to its shallow morphology.

Dissolved oxygen (DO) concentrations in Turner Lake did not indicate any significant problems. Generally concern arises when DO concentrations fall below 5 mg/L in the epilimnion. In 2002, all DO concentrations at the surface were >5mg/L. In May, August, and September, when the lake was not stratified, the entire water column (surface to bottom) was fully oxygenated. Anoxic conditions (where DO concentrations drop below 1 mg/L) did exist below approximately 9 feet in June and 7.5 feet in July. The DO concentrations in 2002 were down slightly from conditions observed in 1997. Conditions in the lake (i.e., shallow morphology, temperature, algae and macrophyte prevalence) may cause DO concentrations to fluctuate widely, which may result in low DO concentrations at various times. In order to determine if these DO conditions are a problem, the percent of volume at specific depths (preferably in one foot increments) is needed. A 1987 bathymetric map of Turner Lake exists, but does not include volumetric calculations. Thus, an accurate assessment of the DO conditions cannot be made.

The current aeration system, which is operating only in the winter, was installed to prevent winter fishkills. It consists of a 2 horsepower motor that operates a single blower that forces air through a homemade diffuser. Since the lake only stratified in June and July, an aeration system is not needed to destratify the lake. However, due to the shallow nature of the lake and history of fishkills the system may be beneficial during times of low DO. The effectiveness of the aeration system to serve as a refugia for fish is difficult to assess. In 2002 the lake did not experience any obvious DO problems. The system could be operated only during the times of the year (i.e., winter) when fishkills are more likely to happen. The aerators should be turned off in the late-fall/early winter to allow the lake to completely freeze over. This will force resident Canada Geese to leave the area. Approximately one month after ice-over the aerators can be turned on again until ice-off.

Water levels on Turner Lake declined throughout the season. The maximum change in water level occurred from May to September (14.6 inch decrease). Fluctuations in water levels may be the result of natural rain events or lack thereof. Significant changes in water levels may have negative impact on water quality. In addition, lakes with fluctuating water levels potentially have more shoreline erosion problems.

Rain events sometime contribute additional sediment or nutrients (like phosphorus) to a lake, which may influence water sample results. However, rain occurred within 48 hours prior to water sampling in each month, except September. May had the heaviest accumulation (0.94 inches) as recorded at the Lake County Stormwater Management Commission rain gauge in Antioch.

Based on data collected in 2002, standard classification indices compiled by the Illinois Environmental Protection Agency (IEPA) were used to determine the current condition of Turner Lake. 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 total phosphorus values obtained at or near the surface. The TSIp for Turner Lake in 2002 classified it as a eutrophic lake (TSIp = 59.3). This is a slight improvement from the 1997 TSIp of 60.9. 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 (Turner Lake is currently #43 of 103). 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, a small, shallow, manmade lake with high nutrient loads could not expect to achieve a high ranking even with intensive management.

In Turner Lake, 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 high percentage of aquatic plants in the lake the swimming and recreation indices indicated only a partial degree of support for these activities. LCHD did not test for bacteria or other harmful pathogens in Turner Lake in 2002.

LIMNOLOGICAL DATA – AQUATIC PLANT ASSESSMENT

Aquatic plant species presence and distribution in Turner Lake were assessed monthly from May through September 2002 (see Appendix B for methods). Thirteen aquatic plant species, one macro-algae, and several emergent shoreline plants were found (see Table 3, below).

The most common aquatic plants in Turner Lake were white water lily (found at 60% of all sites), Eurasian water milfoil (EWM; 57%), chara (47%), and common bladderwort (32%; Table 4, Appendix A). All other species were found in less than 20% of all samples. Three exotic species, EWM, curlyleaf pondweed, and spiny naiad were found. Curlyleaf was only found once in June and spiny naiad was found more frequently but did not appear until July.

During the plant sampling LCHD staff searched for the milfoil weevil (*Euhrychiopsis lecontei*) on EWM plants. This weevil attacks the tip and stem of the plant and is currently being used as a biological control for EWM in many lakes in the Midwest. The weevils are found naturally in many lakes. Unfortunately, no weevils were found in Turner Lake in 2002. However, given the large beds of EWM and the natural shoreline of Turner Lake, natural or introduced populations of milfoil weevils to control EWM may be a feasible management option.

The 1% light levels (the point where plant photosynthesis ceases) were found at approximately 7 feet in May, June, and September. In July and August the 1% light levels reached the lake bottom (10 feet). Thus, the majority of the lake received adequate light for plant growth for most of the season. It was estimated that approximately 90% of the lake bottom was covered with aquatic plants (note: this is plant coverage on the lake bottom and not an estimate of plants at the water's surface).

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 2002, Turner Lake had a FQI of 18.6. The average FQI of lakes studied by LCHD from 2000-2002 is 14.0.

Table 3. Aquatic and shoreline plants on Turner Lake, May - September 2002.

Aquatic Plants	
Coontail	*Ceratophyllum demersum*
Chara/Nitella	*Chara* sp./*Nitella* sp.
Small Duckweed	*Lemna minor*
Eurasian Water Milfoil	*Myriophyllum spicatum*
Slender Naiad	*Najas flexilis*
Spiny Naiad	*Najas marina*
Spatterdock	*Nuphar variegata*
White Water Lily	*Nymphaea tuberosa*
Curlyleaf Pondweed	*Potamogeton crispus*
Illinois Pondweed	*Potamogeton illinoensis*
Small Pondweed	*Potamogeton pusillus*
Flatstem Pondweed	*Potamogeton zosterifomis*
Sago Pondweed	*Stuckenia pectinatus*
Common Bladderwort	*Utricularia vulgaris*
Shoreline Plants	
Swamp Milkweed	*Asclepias incarnata*
Sedges	*Carex spp.*
Dogwood	*Cornus sp.*
Spikerush	*Eleocharis* sp.
Blue Flag Iris	*Iris hexagona*
Purple Loosestrife	*Lythrum salicaria*
Reed Canary Grass	*Phalaris arundinacea*
Common Reed	*Phragmites australis*
Pin Oak	*Quercus palustris*
Red Oak	*Quercus rubra*
Buckthorn	*Rhamnus cathartica*
Elderberry	*Sambucus* sp.
Willow	*Salix sp.*
Hardstem Bulrush	*Scirpus acutus*
Nightshade	*Solanum dulcamara*
Basswood	*Tilia americana*
Cattail	*Typha* sp.
Blue Vervain	*Verbena hastata*
Wild Grape	*Vitis sp.*

LIMNOLOGICAL DATA – SHORELINE ASSESSMENT

A shoreline assessment was conducted in August 2002 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.

Over 99% of the shoreline of Turner Lake was classified as undeveloped. The only developed sections of shoreline were the boat launch and fishing pier areas. The most common shoreline type was wetland (87%), followed by woodland (6.6), shrub (5.7%), and riprap (0.7%; Figure 3). The wetland type was dominated by cattails with some willows.

The shoreline was assessed for the degrees and types of shoreline erosion. Due to the high percentage of wetland habitat comprised mostly of cattails, very little erosion was detected around Turner Lake (Figure 4). Only one 321-foot section was classified as slightly eroding. This section was located just south of the boat launch. No moderate or severe erosion was found during the assessment.

Several exotics were found growing along the shoreline, including reed canary grass, common reed, and buckthorn. Buckthorn was the most common, particularly in the wooded and shrub habitats. 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.

LIMNOLOGICAL DATA – WILDLIFE ASSESSMENT

Good numbers of wildlife, particularly birds, were noted on and around Turner Lake. See Appendix B for methods. Several of the species listed in Table 5 (below) were seen during spring or fall migration and were assumed not to be nesting around the lake.

Habitat around Turner Lake was fair to good. The dominance of cattails provides habitat for some wildlife species, but precludes a more diverse abundance of species due to its lack of plant diversity. The scattered trees around the lake provide good habitat for many insectivorous birds.

Three bird species listed as threatened or endangered by the state of Illinois were found on Turner Lake. Two of them, the common tern and black tern (both endangered), were only seen once and were assumed to be not nesting in the area. However, the sandhill cranes (threatened) were seen throughout the summer and two adults were observed with 2-3 young in July, August, and September suggesting a nest nearby. Turner Lake provides ample habitat for nesting sandhill cranes as well as other species.

LCHD did not conduct any fish assessments in 2002. However, a 1990 IDNR survey found the Iowa darter (*Etheosoma exile*), a state endangered fish species, in the lake.

Figure 3.

Figure 4.

Table 5. Wildlife species observed on Turner Lake, April – September 2002.

Birds	
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhnchos*
Wood Duck	*Aix sponsa*
Blue-winged Teal	*Anas discors*
Red-breasted Merganser	*Mergus serrator*
Ring-billed Gull	*Larus delawarensis*
Common Tern*	*Sterna hirundo*
Black Tern*	*Chlidonias niger*
Great Blue Heron	*Ardea herodias*
Green Heron	*Butorides striatus*
Sandhill Crane+	*Grus canadensis*
Sora Rail	*Porzana carolina*
Killdeer	*Charadrius vociferus*
Ring-necked Pheasant	*Phasianus colchicus*
Wild Turkey	*Meleagris gallopavo*
Red-tailed Hawk	*Buteo jamaicensis*
Common Flicker	*Colaptes auratus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Downy Woodpecker	*Picoides pubescens*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Phoebe	*Sayornis phoebe*
Eastern Pewee	*Contopus virens*
Willow Flycatcher	*Empidonax traillii*
Barn Swallow	*Hirundo rustica*
Tree Swallow	*Iridoprocne bicolor*
Rough-wing Swallow	*Stelgidopteryx ruficollis*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
Black-capped Chickadee	*Poecile atricapillus*
House Wren	*Troglodytes aedon*
Marsh Wren	*Cistothorus palustris*
Catbird	*Dumetella carolinensis*
American Robin	*Turdus migratorius*
Cedar Waxwing	*Bombycilla cedrorum*
Red-eyed Vireo	*Vireo olivaceus*
Warbling Vireo	*Vireo gilvus*
Yellow-throated Vireo	*Vireo flavifrons*
Yellow-rumped Warbler	*Dendroica coronata*
Yellow Warbler	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Red-winged Blackbird	*Agelaius phoeniceus*
Common Grackle	*Quiscalus quiscula*

Table 5. Wildlife species observed on Turner Lake, April – September 2002.

Starling	*Sturnus vulgaris*
Northern Oriole	*Icterus galbula*
Northern Cardinal	*Cardinalis cardinalis*
American Goldfinch	*Carduelis tristis*
Swamp Sparrow	*Melospiza georgiana*
Dark-eyed Junco	*Junco hyemalis*
Song Sparrow	*Melospiza melodia*
Mammals	
Beaver	*Castor canadensis*
Eastern Chipmunk	*Tamias striatus*
Gray Squirrel	*Sciurus carolinensis*
Muskrat	*Ondatra zibethicus*
Amphibians	
Bull Frog	*Rana catesbeiana*
Green Frog	*Rana clamitans melanota*
Western Chorus Frog	*Pseudacris triseriata triseriata*
Reptiles	
None noted.	
Insects	
Cicada	Cicadidae
Dragonfly	Anisoptera

***Endangered in Illinois**
+Threatened in Illinois

EXISTING LAKE QUALITY PROBLEMS AND MANAGEMENT SUGGESTIONS

Turner Lake has good water quality compared to many of the other lakes in the county. Many of the water quality parameters measured were either at or below county medians. The lake provides for public recreation and habitat for fish and wildlife, including species listed as threatened or endangered in Illinois.

- *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, dredging, fish stocking, etc.) are part of the lake's overall management plan. Currently, only an outdated map for Turner Lake exists. An updated map, which includes volumetric calculations at each depth, is needed.

- *Aquatic Exotic Plant Species*

  In the water, Eurasian water milfoil (EWM), curlyleaf pondweed, and spiny naiad were found in Turner Lake. EWM is the dominant aquatic plant and has been reported to be a problem in the lake for some time. Due to the relatively shallow depth of the lake, aquatic plants could cover much of the lake. An active aquatic plant management plan should be created to control these exotics.

  No milfoil weevils were found in the lake in 2002. However, populations of this EWM bio-control insect may be in the lake in low numbers (undetected by LCHD staff) or could be introduced. The natural shoreline and relatively low boating activity on the lake should provide favorable conditions for the weevils. Typically weevils are stocked to achieve a density of 1-4 weevils per stem. This translates to 500-3000 weevils per acre. At a cost of $1 per weevil plus labor, a EWM management program using weevils can be expensive. Additionally, there is no guarantee that weevils will provide long-term control or even produce any results at all.

  Weevils are sold in units of 1000 bugs/unit and stocking rates must be at least 1 unit/stocked area. Normally there is a minimum purchase of 5-10 units. The cost of the weevils does not include the labor involved in initial surveys, stocking, and monitoring, which typically run an additional $3,500-$4,500.

  For information contact:
  EnviroScience, Inc.
  3781 Darrow Road
  Stow, Ohio 44224
  1(800) 940-4025

If the aquatic management plan includes chemical treatments, care should be taken in the selection and application of herbicides. Since EWM is the main target species for control, the herbicide should be selective for its control while minimizing the impact on the native aquatic plant populations. One option for treating the EWM is granular 2,4-D which is a systemic herbicide that is selective for dicots like EWM while having no effect on monocots like many of the native pondweeds. Spot treatments can be made in areas of heavy plant growth, such as around the fishing piers and the boat launch. The granular formulation is often preferred over the liquid form since the liquid form has a greater tendency to drift and impact non-target plant species.

Fluridone is another herbicide that is often used as a whole lake treatment. In many lakes this chemical can be very effective, however, its use on Turner Lake is not recommended. For fluridone to be effective it has to maintain a concentration for at least 30 days. Systems that have low retention times (i.e., flow-through systems) may not be very good candidates for such a treatment. The water retention time for Turner Lake is unknown, however it does flow into the Fox River so maintaining consistent fluridone concentrations may be difficult. Fluridone is a whole-lake treatment option and since EWM is not dominant throughout the entire lake, areas would receive treatment that may not need it. A whole-lake treatment would also be more expensive than spot-treatments in the areas of highest recreation use. Lastly, a fluridone treatment requires an accurate volume calculation. This would not be possible with the outdated bathymetric map of the lake, particularly considering the water level in the lake has changed since the map was created.

- *Terrestrial Exotic Plant Species*

  Several other exotic species were found along Turner Lake shoreline including reed canary grass, buckthorn and others. Buckthorn was most common along the woodland and shrub habitat. These exotics have the potential to become a significant problem and should be removed or kept in control to prevent their spread.