Evergreen Lake Watershed Plan

Prepared by:

Evergreen Lake Watershed Planning Committee

McLean County Soil and Water Conservation District

Illinois Environmental Protection Agency

NRCS Natural Resources Conservation Service

Association of Illinois Soil & Water Conservation Districts

Funding for this project provided, in part, by the Governor of Illinois and the Illinois Environmental Protection Agency through Section 319 of the Clean Water Act.

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Mission Statement

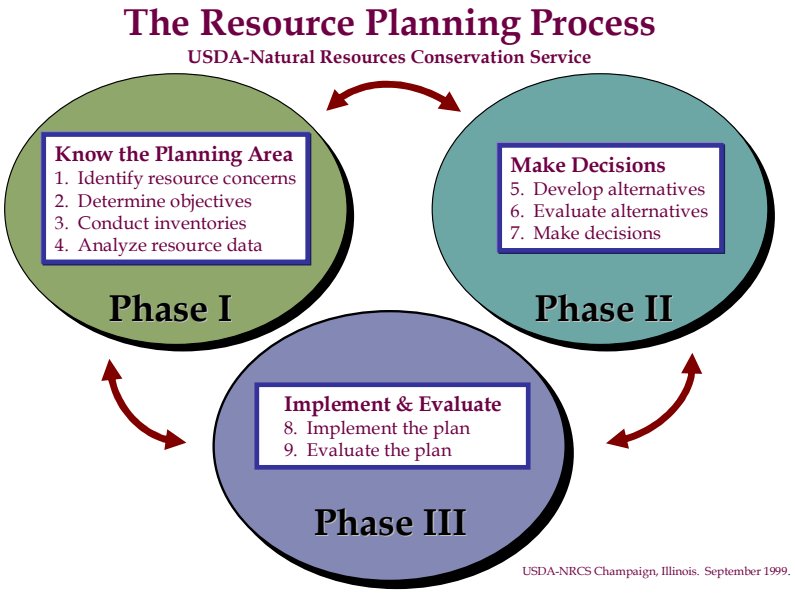
We, the community of the Evergreen Lake watershed, desire to address regulatory requirements and to improve & protect agricultural, water, recreational and other natural resources with proactive strategies that maximize local control.

Introduction

In February 2005, the McLean and Woodford County Soil and Water Conservation Districts, the Association of Illinois Soil and Water Conservation Districts (AISWCD), and the McLean and Woodford County Natural Resource Conservation Service (NRCS) invited landowners, representatives of local governments, local experts, and concerned citizens to meet to address the issue of elevated levels of phosphorus in Evergreen Lake. From that initial group a Planning Committee was formed, which then developed a list of action points that

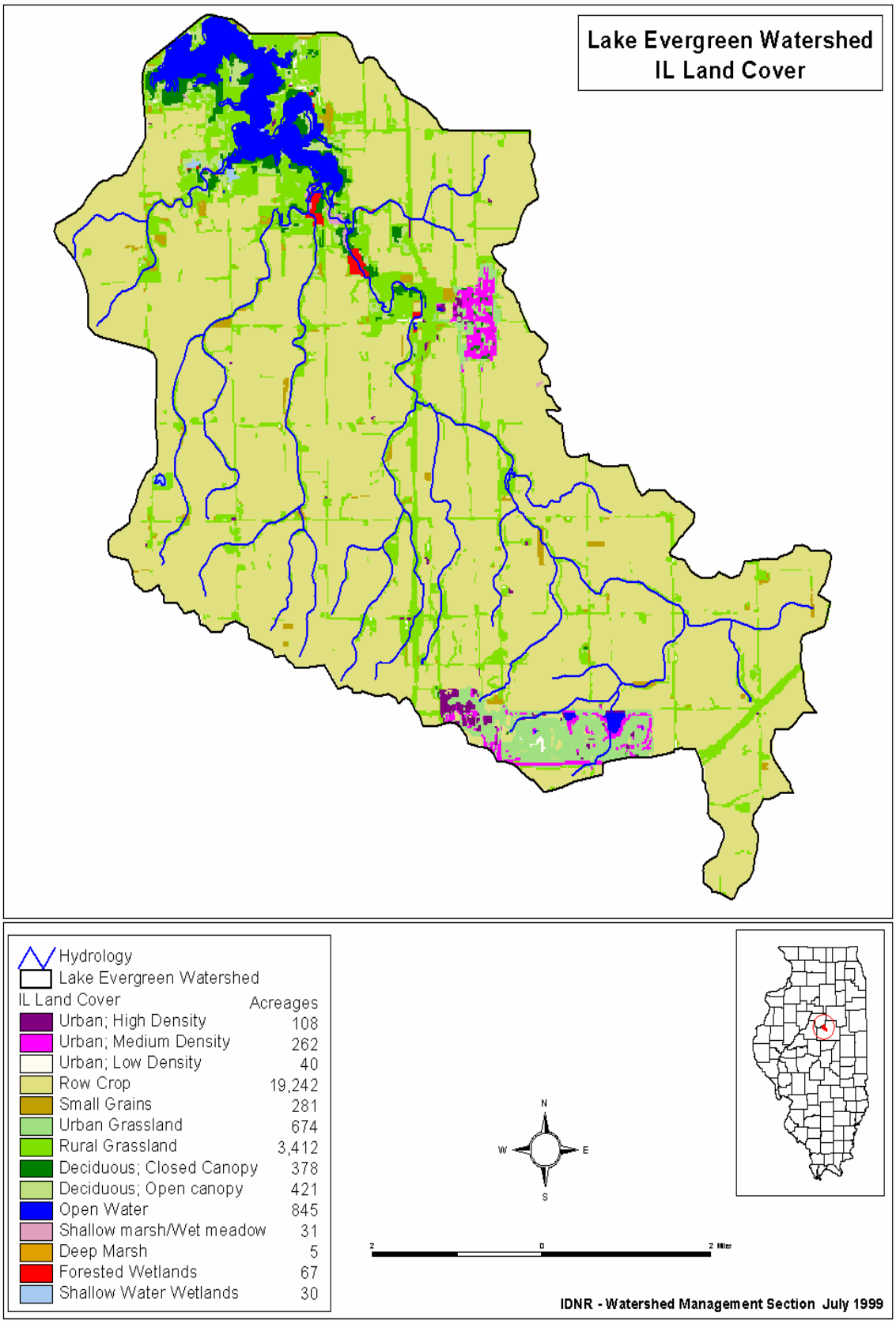
needed to be investigated. The Planning Committee then appointed a Technical Committee to address the individual problem statements, investigate existing data of Best Management Practices to address the problems, inventory resources in the watershed and develop alternatives. The Technical Committee divided into three areas of expertise: the Biological/Streams Committee, the Urban Committee, and the Agriculture Committee. Funding for the entire Evergreen Lake Watershed Plan development was through grants by the Illinois Environmental Protection Agency, while implementation funding will be from IEPA, Association of Illinois Soil & Water Conservation Districts (AISWCD), SWCD, Sand County Foundation, and NRCS, as well as other local and private funding.

The committee started the planning process under the guidance of NRCS and used a three phase planning approach.



Stakeholders were invited to committee meetings and provided with plan drafts. Their comments were integrated into the final plan. A list of members of the Planning and Technical Committees are in Appendix I.

Watershed Description

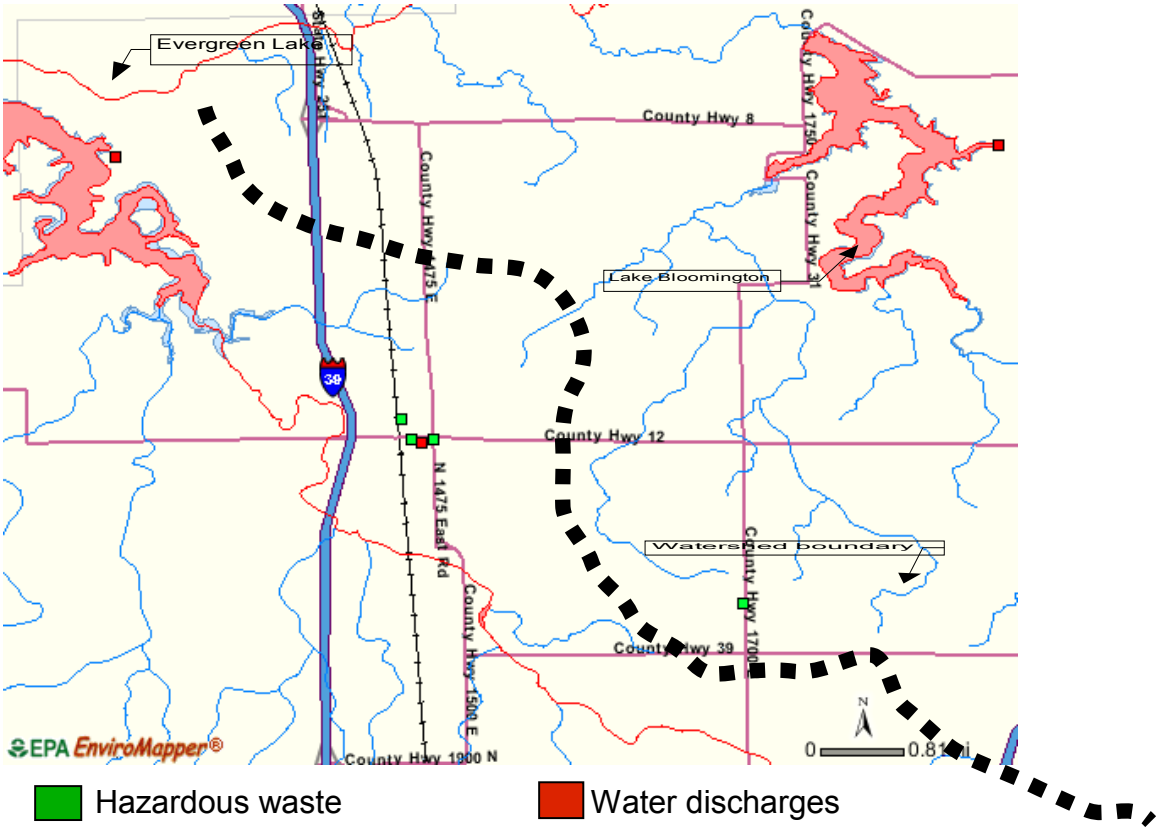


General Overview

The Evergreen Lake (Water Body Segment ID SDA) watershed encompasses 41.1 square miles (25,730 acres) within McLean County and Woodford County, Illinois. It is within the U.S. Geological Survey Mackinaw River Basin (Hydrologic Unit Code 0713000404010). Six Mile Creek (Water Body Segment ID DKN 01) and two major unnamed tributaries and six minor tributaries drain into Evergreen Lake. (see map p.21)

The watershed includes the village of Hudson and the far north edge of the Town of Normal. Agriculture and rural grassland are the predominant land uses, with row crops covering 87 percent of the watershed. The land is gently sloping (1-4%) except in areas near the Mackinaw River (4-10% slope).

There are seven water, multiple, and/or waste point sources in the watershed as identified by the EPA. Four are in the village of Hudson: Birkey's Farm Store (Waste), Bransfield Inc. (waste), Casey's General Store (waste), and Prairie View Homeowners Association (water), and three are out side any urban boundaries: Whitacre's, (waste) Ni-Cor (waste) and McLean County Parks and Recreation (water).



Watershed History

Geological

The geological history of Illinois is dominated by four glacial advances. The Wisconsinan glaciation of about 15,000 years ago formed a series of moraines across east-central and northeastern Illinois.

Glaciers played a significant role in shaping McLean County. A number of glacial moraines run from northwest to southeast across the county. Over time, the glacial ridges were worn down, lower areas were filled with sediments, and wind-deposited loess smoothed out the features.

Human Use

This depositional loess base created a perfect environment for the subsequent prairie formation, which provided natural nutrient loading and water

retention in the soil. As the land was subsequently farmed, phosphorus was routinely added to the soil in larger amounts than required. Modern practices actually use much less fertilizer than required, but due to this heavy historical phosphate loading, there are still phosphorus reserved in the soil. From a 1990 USDA report (90-130) "Phosphorus fertilizer use peaked in 1978 and remained largely unchanged until 1983 when phosphorus fertilizer use declined approximately 25 percent." As this friable loess based soil erodes, phosphorus migrates into the waterways.

Construction of Evergreen Lake

Evergreen Lake was constructed in 1971 as a supplemental water reservoir for the City of Bloomington, population 74,975, as well as for recreational use. It was formed by an impoundment of Six Mile Creek upstream of its junction with the Mackinaw River.

In 1995, the city modified the Evergreen Lake dam to increase the normal pool elevation by five feet, resulting in a 36 percent increase in storage capacity. Currently, the lake has a surface area of 900 acres, 22.5 miles of shoreline, a maximum depth of 53 feet, a mean depth of 22 feet, and a storage volume of 15,480 acre-feet.

During the drought of 1988, water quality suffered, leading to complaints of taste and odor in finished water. These issues were partially due to severely anaerobic regions and resulting chemical decomposition. In 1996, on the recommendation of the Illinois State Water Survey, the city installed an Aspir-Air Aeration System to destratify the lake near the water intake site.

A subsequent study by Raman et al. found that the destratifier had a significant positive impact on the biological, chemical, and physical health of the lake. The lake was nearly isothermal to a depth of 30 feet, the depth of the destratifier. Compared with prior conditions, the dissolved oxygen levels improved significantly near the water treatment plant intake point, and overall oxygen conditions improved throughout 95 percent of the lake. Increased oxygen contributed to a significant decrease in ammonia levels in the bottom waters. Turbidity decreased and lake transparency increased, although this was

in large part due to increased lake depths from the raising of the spillway the previous year. Total alkalinity values increased, indicating a decrease in algal activity.

Recent issues

In late fall 2004, after unseasonably warm temperatures and heavy rains, Bloomington water suffered taste and odor issues. The problem was later attributed to a species of blue-green algae present in both Lake Bloomington and Evergreen Lake. Blue-green algae present a particular problem in lake management because they can fix nitrogen and control their buoyancy to best utilize dissolved nutrients, allowing them to out-compete other algae. Some species produce potent toxins, and many are associated with unpleasant tastes and odors.

The recent taste and odor issues have been attributed to a blue-green algae called oscillatorid, specifically to geosmin and 2-methylisoborneol (MIB), two chemicals it produces. While not toxic, these metabolic byproducts are difficult to remove completely from finished water. Humans are highly sensitive to their characteristic musty smell and taste, with some people able to detect their presence at levels lower than the 5 ng/L Method Detection Level.

In April 2005, Wayne Kinney of Stream Technical Resource and Management Service (STREAMS) surveyed the extent of erosion in the lower portion of the waterways that feed into Evergreen Lake. Six Mile Creek and seven unnamed tributaries were surveyed for one to four miles outwards from the lake, until the start of the upper, actively managed, drainage systems, for a total of 16.3 miles of streambeds. The survey showed that the inventoried erosion sites contribute approximately 2,100 tons of sediment to Evergreen Lake per year. In addition, more than 90 percent of lake sediment due to streambank erosion originates within 4 miles of the lake. Kinney concluded that the most effective way to reduce sediment loading from the waterways would be to achieve and maintain channel stability over long stretches of streambank, not just in isolated eroding sites. (see map p.21)

Several studies have been completed by IDNR on the Mackinaw River Basin, including Six Mile Creek. In 2000, studies have found that the data suggests that Six Mile Creek has little mussel habitat or mussels. Six Mile Creek was rated as the lowest ranking for mussels in the entire Mackinaw River Basin. Six Mile Creek the largest of the two major tributaries to Evergreen Lake had fish surveys conducted in 2000 and 2005 by the IDNR. The survey in 2000 was located just west of Hudson off 2200 N and the 2005 survey was at the bridge on 2000 N. Between the two surveys 17 species of fish were collected of which none are on the state endangered or threatened species list. These species are common to streams in central Illinois. Fish samples in streams are characterized by an Index of Biotic Integrity (IBI). A score for each site is based upon ten parameters which yield a score from 1-60. The higher the score the better the quality the streams is considered to be. The IBI score in 2000 was 30, which would be interpreted as a stream with 'Limited Aquatic Resources'. In 2005 the score dropped to 12, though the survey was taken at a different location. This lower score would give the stream a listing of 'Restricted Aquatic Resource'.

All of the fish that were collected are considered to be tolerant to moderately tolerant species, indicating that they can tolerate poorer water quality and are adaptable to poorer habitat conditions. Almost all are considered to be generalist feeders indicating that they require no special feeding conditions or habitats.

Changes in the watershed has altered the characteristics of Six Mile Creek and influenced its species composition. In addition the lake has eliminated connectivity between Six Mile Creek and the Mackinaw River, which also would influence the species composition in Six Mile Creek.

Since1989 development within the Town of Normal has changed almost 1000 acres from agricultural to urban residential land use in the upper reaches of Six Mile Creek.

In the fall of 2006, Invenergy Wind LLC has proposed to develop the White Oak Wind Energy Center, which is a $250-million wind farm project located in McLean and Woodford Counties. The company is requesting zoning variance approval for the 150+ wind turbines, which will be erected on agricultural land.

Most of the turbines will be located in McLean County, with about 60 turbines in the Evergreen Lake watershed area. Each turbine and access road will occupy about .33 of an acre of land. The turbines are sited on a concrete base, and the access roads are a minimum of 15 feet wide with a base of crushed limestone/gravel. Therefore, the approximate total acreage which will now be changed from agricultural fields to impervious surface for this project is 20 acres. This has the potential to change drainage patterns and increase surface runoff, thereby increasing sedimentation delivery to the associated stream tributaries, especially tributaries 1, 2 & 3 (see map p.21). While the total acreage affected is only a tiny percentage of the overall acreage in the watershed, there remains the potential for increased sediment delivery to the lake, especially during the construction phase of this project. Since the project has to go through the NPDES Phase II permit process, it is hoped that appropriate measures will be taken to minimize soil erosion during construction, and that access road usage will not contribute substantially to any appreciable erosion and sediment delivery in the long term. Unfortunately, neither McLean County Zoning or IEPA has the staff to ensure that all construction sites are monitored for compliance.

Watershed Activities

Conservation Practices

The City of Bloomington, Pheasants Forever, and the McLean County Soil and Water Conservation District (SWCD) have provided funds for filter strips along waterways in both the Evergreen Lake and Lake Bloomington watersheds. Between the two watersheds, about 66 acres of new filter strips were installed by the year 2000.

The McLean County SWCD has promoted and assisted with willow plantings at a number of points along Six Mile Creek to help stabilize the banks and limit sediment from entering the lake.

The City of Bloomington has installed some erosion control measures around Evergreen Lake and plans to implement extensive shoreline stabilization measures, possibly to include riprap and plantings.

Presently, in the 26,500 acres of the Evergreen Lake watershed, there are 758 acres utilizing some type of conservation in agricultural areas, as well as one concrete block chute, 300 feet of streambank willow plantings and 1200 feet of water and five sediment control basins. The watershed is located in two adjoining counties, with 960 cropland acres in Woodford County, and the 900 acres of lake itself, and 22, 720 acres of land in McLean County. In McLean County the current conservation acreage practices are:

- Nutrient management- 173 acres
- Waterways- 58 acres
- Conservation cover- 98 acres
- Tree plantings- 269 acres
- Flood plots- 7 acres
- Filter strips- 136 acres
- Riparian buffer-17 acres

COMLARA Park Fish and Wildlife

In 1986, the Department of Parks and Recreation identified improving the fishery of Evergreen Lake as a primary objective in meeting the goal of

expanding recreational usage at COMLARA County Park. The Department of Parks and Recreation entered into an intergovernmental agreement with the Illinois Department of Conservation (now the Illinois Dept. of Natural Resources) for fishery management of Evergreen Lake. This agreement has provided intensive fishery management including regular population surveys, stocking of games species to supplant limited natural reproduction, introduction of fish species to control over populations of certain species and the initiation of an aquatic vegetation program to increase natural reproductions of fish species and water quality overall. The fishery management program is performed jointly by IDNR Biologists, Technicians and County Parks staff.

Evergreen Lake has produced the last two state record hybrid walleye, has high quality and quantity game fish populations including muskellunge, black bass and crappie. In 1998, the Department of Parks and Recreation installed a temporary fish barrier below Evergreen Lake spillway. In 2004, the Department constructed a permanent fish barrier below the spillway, allowing for game fish to be retrieved and returned to the lake without threat to the stability of the Dam.

A relatively large portion of the public ownership in the watershed remains left in its natural condition, with plantings and other modifications to improve the habitat for wild birds and animals. Migratory water birds including geese, ducks and herons continue using the lake as a refuge and rest stop. Most of the song birds found in Central Illinois have been recorded. Muskrats and beaver inhabit the lake shore, while inland there are squirrel, raccoon, fox, opossum, rabbit, skunk, and a large herd of deer.

McLean County Parks and Recreation (MCPR) has worked with a wide range of community organizations and groups to improve wildlife habitat at COMLARA County Park. In the 1970's, along with many other public land agencies, the Department made large plantings of Autumn Olive as a wildlife cover within the Park. In addition MCPR has made limited plantings of trees in active use and conservation areas. MCPR has worked with organizations to improve nesting habitat for a wide range of species including active programs for waterfowl nesting and, blue-bird houses.

In 1987, MCPR removed approximately 260 acres or approximately 20% of the Park, from cropland production and commenced reforestation and grasslands replacement in these areas. This program significantly changed the nature of the facility.

MCPR began working with other landholders along the Mackinaw River greenbelt in the 1990's to address dramatic increases in white tail deer populations. They instituted measures to attempt and assist in minimizing growth of these populations and in turn the negative impact that such over-population has on the resource due to over-browsing. Also, MCPR has worked with IDNR Biologists on a program to release and re-establish river otter in the Evergreen Lake and Mackinaw watershed.

Based upon significant conflicts with recreational use of facilities, MCPR began developing methods to assist in controlling increasing populations of resident Canada geese in 2002. Modifications to grounds management practices, vegetative plantings and a pilot program of egg transfer in cooperation with the IDNR Urban Geese Program has provided for some reduction in recreational conflict.

MCPR initiated a program for removal and control of Autumn Olive vegetation in 2005. Once thought to be non-invasive, this plant species has been since identified as an invasive exotic. The program has identified approximately 80 acres of Autumn Olive Plantings and another 80 -120 acres of invasive impact. This project will entail a multi-year removal, temporary ground cover and management process, followed by new plantings.

Educational activities in the Evergreen Lake watershed include:

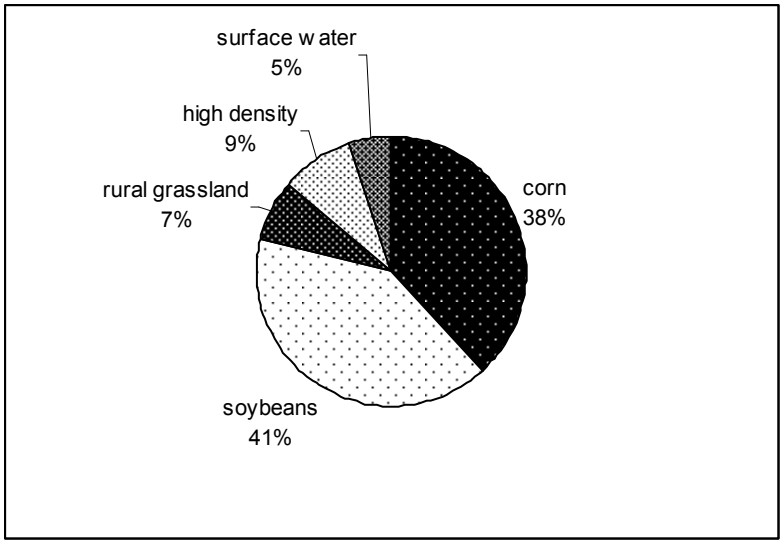
- Earth Express- a county wide activity for 4th and 5th graders
- Conservation Day- 3rd graders
- Wilderness Camp- 5th through 8th graders
- Yard Smart- a county wide campaign to encourage pesticide free and wildlife friendly yards
- Wellness and Sustainability Fair at Illinois Wesleyan University
- Ecology Action Center- provides ecology and recycling programs for all grade levels, and the county at large

- Lake Fest- Family oriented single day special event providing presentations/demonstrations of Fishery Management, Aquatic Vegetation, shoreline/streambank erosion control techniques, and lake related outdoor recreational activities.

Watershed Resource Inventory

Land Uses

The majority of land in the Evergreen Lake watershed is used to grow row crops, with soybeans covering 41 percent of the land and corn covering 38 percent, according to the 1999-2000 Illinois Interagency Landscape Classification Project. Rural grassland, high density (urban), and surface water each cover less than ten percent of the total surface area.



Watershed land use

In a 1998 study of the Evergreen Lake watershed conducted by the Clean Lakes Program, there were 263 total livestock animals in the area, a number likely to have declined over the years. According to the IEPA, this is a relatively low livestock density and therefore will have a small impact on water quality.

The most common soil type in the watershed is Sable silty clay loam, which is a byproduct of the windblown silt, called loess, distributed during glacier retreat. This soil has slow infiltration rates and a high clay content, as well as

poor drainage with high runoff levels. The second most common soil is Ipava silt loam, which, according to the SWCD, resembles "soils with less clay in the subsoil and with loamy outwash or till in the substratum."

Subsurface drainage, or tiling of fields, is practiced to remove excess water from the soil. Drainage pipes are installed below the root zone and release the water into a ditch or stream. In Illinois, pipes are usually installed at a depth of 3 to 4 feet and 80 to 120 feet apart. Based on the amount of soil classified as poorly draining, the SWCD estimates that 7500 acres in the watershed are tiled (approximately 25%).

Hudson had 1,510 residents in the year 2000, according to the U.S. Census of Population. The McLean County Planning Commission predicts that its population will increase by approximately 400 by the year 2020.

The Town of Normal had a population of 45,400 in 2000 and grew to 50,500 as counted by a special census in 2005. The Town's current comprehensive plan indicates that another 1,400 acres of the Evergreen Lake watershed could be urbanized in the next 20 years.

The Evergreen Lake watershed includes two permitted point sources. According to the McLean County Environmental Health Department, there are approximately 765 permitted septic systems within the watershed. There are 20 septic systems (2.6%) within a half mile of the lake located at camping and residential sites within close proximity to Evergreen Lake.

Evergreen Lake is immediately surrounded by Comlara Park. The vegetation or cover on the park lands generally falls in five categories; namely, woodlands, reforestation, active use fields, native/warm season grasses, and wetlands.

- Woodlands(approximately 350 acres) - certain areas are presently covered with dense stands of mature trees of the native oak-hickory plant association. The majority of the trees are in good condition and as many as possible are conserved.
- Reforestation(355 acres). Reforestation efforts in the late 1970's included approximately 150 acres. These areas included a mixture of hardwoods and pines. The Department initiated reforestation projects in the late

1980's adding an additional 200 acres to reforestation which included oak and ash plantings, as cropland was removed from production. This program also provides stock for transplanting into woodland areas.

- Active Use Areas (approximately 310 acres). All active recreational use areas have been seeded to establish a strong, weed free, grass sod. Shade trees also should be planted, which with mowing will prevent unsightly weed infestations.
- Native Grasses (100 acres) Native warm season grasses were planted in several locations totaling approximately 70 acres in the mid 1980's. An additional 30 acres were planted in 2005.
- Wetlands (60 acres) Guidelines for wetland design suggest a wetland to watershed ratio of 0.6 percent for nutrient and sediment removal from agricultural runoff. Table 9-2 outlines estimated wetland areas for each subbasin based on these recommendations. A wetland system to treat agricultural runoff from the four subbasins comprising the 26,000-acre (41-sq. miles) Evergreen Lake watershed would range between 11 to 93 acres (Denison and Tilton 1993). According to the U.S. Division of Fish and Wildlife's National Wetland Inventory, there are approximately 60 acres of freshwater forested/shrub and emergent wetlands currently existing within the watershed. Figure 9-2 shows the wetlands identified by the inventory in the vicinity of Evergreen Lake (where the majority of acreage is located). Table 9-2 further categorizes the wetlands by subbasin for reference. Restoring or improving these areas can potentially improve the quality of agricultural runoff that reaches Evergreen Lake.
- Experimental Tracts (50 acres) Small experimental tracts using natural succession and different combinations of plantings of native and cultivated shrubs, trees, and prairie plants for Parks Department, local university and school research purposes.
- Crop Lands (0 acres). All park lands crop areas have been retired for recreational or conservation use.

Water Uses

The primary use of Evergreen Lake is as reservoir for the city of Bloomington. The city has three pumps rated at 18 million gallons of water per day total pumping capacity at the lake. Pumpage levels vary widely between years, depending on the weather and the water quality in both Evergreen Lake and Lake Bloomington. At full pumping capacity, the lake contains enough water for approximately 280 days.

Boats with a 10 horsepower or less motor and park registration are permitted on the lake. Gas motors are prohibited in certain parts of the lake between October 15 and January 1 to accommodate migratory waterfowl.

Evergreen lake is inhabited by fish species including largemouth bass, crappie, muskellunge (muskie), hybrid walleye (saugeye), catfish, bluegill, white bass, yellow bass, common carp, and buffalo. While some species occur naturally, the McLean County Department of Parks and Recreation and the Illinois Department of Natural Resources also direct a long-term fishery management plan for the lake. Since 1990, the lake has been stocked with almost 80,000 largemouth bass, 10,000 muskie, and 400,000 hybrid walleye.

Evergreen Lake Shoreline Erosion Summary

In July of 1988 a shoreline erosion inventory was conducted on the 22.5 miles of shoreline of Lake Evergreen in McLean County. This inventory was completed to update an earlier survey that had been conducted before the level of the lake was raised to its current 720 foot elevation. This inventory was a visual estimate of eroding bank conditions completely surrounding the lake. Two categories of erosion were estimated. “Moderate” erosion consisted of Lateral Recession Rates on an *annual basis of up to* 0.5 foot per year. “Severe” erosion consisted of rates of 1.0 or more feet per year on an average annual basis. “Lateral Recession Rates” are rates established to estimate the vertical recession of an exposed bank on a yearly basis. Some banks will erode more than this

rate during high water times, but then have lower rates the following years as the bank reaches a more stable slope. Average annual values are meant to "average" these years out for lake management planning purposes. These rates are based on vegetative cover and overhang, type of geologic material exposed to the lake, estimated shear strength of this material, presence or absence of rotational slumping, material deposited at the base of the banks, and changes in associated cultural features. Height of the bank eroding and length of the bank eroding are based on actual measurements.

It was determined during the inventory that approximately 6,000 feet or about 1.2 miles of the shoreline was experiencing Moderate Erosion and about 9,000 feet or 1.7 miles was in the Severe Erosion stage. These values are somewhat less than the earlier report but some of those eroding reaches identified are now under water as the lake level has risen. If we assume total miles of shoreline is about 22 miles, then roughly 5 percent is eroding at a moderate rate and about 8 percent at a severe rate. The remaining 19 miles or so of lake shoreline varies from a non-eroding stable condition to one of slight erosion with low grassy banks.

Using the measured values for height and length of eroding bank, the Moderately Eroding areas contribute about 360 tons of sediment on an average annual basis to the lake. The Severely Eroding areas are contributing a significantly greater amount of about 1,750 tons per year. This brings the total estimated shoreline erosion in the lake to 2,300 tons. There are certainly years on the lake where the erosion total is significantly less than this and years when it is much more. What we saw when conducting the inventory might also be a reflection of what had happened around the lake *before* the lake level was raised. No monitoring stations were set up and without detailed surveying; it is difficult to measure the erosion in exact amounts. The sites most likely to be eroding are those on points that jut out into the lake and which may have several "faces" exposed to the wind and waves. The west and southwest portions of the lake have fewer eroding sites than other sides. This is probably due to being somewhat protected from the dominant west wind and thus accompanying waves. The material generally exposed to the erosion is glacial till. Glacial till

has a higher shear strength than the overlying silty loess, but will erode if the toe of the slope (bank) is undercut. In the very upper reaches of the lake, a silty loess-like alluvium is exposed but the bank heights are very minimal. Thus erosion rate is low. For the Moderately Eroding areas, bank height ranged from 1 foot to about 5 feet, while on the Severely Eroding areas, bank height ranged from 2 feet to about 14 feet.

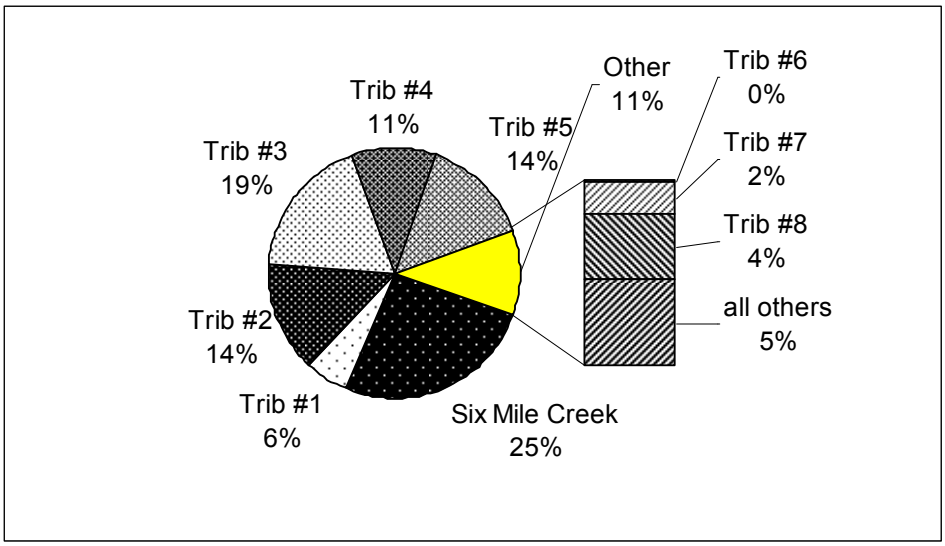
A 2005 study of lakeshore erosion in the Evergreen Lake watershed was conducted by Wayne Kinney and found that Evergreen Lake is a 900 acre water supply reservoir for the City of Bloomington. The reservoir was originally completed in 1971-72 with a surface area of 789 acres. In 1995 the principal spillway was raised from Elev. 715 to 720 increasing the surface area to its present size. Prior to the increase in lake elevation there was a retainer wall approx. 700 ft. long installed along the shoreline on the northwest side of the beach area. Today the top of this retainer wall is approx. 2.2 feet below normal pool at 717.8 ft. In addition a portion of the retainer wall has collapsed and the structural integrity of the remaining wall is uncertain. Therefore, the design for shoreline stabilization plan will assume that the remaining wall may fail at any time. The retainer wall was designed with excess material to account for wall failure. It will become part of the lake bottom.

The 1997 Erosion Control Study presents a very thorough analysis of the shoreline erosion on Evergreen Lake and concluded that the primary cause of erosion is wind generated wave action. This study also analyzed historical wind information and computed wave generation along the maximum fetch (6300 ft) at various wind velocities. A design wind velocity of 12 mile per hour will provide erosion protection from 96.8 percent of all waves generated on Evergreen Lake.

Streambank Stablization Study

In May 2005 a study of the feeder streams for Evergreen Lake was completed by Wayne Kinney of STREAMS. The survey found that of the nine tributaries, four were considered critical for immediate stabilization. Six Mile Creek, along with tributaries #2, #3, #5 together provide 72% of the erosion sediment to Evergreen Lake. The percentage of delivery for each tributary is shown in this chart.

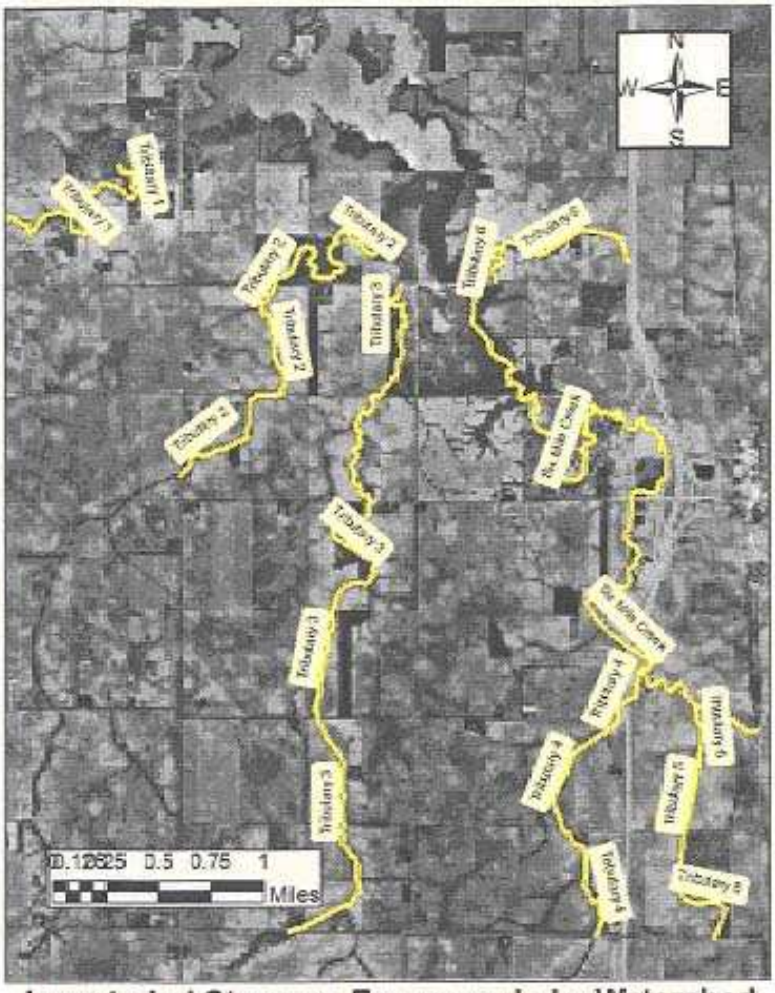
Percentage of sediment total delivered by tributaries



SOIL EROSION AND DELIVERY TO EVERGREEN LAKE

Stream	Length Inventoried (Miles)	Soil Erosion	SDR	STF	Sediment to Lake	Drainage Area Sq. Mi.	Tons per Sq. Mile	Tons per Mile
Six Mile	3.8	1176 tons	1	0.4	470 tons	17.65	27	124
Trib. #1	1.7	257 tons	1	0.75	193 tons	2.52	77	113
Trib. #2	2.3	627 tons	1	0.6	376 tons	4.38	86	163
Trib. #3	4	834 tons	1	0.6	500 tons	4.78	105	125
Trib. #4	1.4	488 tons	1	0.4	195 tons	3.61	54	139
Trib. #5	1.2	640 tons	1	0.4	256 tons	1.46	175	213
Trib. #6	0.9	10	1	0.75	8 tons	2.38	3	11
Trib. #7	0.7	84	1	0.24	20 tons	0.61	33	29
Trib. #8	0.3	165	1	0.24	40 tons	0.29	138	133
All Others		225 tons	1	0.34	77 tons	N/A	N/A	
	16.3 miles			Total	2135	37.68		

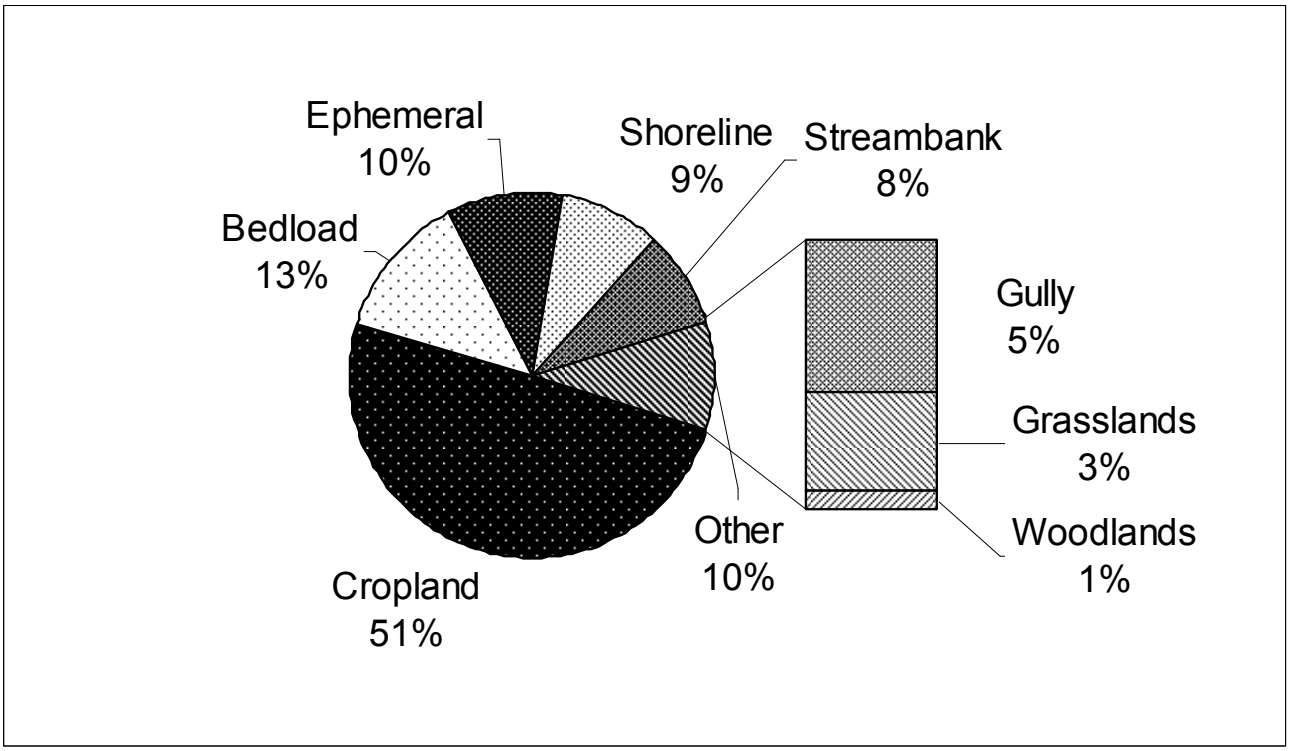
Soil Erosion is only from 16.3 miles of inventories of unmanaged streams
SDR is Sediment Delivery Rate (from NRCS guidelines)
STF is Sediment Transport Rate (from NRCS guidelines)



Inventoried Streams--Evergreen Lake Watershed

A process referred to as the Rapid Assessment, Point Method (RAP-M) was conducted to statistically estimate erosion and sedimentation rates within any given watershed by sampling a portion and then expanding this data to fit the entire watershed. Inventory data collected in the field from these sites includes all information necessary to compute sheet, rill and ephemeral erosion losses by randomly selecting sites, including stratified areas and samples from forested and agricultural riparian areas. Using this data, an **annual sheet and rill** soil loss rate for each type of major land use within the watershed is determined. If the total number of acres for each land use is multiplied times this rate, a gross amount of sheet and rill erosion occurring within the watershed is estimated. From these same 160-acre sample units, gully or concentrated flow reaches are also selected, again using a random procedure. The T-transect data is gained from an inventory of land use and tillage in 500 sites taken at 1.5 mile increments. The T- transect has been conducted by the McLean County Soil and Water Conservation District for the whole county biannually since the mid 1990's to give a statistically accurate gauge of the acres in conservation tillage for the primary crops in the county. The same route is completed each time in early June with a determination of which crop is growing, how much residue is left on the field and if no-till, strip till, mulch till or minimum tillage is used to establish the growing crop. This information when combined with the soil types and slopes in each field gives an estimate for the field if it is above or below the Tolerable soil loss or "T" hence the name T-transect.

Data gathered by the RAP-M show from where sediment found in the feeder creeks are coming.



Additional supporting survey data from the RAP-M Inventory and the T-Transect Inventory can be found in Appendix V.

Problem Statements

The primary problem found in the Evergreen Lake watershed area is that the level of phosphorus is too high. The Evergreen Lake Technical Committees each addressed the sources of phosphorus and prioritized them.

The IEPA TMDL phosphorus limit level may or may not be attainable, and as standards might be revised over the course of the implementation, the planning committee met to address problems in the watershed based on current regulations. Below are the problems addressed. The plan will strive to implement strategies to work toward the current limits. Lack of data in many areas acts as a significant detriment to planning, therefore data gathering is part of future planning.

Problem statements:

Biological Committee

1. Phosphorus is entering the lake though sediment delivery from feeder stream streambank erosion.
    - Stream survey reports that over 90% of sediment entering Evergreen Lake comes from within 4 miles of the lake.
2. Phosphorus is entering the lake through sediment delivery from erosion of the lakeshore.
    - The total estimated shoreline erosion in the lake is 2,300 tons annually.
3. Phosphorus is being released from the zero oxygen zone at deeper levels of the lake.
4. Sediment containing phosphorus that would typically be inert on the lake floor is being resuspended by the action of wind, fish and boat motor movement in the lake.
    - The 1997 Erosion Control Study presents a very thorough analysis of the shoreline erosion on Evergreen Lake and concluded that the primary cause of erosion is wind generated wave action.

5. Wildlife in the watershed area is providing a significant amount of phosphorus from their waste.
    - Studies in Wisconsin of Canada geese feces have shown that each goose adds approximately 400g of phosphorus to its habitat each year. There is a permanent population of approximately 200 geese and a migratory population of approximately 500 geese. These birds add 180kg (396 lbs) of phosphorus to the lake and lakeshore each year.

Agriculture Committee

1. Upland erosion from cropland is carrying phosphorus into the feeder streams.
    - Studies done by local fertilizer dealers show an average phosphorus level in area agricultural land is 37-42 pounds per acre.
2. Agricultural animals in the watershed are contributing phosphorus through their waste.
3. Upland erosion from cropland and streambed erosion is carrying sediment into feeder streams and Evergreen Lake.

Urban Committee

1. Increased runoff flow rates during large rain events increase the amount of erosion in urban streams that adds phosphorous to sediment entering the watershed through urban storm sewer systems.

2. Sheet flow runoff from paved surfaces carries phosphorus and other chemicals from urban areas into feeder streams.

3. There is no monitoring or collection of water quality data of urban runoff in the Evergreen Lake watershed. Lack of primary data prevents effective evaluation of urban storm water management practices and prevents setting priorities of proposed programs and improvements.

Goals/Objectives

The total allowable load of phosphorus set by the USEPA for Evergreen Lake is 4,900 lbs per year. To reach this level, the total load in Evergreen Lake needs to be reduced by 85%. Many of the sources of phosphorus in the watershed are presently not monitored, so the percentage of improvement from each individual practice has not been modeled. These practices will improve the water quality, but until further monitoring is in place, the final reduction cannot be predicted. Goals were calculated based on a percentage of reduction based on tons of sedimentation per year and converted to tons of phosphorus per year by taking samples and analyzing phosphorus content.

Goals for each Problem Statement identified in the previous section are as follows:

1. Streambank erosion
    a. Stabilizing the streambank erosion on the lake feeder streams will reduce the amount of phosphorus entering the lake by 6%.
2. Lakeshore erosion
    a. Controlling lake shore erosion will reduce the amount of phosphorus entering the lake by 6%.
3. Deep lake sediment
    a. The destratifier is presently responsible for reducing the amount of phosphorus held in the deep zone of the lake. We would expect that the effectiveness of the destratifier would continue. The destratifier increases the oxygenated zone from 16 ft to 30 ft. The oxygenated zone has approximately 70% less phosphorus than the unoxygenated zone.
4. Resuspended sediment
    a. A management plan that addresses aquatic plantings to hold sediment in place, and the influence of carp on the lake floor will reduce the phosphorus load.

5. Wildlife
    a. Through wildlife management practices that place control on the placement and population of Canada Geese, we will reduce the amount of phosphorus entering the lake by 0.5%.
    b. Control of the carp population will reduce the amount of phosphorus entering the lake from resuspended solids by 0.5%.
6. Upland cropland erosion

    Reduce delivery of sediment from upland erosion caused by sheet and rill, and ephemeral erosion by 33% in the next 10 years to the lake if there is 100% compliance. The expected compliance is 25%. This will be accomplished through implementation of agricultural Best Management Practices such as no-till/strip-till, grassed waterways, terraces and water and sediment control basins, filter strips and field borders. Along Agricultural corridors, reduce streambank and shoreline erosion and the accompanying sediment delivery to the lake by 6%, at 100% compliance, through streambank and shoreline stabilization projects. The expected compliance is 30%. These practices will include rock riffles, stream barbs and longitudinal peak stone toe protection.
7. Agricultural animal waste

    Reduce phosphorous loading to the lake from all agricultural sources. This will be accomplished through implementation of agricultural Best Management Practices, such as nutrient management plans, filter strips, field borders and no-till/strip till, wetland restoration, and conservation cover. There are 263 head of cattle, swine, horses, sheep and dairy in the watershed in 13 different operations. The committee decided that agricultural animal waste was not a high priority as there are no high concentrations of livestock in any one area.
8. Increased urban runoff

    Reduce general phosphorous loading and other pollutants of urban runoff.

9. Sheet Flow runoff

   Reduce erosion and deposit of phosphorous laden sediment into watershed streams

10. Monitoring needs

    Establish a program to monitor urban runoff and collect water quality data to better evaluate storm water management practices and propose improvements

Best Management Practice (Presently quantifiable)	Estimated participation	Estimated Phosphorus Reduction (lbs) At 100% participation	Phosphorus Reduction Percentage
Streambank Stabilization	20%	1902	6%
Lakeshore Stabilization	100%	1678	6%
Upland cropland erosion control	25%	9015	33%
Wildlife management (partially quantifiable)	100%	Geese-200lbs Carp- N/A	>1%
BMP Presently Unquantifiable			
Deep Lake Sediment	Data not available.		
Resuspended sediment	Data not available		
Agricultural Animal waste control	Data not available		
Urban Runoff control	Data not available		
Sheet flow runoff control	Data not available		
Total Quantifiable		12795	46%
Goal		**22,322**	**85%**

Implementation strategies/Alternatives

The implementation plan focuses on three areas that need attention:

- Reducing the amount of phosphorus presently in Evergreen Lake.
- Reducing the amount of phosphorus that will be entering the lake in the future.
- Setting up monitoring systems to measure our effectiveness.

1. Reducing Phosphorus Presently in Evergreen Lake

Using destratifiers in Evergreen Lake will minimize the effect of zero oxygen areas in the lake and the subsequent phosphorus release from these areas. A change in shoreline management practices will move the major wildlife source of phosphorus, *Branta canadensis* (Canada Goose) away from the lake and feeder stream shorelines and thus reduce the impact of waste matter on the lake.

Destratification

On June 20, 1996, destratifier units were placed on the bottom of Lakes Bloomington and Evergreen. The units are designed to maintain adequate dissolved oxygen levels in the lakes. The City of Bloomington installed the units

as part of its overall lake management program. The Illinois State Water Survey Office of Water Quality Management recommended the system.

Dissolved oxygen is an extremely important substance in lakes. Dissolved oxygen (D.O.) is essential for fish and other organisms to survive. Lake water can gain D.O. through the release of oxygen by algae and other submerged aquatic plants. Another major source of oxygen transfer occurs at the lake surface, where oxygen from the atmosphere can diffuse into the water. By moving the destratifier to the deepest part of the lake, the entire 50 feet of water in the water column would be improved instead of the current 35 feet.

Oxygen can be consumed in lakes by fish and other organisms, by algae and other plants when no light is present, by the decomposition of organic matter, and by oxygen demanding substances. Decaying matter in the sediments of the lake bottom can also cause D.O. levels to drop. In the lower levels of a lake, oxygen can be consumed faster than it can be replaced, and the D.O. levels can drop to zero.

Without D.O. in the bottom levels of lakes, compounds can be released by the lake sediments which can cause excessive growth of algae and can cause taste and odor problems in drinking water. The part of a lake where no dissolved oxygen is present is called the *anoxic zone*.

Like most constructed lakes in the Midwest, Lake Bloomington and Lake Evergreen develop anoxic zones during the summer months. As the summer progresses, the anoxic zone grows and undesirable compounds, including phosphorus, concentrate. The anoxic zone is prevented from mixing with the oxygen rich upper layer of the lakes by a sharp difference in temperature (called a thermocline) between the two layers. The depth at which the thermocline forms is a function of lake morphometry and energy transfer from the wind during the spring months, and can range from 12 to 18 feet from the surface of the lake..

In the fall, the upper layers of the lakes cool down. When the temperature of the upper layer approaches the temperature of the bottom layer, the entire lake can mix (*lake overturn*). The oxygen demanding compounds, the taste and odor causing compounds, and the nutrients that can cause excessive algae are then released into the entire lake. This is the time when taste and odor problems most often occur in drinking water.

The destratifiers provide uniform temperature and oxygen only to the depths at which they are deployed. The destratifier at Evergreen Lake is deployed near the water intake structure at a depth of 35 feet. As a result, depths greater than 35 feet will form an anoxic zone.

Samples were taken throughout the water column at the deep station just before overturn in the fall of 2005. Total P concentrations of 0.5 mg/l and 0.14 mg/l were observed in samples collected at 1 foot and 3 feet from the lake bottom, respectively. Samples collected from other depths were all below the detection limit of 0.1 mg/l.

In order to arrive at a crude, conservative, estimate of internal loading of phosphorus due to anoxic conditions in the lake and to estimate the load reduction due to destratification, several assumptions were made. The first assumption was that all of the phosphorus loading from anoxic release of P occurs during fall overturn. The second assumption was that elevated P concentrations only occur in an anoxic zone extending two feet above the sediment surface, with chemical precipitation and other processes keeping P concentrations near background levels in zones extending greater than 2 feet above the sediment. The Total P concentration for the bottom 2 foot layer for October 2005 was estimated as the average of the concentrations for the 1 foot and 3 feet samples (0.32 mg/l P).

Using the depth volume relationship developed in the Hanson Engineering sedimentation survey (1999), 0-2ft above the sediment surface water volumes

were calculated for each 2 foot depth increment and multiplied by the 0.32 mg/l total P concentration. The pounds of phosphorus contained in each 2 foot "ring" were then summed for a total of the pounds of phosphorus in the anoxic zone of the lake.

For the October, 2005, samples, the calculated mass of phosphorus was 147 pounds. If the destratifier was not operating and the anoxic zone started at 15 feet, the calculations would result in a mass of 797 pounds of phosphorus. The P load reduction from the destratifier would then be approximately 650 pounds per year. The destratifier operated on an intermittent basis over the last few years. The unit operated continuously last summer.

Evergreen Lake aquatic habitat restoration plan

The McLean County Department of Parks & Recreation and IDNR have begun planning for aquatic habitat restoration. Restoring habitat to the lake shore and lake bottom will reduce erosion and resuspension of sediment in the lake. The first objective to the habitat improvement project is to review pertinent literature. This process has been initiated and will continue. An extensive literature review has taken place and indexed by topic and/or plant species. Further information is being gathered from biologists who have implemented similar projects. These contacts have proven to be very beneficial.

The second objective is to secure plant material to create an in-lake nursery. Local lakes were surveyed for aquatic vegetation types to determine the availability of certain plant species. It was determined that some plants are not found in enough quantity in local areas. The Missouri Department of Conservation has agreed to supply some plants for this project. It is felt local genotypes will be better, but the acquired plants should be fine. Some plants will be purchased from local wetland owners, while others can be taken from local lakes.

Implementation

The first objective is to establish a nursery area in Evergreen Lake. The nursery area will be a fenced area that will contain small swimming pools. We will place nursery pots in the swimming pools. The pots will contain either plant cuttings or plant tubers. We will add a fertilizer tablet to the pot when we plant the cuttings. The tubers will be handled the same way. We plant the tubers in pots, fertilize, and then wait until they are flowering to transplant them into the lake. This first objective was completed in 2005. Five cages were placed into Evergreen Lake that contained a total of 14 pools. Plant species contained in the nursery area include water stargrass, largeleaf pondweed, sago pondweed, vallisneria, and American pondweed. Two of the pools containing water stargrass were moved to Jone's Pond at Comlara Park. Sweet Flag was transplanted in 2005 but was not found later in the year. This species will be transplanted again in 2006.

The second objective is to transplant the mature plants into the lake. Exclosures will be built to protect the plants. Suitable habitats will be selected for planting. Once the plants have grown outside the exclosure, we will remove the fencing. This may take several years. Once ideal locations have been exhausted, sites that exhibit a harsher environment will be planted.
The second objective should be started in May of 2006. With low water levels in 2005, the aquatic nursery might not be as productive as hoped and more resources might be placed in recovering the nursery.

The third objective is to plant trees and shrubs along the shore to reduce erosion. Erosion is severe entering the lake and is causing high turbidity. High turbidity can hinder the establishment of aquatic vegetation.
Willow cuttings were utilized and planted in the winter of 2004/2005 in the lake. This practice will continue.

Monitoring

All vegetation plots will be monitored for survival. Each species will be monitored to determine the suitability of each species in Evergreen Lake. It is

hoped that once plants have become established they will expand into other areas of the lake.

Fish populations will be monitored each year to determine if the increase in vegetation is having a positive effect on sportfish populations.

Wildlife management practices

Goose management:

Evergreen Lake participates in a goose egg removal project, whereby goose eggs are removed from nests and relocated to southern Illinois for incubation and hatching. This greatly reduces the number of geese born on the lake every season.

Carp Management:

Common Carp (*Cyprinus carpio*) is an exotic species from Asia that was introduced to the United States in the 1870's. Carp have become so abundant on Evergreen Lake they have attributed to the increase in lake turbidity and the destruction of aquatic vegetation from their feeding practices.

Evergreen Lake promotes bow fishing on the lake for carp in an attempt to reduce the density of the carp population. Bow fishing can remove large numbers of carp from a lake, but no documentation exists that quantifies the impact on carp population. In order to significantly reduce carp population, a commercial fishing program should be initiated. The feasibility of a commercial fishery for carp is variable and depends on the market demand for carp. Currently, there is a market for common carp and a commercial fishing program will be pursued to lower the density of carp in Evergreen Lake.

The removal of common carp would allow more aquatic plants to grow and help stabilize the sediment on the lake bottom. A carp project in Wisconsin documented the increase in game fish populations and an increase in aquatic vegetation after the removal of carp from a lake.

1. Reducing potential sources of phosphorus entering the lake

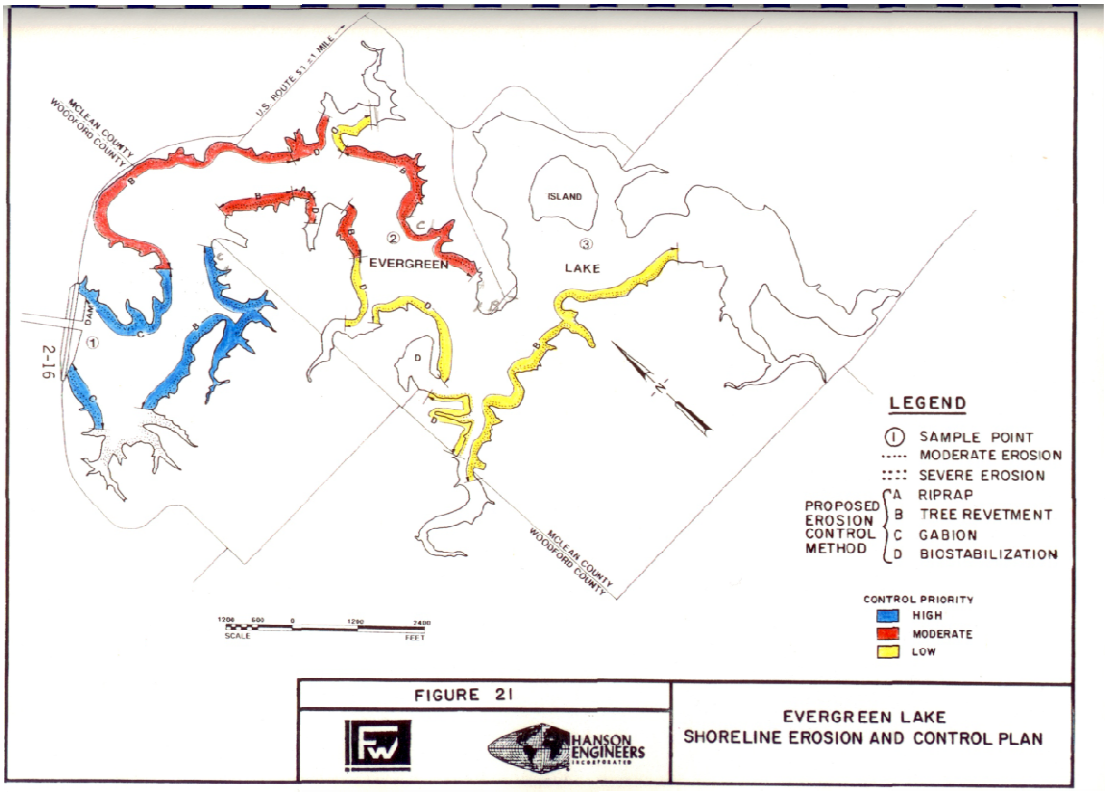
By reducing the amount of phosphorus loaded sediment entering the feeder streams and lake, the phosphorus loading of Evergreen Lake will decline dramatically. Finding the major erosion sites and of streambank and shoreline erosion and remediation of these areas with be the top priority.

Lake Shoreline stabilization

In searching for an effective and yet economical treatment method for shoreline protection several factors were considered.

1) Cost of materials
2) Ease of Construction
3) Durability
4) Maintenance Costs
5) Appearance

Previous studies at other reservoirs have led some to the option of using a method of Longitudinal Peaked Stone Toe Protection (LPSTP) as the best combination of all these factors.



LPSTP is a tried and proven method used extensively by the U.S. Army Corps of Engineers for bank protection on rivers and streams. Its adaptation to shoreline protection is relatively new, but very promising, especially where there is a “wave bench” of sufficient width on which to construct the LPSTP. The method consists of a simple “windrow” of stone of sufficient size to resist movement by water placed parallel to the eroding bank. The height of the protection and stone size is determined for each application based on flow depth or wave heights and velocities.

The Evergreen Lake Erosion Control Study has determined that the combined pressure that must be withstood to be 777 pounds/square foot and that an average aggregate size of 1.0 ft. will be sufficient. The study has identified 28,000 feet of shoreline that needs to be stabilized.

Therefore the basic design assumption for Evergreen Lake is that protection must be provided for 1 ft. high waves with a stone size of 1.0 ft. in diameter. By adding 0.5 foot of freeboard the design height is then 1.5 ft. above normal pool or Elev. 721.5.

Freeboard of 0.5 ft. above maximum wave height generated is sufficient to allow the bank to stabilize behind the LPSTP as there will be a small area of water pooled behind the LPSTP and in the most critical areas there will be a 3.0 ft. top width to help dissipate the energy before reaching the exposed bank material.

The advantages of this technique that make it attractive as a shoreline protection measure are:

1) Material can be placed from the bank with a trackhoe into standing water. Thus there is no need to lower water levels to make the installation.
2) U.S. Army Corps of Engineers does not recommend any filter fabric or bedding material be used with LPSTP. This recommendation was confirmed by a telephone contact to Mr. David Derrick, USACOE, Waterways Experiment Station, Vicksburg, MS. Therefore the cost of installation and materials is reduced.
3) No site grading or preparation is required prior to placement of stone.
4) RR-5 Stone with a median diameter of approx. 10 inches is suitable for this installation and readily available.
5) Should there be additional loss of lakebed material on the lakeside of the LPSTP the stone will be free to launch and adjust to “self-heal” the damage. Should the crest elevation be compromised due to stone launching to the lakeside of the LPTSP, additional RR-5 material can be easily added to restore the crest elevation.
6) The bankside of the LPSTP will collect bank material from the eroding bank and form a level bench at the crest elevation which will then promote natural stabilization of the eroding bank.

Design Specifics for Beach Area Demonstration at Evergreen Lake

1) Stakes have been set at centerline of LPSTP beginning approx. 100 ft north of the fenced beach area west of the Bath House.

2) Some tree removal will be required to get access from the bank with equipment. The willow growth from approximately 700 to 1200 feetshould also be “bush-hogged” to remove top growth only so that the equipment operator can see to place stone.
3) RR-5 material can be stockpiled along shore and then placed along centerline with a trackhoe to elevation 721.5 allowing the sideslopes to assume their natural angle of repose. (approx. 1.5:1)
4) Access to site may require removal of some portions of chain link fence and care must be taken to avoid damage to the pumping stations located on the bankline west of the beach area.
5) LPSTP will be constructed with a 3.0 ft. top width for the first 700 feet from the bath house. LPSTP from 700 feet to 1200 feet will have a narrow peaked crest. All crests shall be constructed to Elev. 721.5.
6) RR-5 Material shall be of sound quality meeting IDOT standards for gradation and durability.
7) Where the existing retainer wall is intact, the LPSTP is located 13 ft toward the bank so that if the wall fails a 1.5:1 slope failure will not compromise the LPSTP. Should the slope failure be flatter than 1.5:1 some additional stone would be needed to maintain the design height.

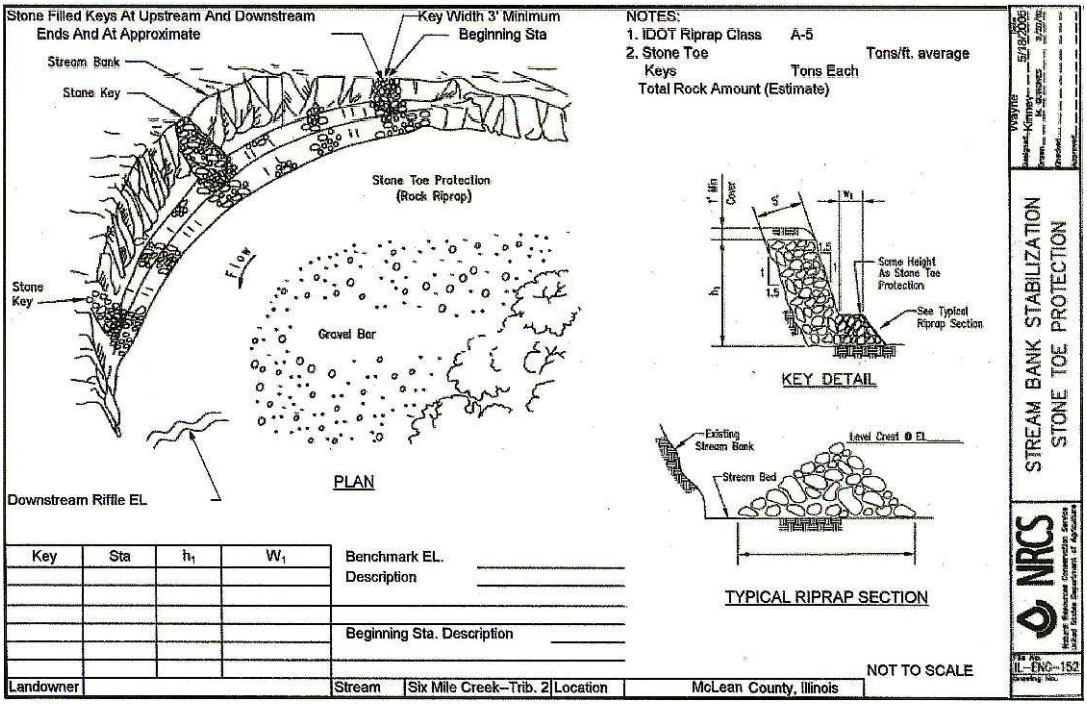
Streambank Stabilization Program

In Wayne Kinney’s 2005 streambank survey, he makes the following recommendations:

The “bankfull” widths of all the inventoried stream segments is 40 feet or less, therefore it is impractical to consider any type of in channel flow redirection, such as Stream Barbs or Bendway Weirs. Use of these techniques is only applicable to wider channels with bar material that can be easily moved. Therefore there are three approaches left to stabilize the eroding banks.

1. Stone Toe Protection (STP)-Each eroding bank can be protected with non-erodible material. Typically meandering beds similar to those in Evergreen Lake watershed can be stabilized by placing hard armor only on the toe of the bank. The most common method

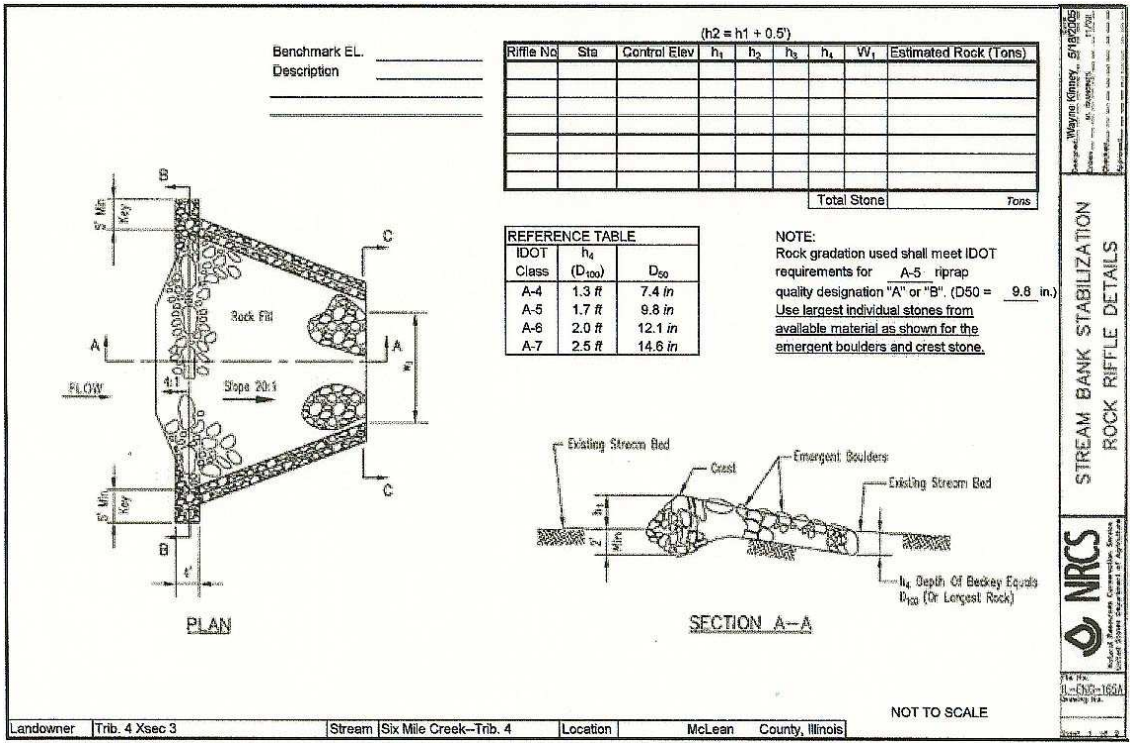
is to use quarry stone properly sized to resist movement and placed on the lower one-third of the bank in a windrow fashion. This technique is called Stone-Toe protection and is widely accepted and successful. Some areas will need to be properly stabilized and realigned for STP to work properly, and several areas will need STP on both sides of the bank, which can be costly. Channels that are deepening pose other problems, as the STP can fall into the channel as the channel lowers, so additional stone should be used in those areas.



2. Rock Riffle Grade Control (RR)- Use of loose rock grade control structures at the natural riffle locations in a stream will create or enhance the riffle-pool flow sequence found in natural channels. In stable systems, this alternating riffle-pool sequence dissipates the energy in the stream and allows streambanks to remain stable with little or no lateral movement. By installing RR in an incised channel, the riffles will raise the water surface elevation resulting in lower effective bank heights, which increases the bank stability by reducing the tractive force on the banks. Research has found that stable streams have a riffle every 5 to 7 bankfull widths and that at

this natural spacing the stream is still able to transport the sediment generated in the watershed. This is crucial because failure to transport the sediment would result in the channel filling with sediment and losing its capacity. Such stable streams therefore have a well developed floodplain at the one to two year return interval discharge rate. Thus the flows larger than this go “out-of-bank” and dissipate excess energy over a wide floodplain, allowing the banks to remain stable and intact.

In Evergreen Lake watershed nearly half of all cross sections evaluated require more than twice the bankfull discharge to reach the floodplain. Under these conditions, energy dissipated on the floodplain of a stable stream is contained within the channel and results in unstable, eroding, rapidly migrating banks. Properly designed rock riffles would restore this connection to the floodplain, increase pool depths, halt degradation and produce a stream system that can be maintained in equilibrium. There are drawbacks to the riffle system for Evergreen Lake watershed. Because the channel is narrow, there is a need for many riffles, and there would be more flooding outside the banks as the streams reconnect with their floodplains. There is a compromise to construct the riffles so there is little or no flooding of cropland with filterstrips and easements to prevent economic damage from increased flooding.



3. Floodplain Excavation- This is an alternative to raising the water surface and reconnecting the channel to the existing floodplain to dissipate energy. By excavation to develop a new floodplain within the existing stream corridor the channel can be returned to its naturally stable position. In other words, instead of raising the water level, we lower the floodplain. By using mechanical means to restore the floodplain we could utilize the soil that would eventually be eroded as the stream tries to establish its own floodplain over time. This technique had no obstacles except land rights, loss of woody vegetation near the stream and the utilization of excavated material, which can be stockpiled, sold, or put on adjacent cropland.

The best solution to streambank erosion in the Evergreen lake watershed would require the use of all three methods.

Agricultural Best Management Practices

Agricultural use of fertilizers has been decreasing in the past several decades, so that the amount of phosphorus used on fields is less than the demand from the crop load. Increasing the width and amount of filter strips along

stream banks will control runoff from heavy rains after application. Encouraging landowners in the watershed to participate in Conservation Reserve Enhancement Program (CREP) will increase the overall amount of acreage used as streambank buffer strips. The Rapid Assessment Point Method (RAPM) inventory will help to pinpoint agricultural areas where erosion is a problem.

The phosphorus input from the two major agricultural sources in the watershed can be addressed with similar solutions. The primary control of agricultural phosphorus loading is through nutrient management. Working with watershed farmers, scheduling both the timing of application and the amount applied will greatly affect the amount of all added nutrients that enter the feeder streams and lake through runoff. Other practices, in order of effectiveness, are no-till and strip-till practices, filter strips, riparian forest and contour buffers on cropland margins, and grassed waterways through croplands. Grade stabilization programs and developing additional incentive programs to encourage landowner participation in these programs would also address field runoff issues.

Urban Area Best Management Practices

The Town of Normal was required to submit in 2003 a storm water management plan in accordance with United States Environmental Protection Agency law**.** This document outlines the Town's program to develop, implement and enforce a storm water management program designed to reduce the discharge of pollutants to the maximum extent practicable, to protect water quality, and to satisfy the appropriate requirements of the Federal Clean Water Act in accordance with the USEPA NPDES Phase II program. The plan addresses six minimum control measures as required by state regulations:

- Public Education/Outreach
- Public Participation/Involvement
- Illicit Discharge Detection/Elimination
- Construction Site Runoff Control
- Post Construction Runoff Control

- Pollution Prevention/Good Housekeeping

The storm water management plan presents a mix of best management practices within each control measure to address soil erosion, sedimentation of streams and Evergreen Lake, fecal coliform, grease and oil, household and lawn/garden chemicals that could potentially end up in local streams.

Public Education/Outreach

This control measure will target homeowners, restaurateurs, industry and the general public in the entire watershed. An informed and knowledgeable community is crucial to the success of the storm water management program. As the public becomes aware of the personal responsibilities expected of them and others in the community, including the individual actions they can take to protect or improve the quality of area waters, a greater compliance with the storm water program will result. The storm water management plan has two major initiatives: the formation of partnerships and the use of educational materials.

The Ecology Action Center and other educational resources, such as the SWCD, and Extension Office, will provide program information, give residents an opportunity to share resources and participate in activities and events in regard to local environmental issues: greenways, bikeways, natural conservation areas, recycling and water quality issues. Education topics might include the benefits of recycling and opportunities for enhancing greenways.

The educational materials will include, but will not be limited to, the following:

1) Brochures
2) Alternative information sources (websites, bumper stickers, posters etc.)
3) A library of educational materials
4) Summer camp/club programs
5) Portable Storm Water Informational Display/Exhibit

The public education program will use a variety of strategies in which to reach a diverse audience. Mass media campaigns will use a mix of media to

generate a watershed message to our audience. Our local strategies will use television and radio ads, including multilingual posters.

The school education program will target school age children. The programs will teach students the water cycle, the watershed, the benefits of composting and storm water runoff.

The adult education effort would target homeowners about proper septic system maintenance, proper disposal of used motor oil, chemicals, pesticides and household products. As noted by the IEPA, septic systems are a potential source of nonpoint source phosphorus loading. The McLean County Environmental Health Department estimates that there are 750 permitted septic systems throughout the Evergreen Lake watershed. McLean County Parks and Recreation has a permit for a lagoon-type system that is located near the lake. Conversations with local officials have indicated that there are no known leach field septic systems in close proximity to the lake. A long range solution to failing septic systems is connections to a municipal sanitary sewer system. Installation of a sanitary sewer will reduce existing nutrient sources by replacing failing septic systems and will allow communities to develop without further contribution of phosphorus loads to Evergreen Lake. Costs for the installation are generally paid over a period of several years (average of 20 years) instead of forcing homeowners to shoulder the entire cost of installing a new septic system immediately. In addition, costs are sometimes shared between the lake community and the utility responsible for treating the wastewater generated from replacing the septic tanks. The planning process is involved and requires participation from townships, cities, counties, lake associations, and citizens.

Support by the citizenry is crucial to the success of the storm water management plan. The measure will involve all socio-economic groups. The public participation program is a key component of the public education measure. Broader public support in the development and decision making process will minimize potential legal challenges.

Public Participation/Involvement

Public meetings will provide an opportunity to discuss various viewpoints and provide input concerning appropriate storm water management policies and practices.

Community cleanup projects for local streams, riparian corridors, trails, highways, streets, open space and parks will be targeted to increase public involvement and awareness.

Recycling programs will be enhanced**.** The largest pollutant components in our storm drains and water bodies will be identified. A recycling program will be modified to target the largest pollutant-components.

The Town of Normal established a storm water phone hotline (433-3403) in July 2006 to aid enforcement authorities in the identification of polluters. "Adopt a Storm Drain" program, will offer individuals and groups an opportunity to monitor what is entering through our waterways.

A storm water inlet stenciling program was initiated in June 2006 to help raise community awareness.

A watershed oversight committee comprised of agency officials, residents, and property and business owners will be organized to provide input and address concerns and questions that may arise with new policies, programs and improvements.

Rural communities in the watershed will be included in educational programs and implementation planning. Rural communities will be encouraged to adopt sediment erosion control and streambank buffer ordinances like those of the nearby urban areas and the county at large.

Illicit Discharge Detection/Elimination

The illicit discharge detection measure will involve both municipal staff and local citizens. Each jurisdiction will locate illicit discharge problems areas through public complaints, visual screening and dry weather screening methods. The program will work to detect and eliminate illicit discharges.

The local Geographic Information System (GIS) will be used to map the location of all storm sewer outfalls and all the waters that receive storm water

discharges. The GIS will also allow the input of citizen complaints and dry weather screening and monitoring data.

The Town's Municipal Code (Section 7.20-20) allows municipal employees access on private property for inspection in locating potential sources of illicit discharges. The enforcement actions that will be taken against those properties found to be in non-compliance or that refuse to allow access to their facilities are varied. They range from cease and desist orders, suspension of water or sewer service, and criminal and civil penalties, including charging the owner of the property for the cost of abatement.

Construction Site Runoff Control

It is recognized that construction sites can deposit a significant amount of silts and sediments in a short period of time. The Town of Normal will adopt an Erosion and Sediment Control (ESC) Ordinance to reduce construction pollutants in its storm water runoff. The ordinance will require that land disturbance of 5,000 square feet or more will be regulated. It requires developers, builders or owners to submit a plan that contains measures to reduce soil erosion and practices to control sediments. Additionally, ESC requires the submittal of construction plans prior to ground being broken.

Once a plan is reviewed and approved, staff will endeavor to ensure that the ESC plan is followed. The ordinance then requires the developer builders or owners to install and maintain those specified measures and practices agreed to in the plan. Sites may be inspected for compliance and if found lacking, an inspector may issue a permit violation, stop work order, fine or other measure to ensure compliance.

In 1987, the Clean Water Act (CWA) was amended to address storm water runoff in two phases. Phase I of the National Pollutant Discharge Elimination System (NPDES) began in 1990 and addressed point sources such as Medium Municipal Separate Storm Sewer Systems (MS4) and other industrial sources of pollution including construction sites disturbing five acres of land or more. NPDES phase II was implemented in March of 2003 and requires a permit for additional MS4s and construction sites disturbing equal to or greater than one but less than five acres of land (http://www.epa.state.il.us/small-business/phase-two/). The Illinois Environmental Protection Agency (IEPA) is in charge of implementing both phases of the NPDES Storm Water Program.

Although IEPA is the regulating agency for Phase II Stormwater permits, they do not have the workforce to inspect and critique permitted sites. Currently, IEPA only has enough manpower to visits sites if violations have been reported. No prophylactic inspections take place. Therefore it is recommended that there be an intergovernmental agreement that would allow for a voluntary program of review of sediment and erosion plans, including inspections of worksites, to ensure they comply with the plan in areas not covered by municipal or subdivision code.

Example 1.

To assist local developers in avoiding fines and address NPDES phase II requirements, the Macon County Soil and Water Conservation District (SWCD) provided plat reviews for erosion control plans. As many of these reports were being filed away with little or no implementation of the suggested practices, the SWCD began an educational program for developers. The goal of this program was to help the construction community implement their plans before IEPA began fining them for violating their Phase II permits. With funding from IEPA, a pilot project was developed to support this effort.

The project focuses on opening lines of communication between the SWCD and developers to explain Phase II rules and inspect construction site soil erosion and sediment control practices. In one of the first inspections, the SWCD found that a construction site was discharging sediment to Lake Decatur, a public

water supply lake. They met with the developer, and explained that they were currently not in compliance with Phase II regulations. The erosion control plan was not on site, and it appeared that none of the plan elements had been implemented. The SWCD gave the developer seven days to implement their plan and offered assistance if needed. The second time the SWCD inspected the site, the plan was on site, all of the suggested BMPs were implemented, and therefore a report to IEPA was not in order. This particular developer went on to appoint one person from their firm to handle all the phase II rules.

The news got out quickly that IEPA was serious and that the Macon County SWCD could help keep developers out of trouble with their site inspections. Soon developers began seeking the assistance of the SWCD to help keep the IEPA off their sites.

Example 2.

In Northeastern Illinois, Kane/DuPage SWCD is participating in the NPDES Phase II pilot program as well as, several MOUs with municipalities and an Interagency Coordination Agreement (ICA) with the Chicago District of the Army Corps of Engineers (USCOE).

The USACOE administers a permit program under Section 404 of the Clean Water Act, which requires appropriate soil erosion and sediment control measures to be implemented and maintained near sensitive areas including wetlands. (http://www.kanedupageswcd.org/erosion.htm). The Corps' program is similar to the Phase II requirements.

Municipalities in Kane and DuPage Counties that adopted stormwater regulations based on NPDES Phase II, did not have the work force to monitor their soil erosion/sediment control ordinances. The SWCD approached these municipalities with an offer to approve erosion control plans and inspect construction sites for a fee. According to the Illinois Soil and Water Conservation District Act, SWCDs have the authority to charge fees to cover the cost of assistance to municipalities. The fees agreed upon, are charged directly to the developers and are charged on a per acre basis. This practice came about with the knowledge that developers would be more willing to pay higher fees as the

acres developed increased. County Forest Preserve Districts are charged half for plan and site inspections while state and federal projects are *pro bono*.

The municipalities that entered into MOUs with Kane/DuPage SWCD require the developers to submit their SE/SC plans to the SWCD and allow them access to sites during construction in order to get a construction permit. Once the SWCD approves the erosion plan, a permit is issued and CPESC certified SWCD employees inspect the site on a monthly basis. Inspections are also done after rain events to determine the effectiveness of the selected practices.

Post Construction Runoff Control

The Town of Normal proposes to address the post-construction runoff with structural and non-structural management practices. The controls seek to reduce the amount of impervious cover, by increasing natural land set aside for conservation and to use pervious areas for more effective storm water management. The Town of Normal has looked at a variety of ways to increase green spaces. For example, Normal has new landscaping requirements for parking lots.

The Town of Normal is planning to develop a Stream Buffer Ordinance, which includes, but is not limited to, the 100-year flood plain.

Structural management practices shall include the use of wet and dry retention basins, which will principally be used in the urban environment. Programs for designers and developers will provide information on proper design and the overall need for retention basins.

Pollution Prevention/Good Housekeeping

The Town of Normal's pollution prevention/good housekeeping measure for municipal operations program goal is to reduce pollutant runoff from municipal operations. The vehicle maintenance program requires that all city-owned vehicles be regularly inspected to eliminate oil, grease, and fluid leaks. Street sweeping will be more frequent at high traffic areas. A program for the inspection of storm drains will be developed.

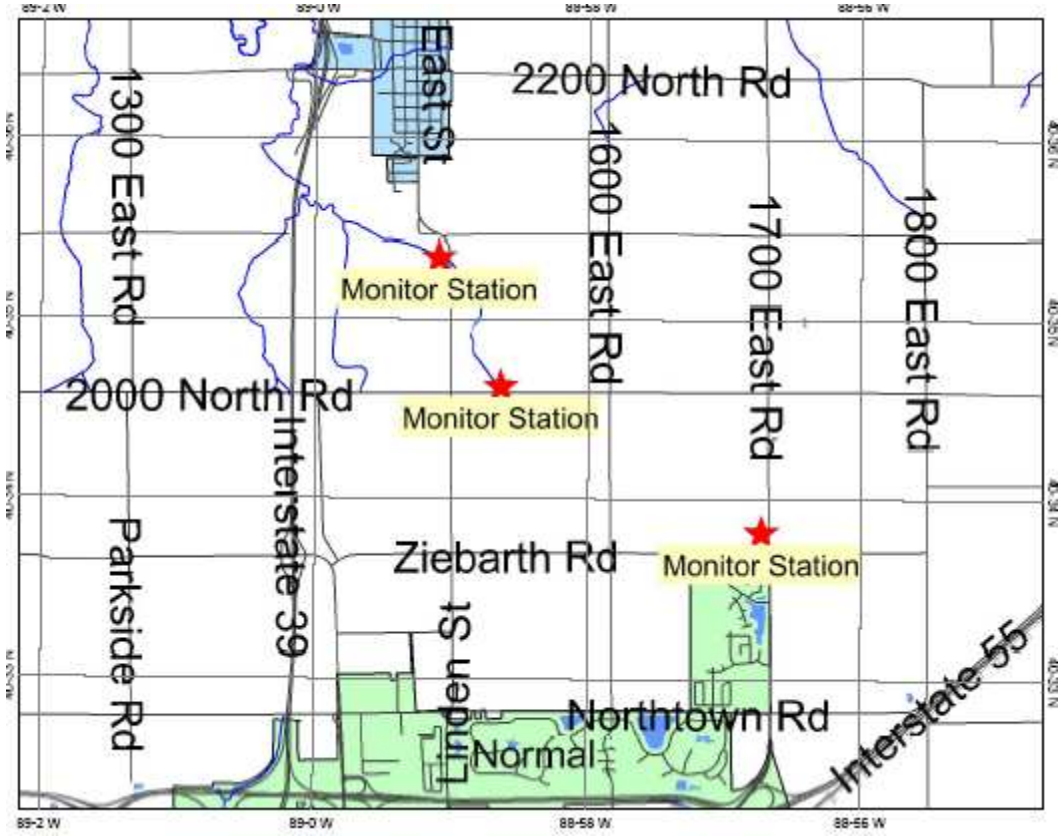
An Integrated Pest Management program (IPM) will be developed and offered. The program will train municipal employees on current best management practices for pest management. Lawn pesticide application classes will be offered to municipal employees and city residents.

In addition to the management practices of the Town's storm water management plan, the Town with the help of Bloomington Water Reclamation District and the Illinois Environmental Protection Agency will install a stream gauging and sampling station on a critical feeder stream of Six Mile Creek to collect runoff data so that a reliable water quality baseline can be established to evaluate management practices and propose improvements.

3. Monitoring for Evaluation

The second issue stemming from urban runoff is that there is very little monitoring of this runoff. An increased monitoring system is needed to pinpoint problem areas in the urban areas so further plans can be developed.

The primary purpose of the Urban Monitoring program is to measure contributions in runoff quantity and quality emanating from the urban development sites within the Six Mile Creek watershed. Storm water runoff from urban and urbanizing areas is recognized as a cause of water pollution. Three proposed locations would be constructed and monitored as part of the initial program. Location of these sites would include monitoring stations on Six Mile Creek and it's tributaries at three bridges, Pipeline Road, Towanda Avenue and Linden Street.



Location of monitoring station at Towanda Avenue.

Monitoring station at Pipeline Road.

The program would monitor flow, total Phosphorous(TP) and total Suspended Solids (TSS) contributions from the urban area of north Normal, IL, measured by analyzing flow-weighted composite samples, with frequency to be determined. Additional grab samples would be obtained for defined events.

Monitoring of storm water quality and quantity would be conducted as the Town of Normal's urban development progresses. In addition to quantifying the contribution from the urban area to the watershed, it could also provide important information on the differences between the addition of new, traditional or "environmentally sensitive" development sites to each tributary. Information from this project could be shared with other communities through ongoing technical assistance and training programs administered by the NRCS, IEPA, and other agencies and organizations.

Consideration should also be made to installing similar monitoring facilities at one or both of the two NPDES point-source discharges within the Watershed. Due to their low volume and nature, total phosphorus (TP) discharge reporting is not currently required. An expansion of the urban monitoring program may be possible within the parameters of the urban program set-forth and thereby only

require additional capital investment for installation of monitoring equipment, if instituted with the remainder of the Urban Discharge Program.

Cost Summary

Lakeshore Stabilization

Estimated Construction Cost

Since the installation requires no bedding or site preparation within the placement zone the installation should go very rapidly. Typical installations of this type have seen placement of 300 tons RR-5 in an 8 hour day. Therefore the estimated cost for this project is as follows.

Sta. 0+00 to 7+00
840 Tons RR-5 Stone @ $25 per ton ----------$21,000
24 hrs Trackhoe @ $125 hr. ---------- $ 3,000
24 hrs Hi-Lift @ $100 hr. ---------- $ 2,400

$26,400

Sta. 7+00 to 12+00
525 Tons RR-5 Stone @ $25 per ton ----------$13,125
16 hrs. Trackhoe @ $125 ----------$ 2,000
16 hrs. Hi-Lift @ $100 ----------$ 1,600

$16,725

Site preparation:
Remove and replace fencing ---------- $1,500
Clear Trees Sta. 0+00 to Sta. 1+50 ---------- $ 500
Bush hog Willows Sta. 7+00 to 12+00 ---------- $ 300

$2,300
=======
$45,425
+10% Contingency $ 4,543
========
Total Estimated Cost $49,968

The total estimated cost of $49,968 is equal to $41.64 per lineal foot of bank protected, or about 40% of the $100 per foot estimated for bank protection in the 1997 Erosion control Study.

Installation of this bank protection treatment will provide an excellent opportunity to compare actual cost and monitor the effectiveness of this treatment. If this trial proves successful, as is expected, and then applied to other portions of the 28,000 ft. of shoreline protection recommended in the 1997 study it could represent a significant cost savings over other treatment methods.

The above cost summary is for one section of lakeshore stabilization. Using the same cost data, to stabilize the entire 22 mile Evergreen Lake shoreline would cost approximately $2.6 million.

Streambank Stabilization

Treatment and cost estimated for Six Mile Creek and tributaries:

Six Mile Creek and High Priority Tributaries #2, #3, and #5

Stream	Length (feet)	STP (feet)	Quantity Stone (tons)	Est. cost	Riffles (#)	Quantity stone (tons)	Est. cost	Floodplain excavation (yds)	Estimated cost	Total cost
Six Mile	19900	9500	5900	$987,000	42	4140	$513,000	77,500	$155,000	$402,200
Trib #2	11500	7500	5650	$169,500	28	6210	$186,300	17500	$35,000	$390,800
Trib #3	20900	3400	2250	$67,500	27	2850	$85,500	35000	$70,000	$281,500
Trib #5	5260	0	0	0	20	2000	$60,000	10500	$21,000	$81,000
total										$1,155,500

Evergreen Lake Lower Priority Tributaries #1, #4, #6, #7, #8

Stream	Length (feet)	STP (feet)	Quantity Stone (tons)	Est. cost	Riffles (#)	Quantity stone (tons)	Est. cost	Floodplain excavation (yds)	Estimated cost	Total cost
Trib #1	7800	5000	3250	$97,500	35	3500	$105,000	2000	$4,000	$206,500
Trib #4	8300	4000	2700	$81,000	28	1400	$42,000	70000	$140,000	$263,000
Trib #6	5400	500	250	$15,000	0	0	0	0	0	$15,000
Trib #7	4350	1650	825	$24,750	12	480	$14,400	5500	$11,000	$50,150
Trib #8	1775	200	100	$3,000	15	600	$18,000	2600	$5,200	$26,200
total										$560,850

Total streambank stabilization costs would be $1,716,350. The costs of the streambank and shoreline stabilization program and demonstration wetlands and headcut areas would be borne by the City of Bloomington. Funding for wetlands reconstruction and flood plains on private property would be the responsibility of the landowner, but grant funding is available for many water improvement projects such as these.

Destratification

There is presently one destratifier on Evergreen Lake. To be more effective, it would need to be moved to a deeper part of the lake, at a cost of approximately $100, 000. This cost would be budgeted for by the City of Bloomington.

Wildlife control

The Illinois Department of Natural Resources (IDNR), the City of Bloomington and McLean County Parks would be responsible for programs to control goose and carp populations, and for planting aquatic plants in the lake.

Commercial removal of carp in Evergreen Lake would need to be subsidized. The usual charge as of summer 2006 is 25 cents per pound of fish removed. A one year harvest would cost between $15,000 and $20,000. A smaller, but still effective program for fish control would be funded by The City of Bloomington and McLean County Parks and Recreation. For about $2500 for prizes and incidental costs, a carp bowfishing tournament would encourage local residents to remove carp from the lake for prize money.

Canada Goose egg relocation programs have been ongoing and are funded by IDNR. An additional goose hunting season would need to be approved by the state, but would be virtually self funded by permit fees.

Changing mowing practices around the lake would change nesting and roosting practices, and would not incur additional costs.

The planting of aquatic vegetation in Evergreen Lake would be funded by IDNR and McLean County parks.

Agricultural program costs

There are many agriculture grant programs and federal programs designed to assist landowners with the funds needed for nutrient management and erosion control. Most programs offer a 75/25 government/landowner funding method so that the brunt of the cost is not shouldered by the landowners. Landowners can implement these programs with assistance from their county Soil and Water Conservation District (SWCD) and the Natural Resources Conservation Service (NRCS). All costs are a one time payment except for Nutrient Management, which extends over three years.

Program	Past 10 years	Cost	Goal	Total Cost
Nutrient Management	173 acres	$10 per acre	8,000 acres per year over three years	$240,000
No-Till and Strip-Till on cropland		$15 per acre,	4000 acres	$60,000
Filter Strips	136.7 acres	$50 per acre, (10 Year) $75 per acre, (15 years)	20 acres 10 acres	$1,750
Riparian Forest Buffers	17.0 acres	$200 per acre	5 acres	$1,000
Contour Buffers		$50 per acre	10 acres	$500
Field Border	31.3	$60 per acre	20 acres	$1,200
Windbreaks	269.7 acres	$50 per acre	10 acres	$500
Wetlands	1200 feet	$3000 per acre	5 acres	$15,000 (cost share)
Developing Incentives		$200 per acre	5 acres	$1000
Grade Stabilization	One Block Chute	Concrete Block Chutes- $6000 per unit Pipe Drops- $4000 per unit	15 units 30 units	$210,000 (75/25 cost share)
Grassed Waterways	39.8 acres	$2000 per acre	60 acres	$120,000 (75/25 cost share)

Urban Program Costs

On April 17, 2006 the Normal Town Council adopted an ordinance establishing a storm water utility fee payable by all property owners within the

Town of Normal to generate funds to meet the regulatory requirements, goals and objectives of the storm water management plan. It is estimated that nearly $1.7 million in new annual revenue will be generated to offset cost to fully implement the storm water management plan.

Cost to implement the storm water management plan for those areas within the Town of Normal and the Evergreen Lake watershed will be included within the Town of Normal's overall storm water utility budget.

Initial one time costs:

Cost of the Urban Monitoring program would include a capital investment in monitoring equipment and an agreement with a University based research entity to perform data gathering, management and analysis, in addition to water collection.

Projected out for a five year program, the costs would be as follows:

INITIAL COSTS	ANNUAL COSTS	OVER 5 YEARS
Stream Flow Monitors- 3 @ $6,000 = $18,000	Supplies: $14,000	Initial Costs: $28,000
Samplers-3 =$10,000	Research Assistant: $12,000	Annual Costs for Five years- $310,000
	Usage and maintenance= $36,000	
Total: $28,000	Total: $62,000	Total: $338,000

OVERALL COSTS	
Lakeshore Stabilization	$2,600,000
Streambank Stabilization	$1,716,350
Destratification	$100,000
Wildlife Control	$20,000
Agricultural	$636,000
Urban Monitoring	$338,000
Total costs	$5,410,350

Selection of Implementation Strategies/Alternatives

The timeline for implementation (pending funding) is as follows:

Shoreline/streambank stabilization

- Development of primary streambank stabilization survey- ongoing
- Development of headcut area survey- ongoing
- Design of headcut stabilization-ongoing
- Lake shore stabilization- 2007
- Streambank stabilization- 2007-08
- Headcut construction completed – 2007-08

Destratification

- Presently ongoing.
- Moving the destratifier would be scheduled as funding becomes available

Wildlife management

- Carp and goose removal would begin as funding permits and seasons are allowed.
- Goose egg relocation-ongoing
- Aquatic planting- ongoing
- Shoreline mowing practices-ongoing

Agricultural practices

- Nutrient management-2007-2008
- No-Till and Strip-till on cropland-2007
- Filter Strips-2007
- Riparian forest buffers- 2008
- Contour buffers-2008
- Field borders-2008
- Windbreaks-2008

- Wetlands-2008
- Developing landowner incentives- 2008
- Grade stabilization program-2008
- Grassed waterways-2008

Urban practices

1) Public Education/Outreach
    - Educational programs 2006-07
2) Public Participation/Involvement
    - Storm water hotline (Normal) ongoing
    - Storm water inlet stenciling program 2006-07
    - Formation:
        - Watershed(s) implementation committee 2007
3) Illicit Discharge Detection/Elimination
    - GIS mapping of storm sewer outfalls 2007-08
4) Construction Site Runoff Control
    - Erosion & Sediment Control Ordinance (ESC) 2006-07
    - (ESC) permit & inspection program (Normal) 2007
5) Post Construction Runoff Control
    - Stream Buffer Ordinance 2007
6) Pollution Prevention/Good Housekeeping
    - Enhanced street sweeping program ongoing
    - Storm drain inspection program ongoing
    - Install stream gauging/sampling station 2007
    - Integrated Pest Management ongoing

Measuring Progress/Success

There are several plans already in the watershed which will record changes in the Evergreen Lake watershed after these plans are completed.

Continued water monitoring will show the reduction in sediment and sediment carrying phosphorus. The urban monitoring system will allow data to be gathered to indicate the successful progress of urban watershed protection plans.

Aerial flights for mapping purposes to integrate the area into a GIS data grid will allow pinpoint changes to be monitored, especially in highly erosional areas.

A major component to the overall success of this plan is the appointing of an intergovernmental commission to oversee all watershed issues that affect McLean County. This committee will include representatives of all municipalities and community members to over see the implementation and updating of this and any other watershed plans as required. This plan will be maintained by the McLean County Soil and Water Conservation Office, 405 Kays Drive, Normal, IL 61761.