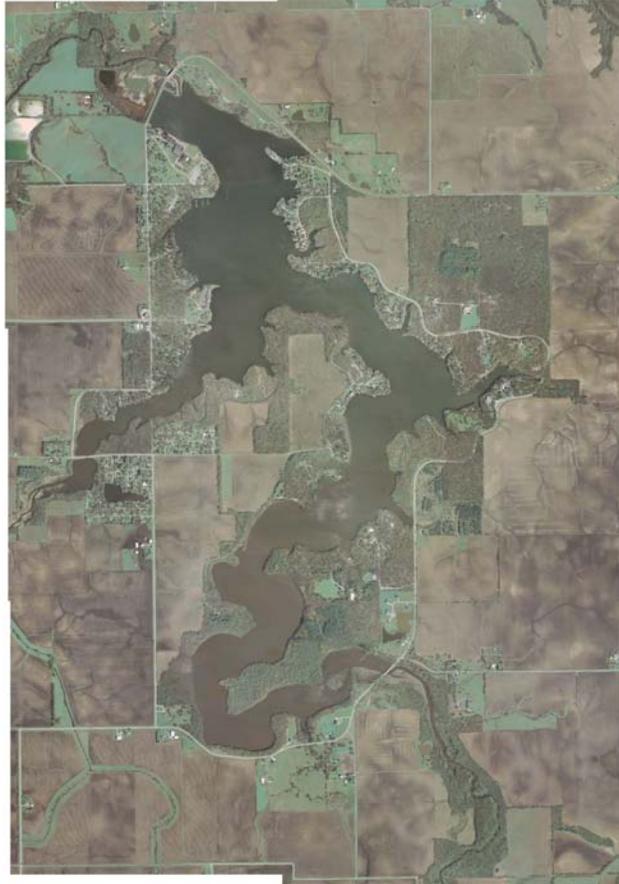


DRAFT

## Lake Bloomington Watershed Plan



Prepared by:

Lake Bloomington Watershed Planning  
Committee



McLean County  
Soil and Water  
Conservation District



Illinois  
Environmental  
Protection Agency



Association of Illinois Soil & Water  
Conservation Districts

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## Table of Contents

Mission Statement.....	3
Introduction .....	3
Watershed Description .....	6
<b>General Overview</b> .....	6
<b>Watershed History</b> .....	9
Geological .....	9
Human Use .....	17
Construction of Lake Bloomington.....	19
Recent issues.....	20
Pending Pipeline Construction.....	20
East Side Highway and Other Roads .....	20
Watershed Activities .....	24
Watershed Resource Inventory .....	26
Land Uses.....	26
Lake Bloomington Community Survey.....	34
Lake Bloomington Shoreline Erosion.....	35
Streambank Erosion Study.....	39
RAP-M Watershed Study .....	45
Water Uses .....	48
Conservation.....	49
Conservation Practices.....	49
Nature Preserves in the Watershed.....	50
1. Parklands Foundation.....	50
2. Indian Creek Homeowners Association .....	51
Problem Statements.....	53
Goals/Objectives .....	60
Best Management Practices.....	64
Riparian Practices .....	64
Lakeshore Erosion Control .....	64
Streambank Erosion Control.....	66
Destratification.....	68
<i>Agricultural Practices</i> .....	69
Urban practices.....	69
Lawn Chemical Application .....	69
Implementation strategies/Alternatives .....	71
Riparian Implementation: .....	71
Lakeshore developed areas implementation strategies .....	71
Lakeshore Erosion Implementation .....	73
Streambank Erosion Implementation.....	74
Destratification.....	77
Wetlands .....	79
Agricultural Implementation: .....	82
Urban Implementation: .....	84
Monitoring System.....	84
Education and public awareness .....	84

1	Public Participation/Involvement.....	86
2	Illicit Discharge Detection/Elimination .....	86
3	Construction Site Runoff Control .....	87
4	Post Construction Runoff Control .....	87
5	Pollution Prevention/Good Housekeeping .....	88
6	Septic System Improvements.....	88
7	Cost Summary .....	91
8	Riparian Erosion Control Costs .....	91
9	Priority Shoreline Protection Areas:.....	91
10	Streambank Stabilization Cost Estimates .....	93
11	Agricultural BMP Costs .....	93
12	<i>Urban Cost</i> .....	95
13	Urban Program Costs.....	95
14	Selection of Implementation Strategies/Alternatives .....	97
15	Riparian Area : .....	97
16	Urban Area:.....	97
17	Agricultural Area:.....	98
18	<i>Measuring Progress/Success</i> .....	100
19	Appendix I- Committee members .....	101
20	Appendix II- References .....	103
21	Appendix III- RAP-M.....	105
22	Appendix IV- Stormwater Ordinance .....	106
23	Appendix V- Lake Bloomington Sewage Management Report.....	107
24	Appendix VI- Manual of Practice of the Subdivision Ordinance .....	108
25	Appendix VII- Public Comments.....	109
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## Mission Statement

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3 We the people of the watershed of Lake Bloomington will address water quality  
4 impairments using proactive strategies that maximize local control in order to improve  
5 and protect water quality and the sustainable use of our watershed resources.

6

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## Introduction

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8 Section 303(d) of the Clean Water Act (CWA) and the U.S. Environmental  
9 Protection Agency (USEPA) Water Quality Planning and Management Regulations (40  
10 CFR Part 130) require states to identify water bodies that do not meet water quality  
11 standards and to determine the Total Maximum Daily Load (TMDL) for pollutants  
12 causing the impairment. A TMDL is the total amount of pollutant load that a water body  
13 can receive and still meet the water quality standards. It is the sum of the individual  
14 waste load allocation for point sources, load allocations for nonpoint sources, natural  
15 background, and a margin of  
16 safety that addresses the uncertainty in the analysis. The CWA establishes the  
17 process for completing TMDLs to provide more stringent, water-quality based controls  
18 when technology-based controls are not sufficient to achieve state water quality  
19 standards. The overall goals and objectives in developing the TMDLs include:

- 20 • Assess the water quality of the impaired waterbodies and identify key issues  
21 associated with the  
22 impairments and potential pollutant sources.
- 23 • Use the best available science and available data to determine the  
24 maximum load the  
25 waterbodies can receive and fully support all of their designated uses.
- 26 • Use the best available science and available data to determine current  
27 loads of pollutants to the  
28 impaired waterbodies.
- 29 • If current loads exceed the maximum allowable load, determine the load  
30 reduction that is  
31 needed.

- 1           • Identify feasible and cost-effective actions that can be taken to reduce
- 2           loads.
- 3           • Inform and involve the public throughout the project to ensure that key
- 4           concerns are addressed
- 5           and the best available information is used.
- 6           • Submit a final TMDL report to USEPA for review and approval.

7           The Illinois Environmental Protection Agency (IEPA) only requires a TMDL be  
8           developed for the chemical parameters with numeric water quality standards. Under  
9           Section 303(d) of the CWA, the State of Illinois prepares a list of waters that are not  
10          meeting state water quality standards (hereafter referred to as the “303(d) list”) in each  
11          2-year cycle. Lake Bloomington (waterbody ID RDO) is listed as impaired because of  
12          excessive nitrate and phosphorus in the water (IEPA, 2006).

13          IEPA implements its TMDL Program in three stages. Stage One was completed  
14          in November 2006 and involved the characterization of the watershed, an assessment of  
15          the available water quality data, and an identification of potential technical approaches  
16          (Tetra Tech, 2006 ) Stage Two involves additional data collection which was not required  
17          for Lake Bloomington. Stage Three involves model development and calibration, TMDL  
18          scenarios, and implementation planning. The TMDL Stage Three Report documents the  
19          modeling and TMDL components of Stage Three and briefly describes the  
20          implementation plan.(Tetra Tech Phase 3, 2007). THE USEPA approved the Lake  
21          Bloomington TMDL for Total Phosphorus and Nitrate in September 2007.

22          In the IEPA report, Chapter 1 discusses the rationale for beneficial use  
23          designations and impairments for Lake Bloomington which is located in central Illinois.  
24          Chapter 2 describes the characteristics of the watershed and water bodies. Chapter 3  
25          describes the water quality standards and water quality assessment of existing data.  
26          Chapter 4 summarizes the nonpoint and point sources in Lake Bloomington. Chapter 5  
27          describes the technical approach used for the TMDL development including modeling  
28          approach and calibration. Chapter 6 presents the TMDL components including load  
29          allocations. Finally, Chapter 7 briefly describes the implementation plan.

30          A review of the available water quality data from the TMDL Stage One report  
31          confirms the causes of impairments in Lake Bloomington. Of the pollutants impairing  
32          Lake Bloomington, total phosphorus and nitrate are the only parameter with numeric  
33          water quality standards. The water quality data also

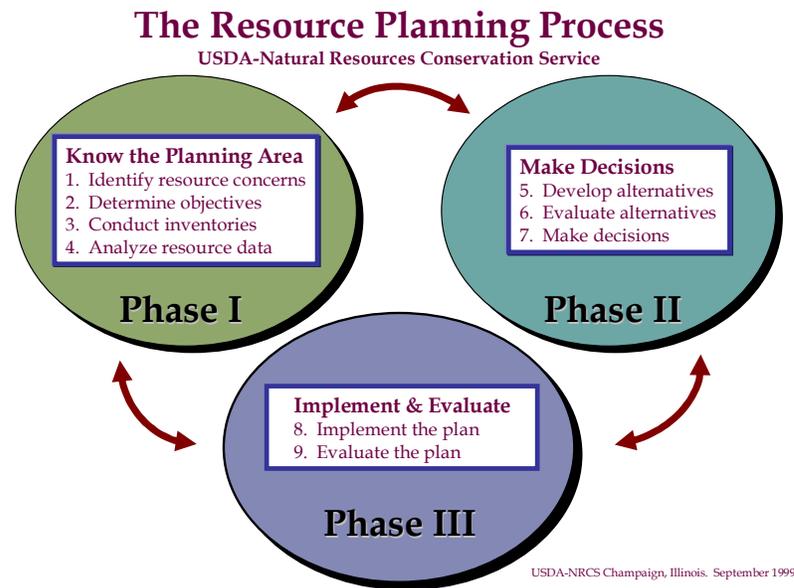
34          verified that total phosphorus is a limiting nutrient in the lake and frequently  
35          exceeded the 0.05 mg/L water quality standard. The nitrate plus nitrite nitrogen

1 concentration data is used to verify the exceedance because nitrite nitrogen seldom  
2 appears in concentration greater than 1 mg/L and tends to  
3 transform to nitrate. The maximum observed nitrate plus nitrite concentration  
4 exceeded the standard of 10mg/L in Lake Bloomington.

5 All Illinois waters must meet general use water quality standards unless they are  
6 subject to another specific designation (CWA Section 302.201). The general use  
7 standards protect the state's water for aquatic life (except as provided in Illinois Water  
8 Quality Standard Section 302.213), wildlife, agricultural  
9 use, secondary contact use, aesthetics quality, and most industrial uses.

10 In December 2006, the McLean County Soil and Water Conservation Districts  
11 (SWCD) and the McLean County Natural Resource Conservation Service (NRCS)  
12 invited landowners, representatives of local governments, local experts, and concerned  
13 citizens to meet to address the issue of elevated levels of phosphorus, nitrates and  
14 sediment in Lake Bloomington. From that initial group a Planning Committee was  
15 formed, which then developed a list of action points that needed to be investigated. The  
16 Planning Committee then appointed a Technical Committee to address the individual  
17 problem statements, investigate existing data of Best Management Practices to address  
18 the problems, inventory resources in the watershed and develop alternatives. The  
19 Technical Committee divided into several areas of expertise: the Biological/Streams  
20 Committee, the Urban Committee, a Homeowners Committee, a Drinking Water Quality  
21 Committee, an Educational Committee, and the Agriculture Committee. Funding for  
22 the entire Lake Bloomington Watershed Plan development was through grants by the  
23 Illinois Environmental Protection Agency, while implementation funding will be from  
24 IEPA, Association of Illinois Soil & Water Conservation Districts (AISWCD), SWCD,  
25 Sand County Foundation, and NRCS, as well as other local and private funding.

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



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Stakeholders were invited to committee meetings and provided with plan drafts. Their input was integrated into the final plan. Members of the Planning and Technical Committees are in Appendix I.

9  
10

## Watershed Description

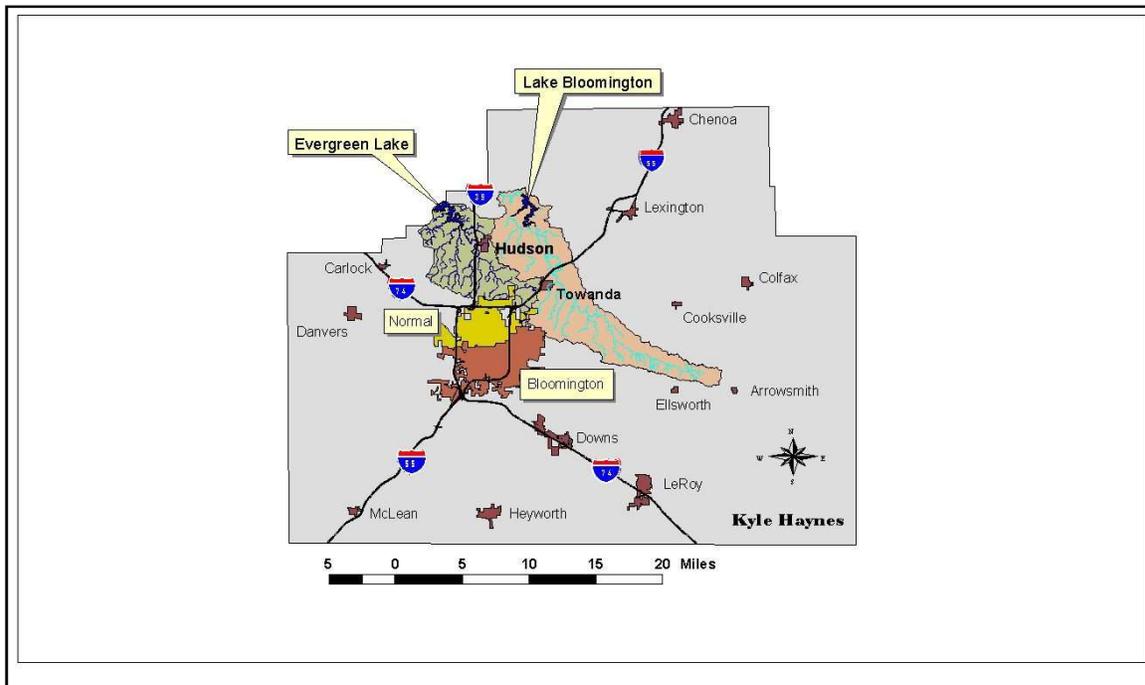
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### 11 General Overview

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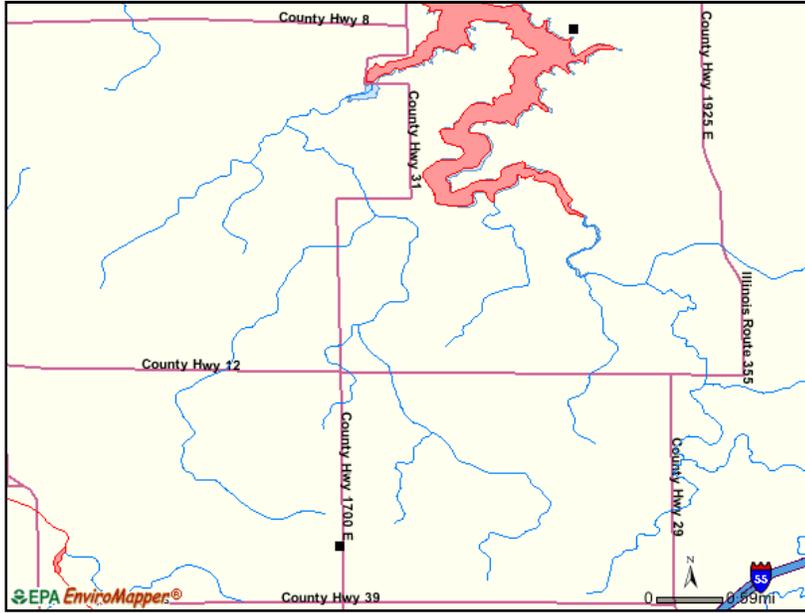
12 Lake Bloomington (572 acres) watershed consists of 43,100 acres in the central  
13 part of McLean County, Illinois. It is located in central Illinois about 160 miles northeast  
14 of St. Louis and approximately 125 miles southwest of Chicago. It is in the Mackinaw  
15 River Basin, (Hydrologic Unit Code) HUC #07130004, sub-basin code 030. The  
16 watershed encompasses hydrologic unit 16, Upper Money Creek and the majority  
17 (upstream of the dam) of hydrologic unit 09, Lower Money Creek. The communities of  
18 Towanda and Merna are located entirely within the watershed. The City of Bloomington  
19 and Incorporated Town of Normal are expanding into the southwestern edge of the  
20 watershed.

1 Lake Bloomington is located in the northern part of the watershed. It was  
2 constructed in 1929 by the impoundment of Money Creek. Hickory Creek is a tributary  
3 of Money Creek which empties into Lake Bloomington. Only two of the tributaries have  
4 IEPA identification numbers at this time: RDO (Bloomington) and DKP-20 (Money  
5 Creek). The lake was constructed to expand the water supply for the City of  
6 Bloomington. To fully utilize the lake's potential, recreation and residential development  
7 were established as second and third priority uses respectively. Water use is for  
8 domestic, commercial industrial, public and agricultural uses. The Lake Bloomington  
9 watershed is immediately adjacent to the Evergreen Lake watershed. Lakes  
10 Bloomington and Evergreen were both constructed for a water source for Bloomington,  
11 and have similar geology and land use. The similarities between the two lakes allows  
12 for studies and inventories on one lake to be applied to both lakes. The watershed  
13 plans for both watersheds, as well as any other watersheds contained entirely within  
14 McLean County, will be implemented and coordinated by the same oversight committee.

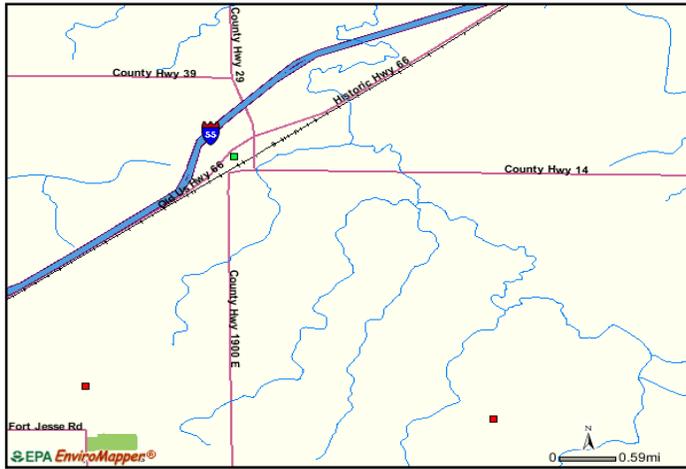


15  
16 There are five water, multiple, and/or waste point sources in the watershed as  
17 identified by the EPA. Myers, Inc (Hazardous waste), East Bay Camp (multi), Ni-Cor  
18 Gas (multi), American Disposal Services ( water), Vineyards Subdivision ( water), and  
19 Myers, Inc. ( Hazardous waste).

20  
21



East Bay Camp and NiCor location



Vineyards Subdivision, Myers, Inc., and American Disposal Locations

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## 1 Watershed History

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### 2 Geological

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3 The uppermost bedrock within the Lake Bloomington watershed is mostly  
4 Pennsylvanian age, 286-320 million years ago. The Pennsylvanian formations are  
5 made of cyclic beds of sandstone, shale, siltstone, limestone, coal, and clay. These  
6 rocks contain 1-2% coal by volume. Much of the Pennsylvanian bedrock is covered by  
7 Quarternary deposits up to 500 feet thick.

8 McLean County is mostly on a loess-covered till plain. Glacial movements,  
9 running water, and windblown deposits have contributed to the formation of the land  
10 within the county. McLean County also consists of a series of glacial deposits formed  
11 about 15,000 to 20,000 years ago by the Wisconsinian glacial movements. As the ice  
12 sheets moved south, they began to melt and recede, leaving moraines and ridges lying  
13 northwest to southeast. The Bloomington Moraine is one of the largest, which runs  
14 immediately south of the watershed. The land north of the Bloomington Moraine is gently  
15 sloping (1-4% slope), except for steeper slopes (4-10%) near the Mackinaw River to the  
16 north of the watershed.

17 Soils data and GIS files from the Natural Resources Conservation Service  
18 (NRCS) were used to characterize soils in the Lake Bloomington watershed. General  
19 soils data and map unit delineations for the country are provided as part of the Soil  
20 Survey Geographic (SSURGO) Database. Field mapping methods using national  
21 standards are used to construct the soils maps in the SSURGO database. Mapping  
22 scales generally range from 1:12,000 to 1:63,360; SSURGO is the most detailed level of  
23 soil mapping done by the NRCS. A map unit is composed of several soil series having  
24 similar properties. Identification fields in the GIS coverage can be linked to the  
25 database that provides information on chemical and physical soil characteristics. The  
26 SSURGO database contains many soil characteristics associated with each map until.  
27 Of particular interest are the hydrologic soil group and the K-factor of the Universal Soil  
28 Loss Equation (USLE).

29 The hydrologic soil groups have similar infiltration and runoff characteristics  
30 during periods of prolonged wetting. Typically, clay soils that are poorly drained have  
31 lower infiltration rates, while well-drained sandy soils have the greatest infiltration rates.  
32 USDA has defined four hydrologic groups for soils listed below:

#### 33 **Soil Group A-**

34 Soils with high infiltration rates.

1 Usually deep, well drained sands or gravels.

2 **Soil Group B-**

3 Soils with moderate infiltration rates.

4 Usually moderately deep, moderately well drained soils.

5 **Soil Group C-**

6 Soils with slow infiltration rates.

7 Soils with finer texture and slow water movement.

8 **Soil Group D-**

9 Soils with very slow infiltration rates.

10 Soils with high clay content and poor drainage.

11 High amounts of runoff.

12 Soils may be assigned to dual groups if drainage is feasible and practical. Dual  
13 hydrologic groups, A/D, B/D, and C/D, are given for certain wet soils that can be  
14 adequately drained. The first letter applies to the drained condition, and the second to  
15 the undrained. Only soils that are rated D in their natural condition are assigned to  
16 dual classes. For the Lake Bloomington watershed, Hydrologic Soil Group B covers  
17 38.7% and dominates the south-eastern portion of the watershed and is found adjacent  
18 to Lake Bloomington and the middle and northern sections of Money Creek. Group B/D  
19 accounts for 59.8% and is evenly spaced throughout the watershed and found adjacent  
20 to the southern section of Money Creek. Group C covers 0.6% and is found in small  
21 areas surrounding Lake Bloomington the the northern section of Money Creek upstream  
22 from the lake. Group C/D accounts for 0.9% and is found sparingly throughout the  
23 watershed.

24 The Lake Bloomington watershed is heavily tiled (7,500 acres or 18%) to  
25 promote agricultural drainage. The draining tile system increases the possibility for  
26 soluble nitrogen to reach surface water. In addition, some private septic systems may  
27 be connected with the drain tile system and provide a direct load to the streams,  
28 especially under low flow conditions.

29

30 **BIOLOGICAL FEATURES OF LAKE BLOOMINGTON WATERSHED**

31

32 The Lake Bloomington watershed lies within the Grand Prairie Natural Division of  
33 Illinois. Prior to settlement, watershed plant communities consisted of upland prairie  
34 (85%), wet prairie (3%), upland forest (10%) and bottomland forest (2%). Existing  
35 areas of these plant communities are currently limited in the watershed, with virtually no

1 remaining upland or wet prairie. Present vegetative cover includes cropland (corn and  
2 soybeans), pasture, farmsteads, forest, and typical urban landscaping.

3

#### 4 **Grasslands and Prairie:**

5 Although tallgrass prairie was the dominant ecosystem in the watershed, no  
6 original prairie remains. A few prairie plantings exist as a part of nature preserves and  
7 CRP lands, but except in the case of the Moon Tract of ParkLands, such plantings are of  
8 low diversity. Some prairie grassland animal species were able to shift to non-native  
9 grassy crops and pasture, but much of this habitat has been replaced by intensive row  
10 crop agriculture. Where non-native grassy habitat remains, outside of CRP acreage,  
11 much is made an ecological trap because of the timing of mowing interferes with  
12 migratory bird breeding. Prairie is an ideal vegetation type to control soil erosion, and  
13 encouraging of more acreage in such vegetation would confer great benefit to streams  
14 and wildlife.

15

#### 16 **Forest:**

17 The forested area around Lake Bloomington is one of the larger remaining tracts  
18 in McLean County. Like many areas, it suffers from habitat fragmentation and both  
19 invasive non-native and aggressive native species. No botanical surveys have been  
20 done to assess the significance of the remaining fragments. Ecological restoration is  
21 critically needed to preserve remnant habitats, and special attention needs to be focused  
22 on preserving the oak and hickory species that are under threat from deer browse  
23 pressure, invading maple trees, and fire suppression.

24

#### 25 **Wetlands:**

26 Wetlands were an important feature of the pre-settlement watershed, both in the  
27 floodplain of the streams and in the uplands. Wet prairies and riparian woodlands were  
28 important habitat for diverse species. There are approximately 1,100 acres of wetlands  
29 in the Lake Bloomington watershed. The National Wetland Inventory indicates that  
30 approximately 75 acres of wetlands are located around the lake where the tributaries  
31 approach the normal pool elevation of the lake. These are mostly palustrine areas with  
32 emergent and woody vegetation that are temporarily or seasonally flooded during the  
33 growing season.

1            Interestingly, the mud flats that form during dry years at the southern end of the  
2 Lake regularly attract migrating shorebirds. These are the most significant mud flats in  
3 the county, and attract enthusiastic birdwatchers from around Central Illinois.

## 4 5            **Biota (Plants and Wildlife):**

### 6 7            **1. General**

8            Our knowledge of the wildlife of the watershed consists of anecdotal information  
9 and, in the case of native fish and mussels, focused surveys. It is clear that much more  
10 work is needed to determine the species of plants, invertebrates (other than mussels), and  
11 vertebrates (other than fishes) that inhabit the watershed. A special focus is needed to  
12 determine the presence of organisms that are Species in Greatest Need of Conservation  
13 (Illinois Wildlife Action Plan: [dnr.state.il.us/ORC/WildlifeResources/theplan/species.htm](http://dnr.state.il.us/ORC/WildlifeResources/theplan/species.htm)) or  
14 officially listed as state or federal Threatened and Endangered Species  
15 ([dnr.state.il.us/espb/datelist.htm](http://dnr.state.il.us/espb/datelist.htm)). Despite the lack of comprehensive surveys, there are a  
16 few of the latter known from McLean County ([dnr.state.il.us/ORC/list\\_tande\\_bycounty.pdf](http://dnr.state.il.us/ORC/list_tande_bycounty.pdf)),  
17 although their presence in this watershed is not known.

18            Additionally, there is enough forest surrounding Lake Bloomington that a  
19 breeding bird survey is likely to find some area sensitive forest species (Herkert et al.  
20 1993). The forest does serve as a migratory stopover site for neotropical migratory  
21 songbirds and other species.

### 22 23            **2. Mussels:**

24            Although found worldwide, freshwater mussels reach their highest diversity in  
25 eastern North America. Unfortunately, due to degradation of our waterways, they are  
26 among the most imperiled group of Midwestern animals. Since 1987, four surveys of  
27 the mussels of Money Creek have been performed by the Illinois Department of Natural  
28 Resources, all at one site (the area around the County Road 1975E bridge) with the last  
29 being in 2005. Due to the physical barrier to dispersal of mussels resulting from the  
30 dam for Lake Bloomington, the degradation of water quality in Money Creek, and the  
31 loss of native fishes that may have been key to the dispersal of certain species, the  
32 original complement of mussel species is likely to be no longer present. However, a  
33 cumulative total of 11 species were found in the four surveys, including two species that  
34 are on the list of Illinois Species in Greatest Need of Conservation. Those two species  
35 are the Pondhorn (*Unio merus tetralasmus*) and Ellipse (*Venusta concha ellipsiformis*).

1

2 **3 FISH:**

3

4 In 1953 the first Department of Natural Resources (IDNR) fish survey on Lake  
5 Bloomington was completed and resulted in the collection of only 6 species. These  
6 same species are still collected in the lake today. The second fish survey was  
7 conducted in 1958 and consisted of 18 species. In the report for the second survey it  
8 was noted that siltation can be readily observed in the areas of Hickory and Money  
9 Creeks entering the lake. The biologist also stated that reproduction of smallmouth  
10 bass in this type of habitat with the presence of so many other species is not typical and  
11 therefore doubtful if smallmouth bass can be successfully managed. In the 1958 survey  
12 they collected 26 smallmouth bass. In the 2007 fish survey they collected zero  
13 smallmouth bass. Smallmouth are still present in the lake, but at a very low density.

14 In 1960 a fish survey report stated that a complete watershed conservation  
15 program would improve the game fish habitat of the lake. The biologist suggested  
16 using BMPs of the day for all farmland in the watershed. The survey report also stated  
17 that shoreline bank erosion should be controlled by grading back the high eroded banks,  
18 vegetative plantings and rock rip-rapping. Wave action was noted to be causing a large  
19 amount of shoreline erosion. In a 1952 State Water Survey Report, the lake was losing  
20 0.5 percent of its storage capacity per year. Even though some BMPs have been used  
21 in the watershed, Lake Bloomington still faces the same issues as it did in 1960. (ISWS  
22 1952)

23 Since 1960, there has been over 30 fish surveys completed on Lake Bloomington  
24 by IDNR personnel. These surveys have been used to set fishing regulations,  
25 recommend fish stockings, and document changes in the fish community. The first fish  
26 stocking was in 1940 and consisted of largemouth bass, bluegill, crappie, bullhead  
27 catfish, and striped bass. Since 1984 the IDNR has stocked almost 127,000  
28 largemouth bass fingerlings, 575,000 walleye fingerlings, and 25,000 hybrid striped bass  
29 fingerlings. There have been stockings of smallmouth bass, northern pike, and white  
30 bass over the years.

31 The game fish populations in Lake Bloomington still have difficulties producing  
32 strong year classes and this can be attributed to the lack of quality habitat. As the water  
33 levels change so does the amount of suitable habitat for young fish. The erosion of  
34 shorelines and deposition of silt also hamper fish reproduction. Recent surveys suggest  
35 that bass and crappie are having a difficult time reproducing in the lake. The stocking of

1 largemouth bass failed to increase the number of bass in the lake. Suitable littoral  
2 habitat is needed to bolster game fish populations in Lake Bloomington.

3 Fishing regulations have been used to regulate fishing pressure and the number  
4 and size of fish harvested. Lake Bloomington currently has fishing regulations for bass,  
5 bluegill, hybrid striped bass, white bass, and crappie. Fishing pressure can be  
6 determined from creel surveys and these were conducted in 1996 and 2003. Almost  
7 every major game fish showed an increase in catch rates and harvest rates from 1996 to  
8 2003. Even though catch rates improved for anglers during the creel surveys, catch  
9 rates during the 2007 fish survey did not meet management objectives for most game  
10 fish. Only the catch rate for largemouth bass met the management objective.

11 Money Creek was surveyed by IDNR during intensive basin surveys four times  
12 between 1987 and 2005 (Table 1). The number of fish species collected ranged from  
13 13 in 2000 to 19 in 2005. Carp, quillback, and bluegill were collected in 2005 and not  
14 during the previous surveys. These species are found in Lake Bloomington and will  
15 move from the lake upstream into Money Creek. Catch rates for spottin shiner,  
16 orangethroat darter, and fantail darter have declined over the 4 surveys. These species  
17 are indicators of good habitat and water quality.

18 The Index of Biotic Integrity (IBI) was developed to assess the quality of streams  
19 using fish species collected during surveys (Smogor 2000). The IBI score is based on  
20 10 matrices that were developed for different regions across Illinois. With each region  
21 comprising a unique set of matrices, the IBI score better reflects the effect of human  
22 disturbance on fish. The IBI scores obtained during the intensive basin surveys ranged  
23 from 24 to 30 (Table 1). The highest score obtainable is 60. The score of 60  
24 represents a stream that has characteristics of the benchmark conditions set to develop  
25 the IBI. The benchmark conditions reflect the biological conditions expected in Illinois  
26 streams least disturbed by human impacts. Therefore, the degree to which an IBI score  
27 deviates from the maximum score reflects the relative amount of human impact  
28 additional to that already represented by the reference conditions. The developers of  
29 the Illinois IBI suggested that a score difference of 10 or less should not be interpreted  
30 as a meaningful difference in biotic integrity (Smogor 2003). The IBI scores of 24 to 30  
31 put Money Creek into the low category of biotic integrity (Table 2). Only minor changes  
32 in a few fish species can be seen from 1987 to 2005, which has kept the biotic integrity  
33 of Money Creek low.

Table 2: IBI score description

<b>IBI-Score</b>	<b>Biotic</b>	<b>Description of Typical Biological, Physical, and</b>
------------------	---------------	---

<b>Subrange</b>	<b>Integrity Class</b>	<b>Chemical Conditions.</b>
56-60	Moderately High	Values of fish metrics are very similar to values expected in Illinois streams where levels of human impact appear to be least in the state.
46-55	Moderate	Number of native fish species is reduced primarily due to loss of intolerant species. Reduced abundances of mineral-substrate spawners indicates disruption of reproductive functional structure.
31-45	Moderately Low	Number of native fish species is reduced further primarily due to further loss of intolerant species, but also due to loss of sucker species and benthic-invertivore species. Reduced abundances of specialist benthic invertivores and increased abundances of generalist feeders, indicate imbalance in trophic functional structure.
16-30	Low	Number of native species is reduced further due to near-complete loss of intolerant species and further pronounced loss of sucker species and benthic-invertivore species. Disruption of fish-community structure is evidenced as indiscriminate loss of species across major families (minnows, suckers, sunfish). Further reductions in abundances of specialist benthic invertivores and mineral-substrate spawners indicates disruption of trophic and reproductive functional structure.
0-15	Very Low	Number of native species is reduced further due to pronounced, indiscriminate loss of species across major families (minnows, suckers, sunfish) with a concurrent increase in the proportion of tolerant species. Intolerant species are absent; benthic-invertivore species are nearly absent. Pronounced reductions in abundances of specialist benthic invertivores and mineral-substrate spawners indicate further disruption of trophic and reproductive functional structure.

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2 No threatened or endangered fish species were collected from Money Creek  
3 during these surveys, nor is there evidence to suggest the presence of threatened and  
4 endangered fish species in Money Creek

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Table 1. Fish collected during four basin surveyed conducted on Money Creek, Mackinaw River Watershed between 1987 and 2005.					
Common name	Scientific name	Money Creek	Money Creek	Money Creek	Money Creek
		07/29/87	09/08/94	07/20/00	07/11/05
		DKP-02	DK P-02	DK P-02	DKP-02
Carp	<i>Cyprinus carpio</i>				1
Creek chub	<i>Semotilus atromaculatus</i>	205	81	22	39
Hornyhead chub	<i>Nocomis biguttatus</i>	77	54	6	88
Central stoneroller	<i>Camptostoma anomalum</i>	15	6	6	12
Suckermouth minnow	<i>Phenacobius mirabilis</i>		7		4
Striped shiner	<i>Luxilus chrysocephalus</i>	29	52	8	164
Redfin shiner	<i>Lythrurus umbratilus</i>	15	4	12	31
Spotfin shiner	<i>Cyprinella spiloptera</i>	18			
Red shiner	<i>Cyprinella lutrensis</i>	41	5	83	117
Bluntnose minnow	<i>Pimephales notatus</i>	336	103	17	311
Bigmouth shiner	<i>Notropis dorsalis</i>	163		2	311
Sand shiner	<i>Notropis ludibundus</i>	73	10	45	194
Quillback	<i>Carpiodes cyprinus</i>				9
Smallmouth buffalo	<i>Ictiobus bubalus</i>		2		
White sucker	<i>Catostomus commersoni</i>	2	83	7	45
Golden redhorse	<i>Moxostoma erythrurum</i>				16
Yellow bullhead	<i>Ameiurus natalis</i>	16	6		5
Stonecat	<i>Noturus flavus</i>	1	1		1
Blackstripe topminnow	<i>Fundulus notatus</i>			1	5
Bluegill	<i>Lepomis macrochirus</i>				2
Johnny darter	<i>Etheostoma nigrum</i>	32	15	10	37
Orangethroat darter	<i>Etheostoma spectabile</i>	2	6	4	
Fantail darter	<i>Etheostoma flabellare</i>	7	3		
Total fish		1032	438	223	1081
Total species		16	16	13	18

Table 1. Fish collected during four basin surveyed conducted on Money Creek, Mackinaw River Watershed between 1987 and 2005.

Common name	Scientific name	Money Creek	Money Creek	Money Creek	Money Creek
		07/29/87	09/08/94	07/20/00	07/11/05
		DKP-02	DKP-02	DKP-02	DKP-02
Electrode minutes		30	35.73	30	27.5
Kilograms of fish		1.38	1.977		18.635
Native fish species		16 (3)	16 (3)	13 (2)	(3) 17
Native minnow species		10 (6)	9 (5)	9 (5)	(5) 9
Native sucker species		1 (2)	2 (3)	1 (2)	(3) 3
Native sunfish species		0 (0)	0 (0)	0 (0)	(1) 1
Benthic invertivore species		5 (3)	6 (4)	3 (2)	(2) 4
Intolerant species		1 (2)	1 (2)	1 (2)	(1) 1
Prop. specialist benthic invertivores		0.04 (2)	0.05 (2)	0.06 (2)	. 0.05 (2)
Prop. generalist feeders		0.87 (2)	0.79 (3)	0.88 (2)	. 0.85 (2)
Prop. mineral-substrate spawners		0.13 (2)	0.29 (3)	0.16 (2)	. 0.29 (3)
Prop. tolerant species		0.31 (5)	0.31 (5)	0.31 (5)	. 0.35 (4)
Extrapolated IBI		27	30	24	26

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## 8 Human Use

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### 10 Social and Economic Characteristics

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12 The population of McLean County is 161,202. The two largest communities in  
13 McLean County are the City of Bloomington (pop. 74,975) and the Town of Normal (pop.  
June 12, 2008

1 50,519). Both of these municipalities are in the southern part of the watershed. In 2007,  
2 the McLean County labor force was 91,382 with 87,926 employed and 3,456  
3 unemployed or a 3.8% unemployment rate. The largest employer is State Farm  
4 Insurance Company with 15,297 employees. The median income for McLean County for  
5 FY 2008 is \$70,900. (EDC, 2008)

6

7

## 8 **East Bay Camp**

9 East Bay Camp started in 1929 when Lester Martin, an attorney from the  
10 Bloomington Water Company, approached the Reverend Frank Breen. According to  
11 Breen, Martin said, "...since our first plan for the lake, we decided to raise it five feet and  
12 we had to buy an extra 40 acres. There'll be a lot of ground back in here and I think it  
13 would be wonderful for a camp. Do you think you could start a camp here?"

14 Today, East Bay Camp lies on 146 acres and has 87 buildings. The most recent  
15 major addition is the Seager-Denham recreation center. The indoor pool is used by  
16 campers in the summer and by Lake residents year-round for water exercise classes.  
17 (LBA 2007)

18 East Bay Camp was given a WLA for their discharge into Lake Bloomington for  
19 both phosphorus and nitrates. This is based on the facility's Design Average Flow (0.03  
20 mgd) multiplied by an assumed concentration of 3.5 mg/L total phosphorus. While the  
21 concentration is a best guess, it is known, through reporting requirements, that this  
22 facility has always discharged less than their Design Average Flow (average discharge  
23 of 0.018). There is potential that during the reissuance of their NPDES permit (expires  
24 Dec 31, 2009) they could be required to report their monthly phosphorus concentrations.  
25 Once this is known, a more accurate determination of their phosphorus load can be  
26 made.

27

## 28 **Timber Pointe Outdoor Center**

29 The camp now known as the Timber Pointe Outdoor Center was founded over 60  
30 years ago, soon after the Lake was built. The camp has 170 acres of woods and four  
31 miles of shore line.

1 It served as the Corn Belt Council Boy Scout Camp until 1989, when it was  
2 purchased by the Easter Seals Rehabilitation Center, Inc. In 2005, 1700 children with  
3 special needs attended the camp.

4 In 2006, The Lodge at Timber Pointe was completed as a joint project between  
5 the four Bloomington-Normal Rotary groups and the Timber Pointe Charitable  
6 Foundation. The complex has a kitchen and dining areas, a medical facility and lodging  
7 for the medical staff, a storm shelter, program and assembly areas, and camp  
8 administration and support services.(LBA 2007)

### 9 **Camp Peairs**

10 Camp Peairs was built as a camp for Girl Scouts in early 1940. It has been  
11 improved over the years, and in a recent summer, over 1300 Girl Scouts attended the  
12 camp. (LBA 2007)

## 13 Construction of Lake Bloomington

14 The Lake Bloomington watershed consists of approximately 43,100 acres (~ 70  
15 square miles) in the central part of McLean County, Illinois. The watershed  
16 encompasses hydrologic unit 16, Upper Money Creek and the majority of hydrologic unit  
17 09, Lower Money Creek. Money Creek flows from the southeast to the northwest in the  
18 watershed and is a tributary of the Mackinaw River (Mackinaw River Basin, Hydrologic  
19 Unit Code 07130004). Portions of the City of Bloomington, Town of Normal, Merna,  
20 Towanda and unincorporated rural subdivisions also are located in the watershed.

21 Lake Bloomington is located in the northern part of the watershed. It was  
22 constructed in 1929 by the impoundment of Money Creek. Hickory Creek is a tributary of  
23 Money Creek which also empties into Lake Bloomington. The lake was constructed to  
24 expand the water supply for the City of Bloomington. A secondary use for Lake  
25 Bloomington is recreation activities.

26 In 1958 the City of Bloomington raised the dam to increase the normal pool  
27 elevation by 5 feet resulting in a 56% increase in storage capacity. The increase in pool  
28 elevation resulted in a volume increase from 4710 acre feet to 7380 acre feet. A 1999  
29 Hanson Engineering sedimentation survey yielded a volume of 6798 acre feet. Lake  
30 Bloomington, as of 2007, has a surface area of 572 acres, 9.5 miles of shoreline, a  
31 maximum depth of 35 feet, a mean depth of 12.9 feet, and a storage volume of 6768  
32 acre feet.

33

## 1 Recent issues

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### 2 Pending Pipeline Construction

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3  
4 One of the recent topics is a proposed crude oil pipeline. This pipe would be a  
5 36" in diameter pipe capable of transporting 400,000 barrels of crude oil per day. In the  
6 future it could be increased to 800,000 barrels per day by adding pumping stations to the  
7 route and increasing the pressure of the liquid. The proposed corridor is 60' in width to  
8 allow for additional pipes to transport refined petroleum products, additional crude or any  
9 other products. The proposed pipeline enters the watershed 3 miles east and 3.5 miles  
10 south of the entrance to the lake. It continues south through the watershed for 6 miles,  
11 at a depth of not less than 5 feet to the surface where practical.

12 The effects of this pipe could include:

- 13 ● Damage to tile that feed into the Money Creek.
- 14 ● Additional sedimentation until the ground has an opportunity to regain its  
15 structure and cover.
- 16 ● Contamination of soil in the watershed from a leak.
- 17 ● Contamination of subsurface aquifers and surface streams.

### 18 East Side Highway and Other Roads

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#### 19 **Introduction.**

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21  
22 Land use changes within a watershed can have significant effects, positive or  
23 negative, on the ability to: 1) predict the future delivery of TMDL pollutants into impaired  
24 streams and lakes, 2) evaluate the choice and likely effectiveness of Best Management  
25 Practices (BMPs) to reduce TMDL pollutants, and 3) assess the future overall ecological  
26 health of a watershed. One category of land use change that can alter significantly a  
27 watershed, through both direct and indirect effects, are roads (Forman and Alexander  
28 1998, Forman et al. 2003).

29 Interstate-type roads often have the largest impacts due to the size of their direct  
30 and indirect ecological footprints, and due to their magnet effect on future growth. In the  
31 context of the Lake Bloomington/Money Creek watershed, an important direct effect of a  
32 major road is the potential increase in sedimentation and runoff, both of which can  
33 contribute to sediment and other pollutant loading into Lake Bloomington. An indirect  
34 effect of a major road would be the potential for conversion of agricultural to urbanized  
35 land. This conversion would change the relative percentages of major land use and

1 thus would affect the current modeling of inputs of TMDL pollutants into Lake  
2 Bloomington.

3

#### 4 **East Side Highway Corridor.**

5

6 Currently, one interstate (I-55) traverses the Lake Bloomington/Money Creek  
7 watershed, roughly through the middle portion. A second major road that would link I-55  
8 to I-74 has been proposed for examination in various studies over the years and, if built,  
9 would include part of the Lake Bloomington/Money Creek watershed.

10 The first recommendation for examining a "parallel freeway or expressway  
11 between I-74 and I-55" was in 1994 (*Long Range Transportation Plan for the*  
12 *Bloomington-Normal Urbanized Area*). Subsequent plans included the recommendation  
13 for this examination in 1999 (*2025 Long Range Transportation Plan*) and 2000 (*McLean*  
14 *County Regional Comprehensive Plan*).

15 These recommendations led to a cooperative effort by Bloomington, Downs,  
16 Normal, Towanda, McLean County and the Illinois Department of Transportation,  
17 administered by the McLean County Regional Planning Commission, to hire Bernardin,  
18 Lochmueller & Associates, Inc. of Charleston, Illinois, for a study. They produced the  
19 *2002 East Side Corridor Feasibility Study Final Report* which can be found at the  
20 website [www.mcplan.org/tran/eastside/ecfs.shtml](http://www.mcplan.org/tran/eastside/ecfs.shtml). The project goals included the  
21 evaluation of "the effectiveness of the build alternates relative to each other and the no  
22 build alternative". For the evaluation of the build alternatives, they assumed "a four-  
23 lane rural freeway...that is typical of interstate facilities in McLean County as well as  
24 throughout the State of Illinois".

25 Key conclusions of the 2002 study were that 1) there is a significant identified  
26 need, and 2) the preferred corridor (of 5 examined) is Alternate C. Alternate C passes  
27 through the central southwest portion of the Lake Bloomington/Money Creek  
28 watershed. An environmental profile was performed and used to compare the  
29 advantages and disadvantages of alternate corridors. The effect on TMDL pollutant  
30 loading was not one of the impacts examined at that time.

31 A Phase 1 engineering study began in late 2006. This effort is a partnership  
32 among Bloomington, Normal, McLean County, the Illinois Department of Transportation,  
33 and the Federal Highway Administration (FHA) and it is called the East Side Highway  
34 Corridor Study ([www.eastsidehighway.com/](http://www.eastsidehighway.com/)). The company, Clark Dietz, Inc. of  
35 Champaign, Illinois, was hired to perform this study. The goal is to start afresh in

June 12, 2008

1 assessing three parameters: 1) the need for a transportation facility; 2) the type of  
2 transportation facility, if it is determined that it is needed; and 3) the location within the  
3 study area of a corridor of 300-500 feet in width, if it is determined that it is needed.

4 The study area for the Clark Dietz study has been expanded from the 2002 study  
5 to include an area between I-55 and I-39 north of Normal and between I-74 and Highway  
6 51 south of Bloomington (see map within the East Side Highway Corridor Study web  
7 site:

8 [www.eastsidehighway.com/index\\_files/pdfs/Corridor%20Study%20Limits.jpg](http://www.eastsidehighway.com/index_files/pdfs/Corridor%20Study%20Limits.jpg)).

9 This study area includes the entire central third of the Lake Bloomington/Money  
10 Creek watershed and also extends into the Evergreen Lake watershed. The final report  
11 from Clark Dietz is scheduled for Spring 2008.

12 The Clark Dietz study incorporates a new FHA standard called Context Sensitive  
13 Solutions (CSS). This process allows for involvement of all stakeholders in all phases of  
14 study design and data collection, although the final report and recommendations will be  
15 the product of Clark Dietz. Although a full Environmental Impact Study will result should  
16 a transportation corridor be recommended, the Clark Dietz CSS process has included  
17 assembling comments from stakeholders regarding environmental issues that should be  
18 considered, including potential impacts on TMDL pollutant loading into Lake  
19 Bloomington.

20

## 21 **Other Road Projects.**

22

23 Of the major road projects listed in the draft *Long Range Transportation Plan*  
24 *2035 for the Bloomington-Normal Urbanized Area*, the only one within the Lake  
25 Bloomington/ Money Creek watershed is the widening and upgrade of Towanda-Barnes  
26 Road north from Fort Jesse Road to the Village of Towanda. No evaluation has been  
27 made of the direct or indirect effects of this project on the watershed. However, it is  
28 likely to increase the conversion of the watershed from agricultural to urbanized land use  
29 and may have other impacts as identified in the introduction to this section. This should  
30 be included in any future modeling efforts of TMDL pollutant loads.

31 Smaller road projects, including bridge work, are likely on county roads  
32 within the watershed. Examination should be done of the current and future  
33 planned utilization of soil erosion BMPs in such projects. Also, proposals for  
34 these and other road-related maintenance and upgrade projects should  
35 include assessment of impacts on TMDL pollutants, both by the individual

1 project and in terms of the cumulative impacts when all projects are  
2 considered together.

### 3 **Twin Groves Wind Farm**

4 Beginning in 2006, a noticeable land use change started in the southeasternmost  
5 portion (south of Route 9) of the Lake Bloomington/Money Creek watershed with the  
6 construction of the Horizon Wind Energy's Twin Groves Wind Farm. When completed  
7 in 2008, the wind farm will consist of 240 turbines producing 400 megawatts of power,  
8 making it the largest wind facility east of the Mississippi River. In addition to the  
9 turbines, there will be access roads, operations facilities, and substations. Although it is  
10 difficult to precisely determine the placement of all facilities within the irregular  
11 boundaries of the watershed, maps indicate that approximately 40 turbines along with  
12 supporting access roads, substation(s) and transmission lines will be in this watershed.  
13 However, the majority of the wind farm will be located south and east of this watershed.

14 The placement of wind turbines will not change greatly the existing agricultural  
15 land use of the watershed because each turbine + access road will replace only one-half  
16 acre of farmed land. Some additional displacement of farmed land will occur with the  
17 substation(s), transmission lines and other infrastructure support.

18 A temporary increase in sedimentation that can carry TMDL pollutants will result  
19 from upgrading the county roads to handle movement of the large equipment as well as  
20 construction of the turbine platform and graveled access road through each field. In  
21 terms of the platform and access road construction, the company has an NPDES permit  
22 and a SWPPP plan using best management practices for soil erosion control.

23 It is likely that the presence of these turbines will inhibit the conversion of this  
24 portion of the watershed from agricultural to urbanized, thus keeping it under current  
25 land use. This is because: 1) there is a minimum distance of 1,500 feet required from  
26 the wind turbine to any residence, and 2) the stable farm income resulting from hosting a  
27 wind turbine may reduce the pressure on landowners to sell farmland for urbanized  
28 development. Therefore, it seems unlikely that there will be any direct long-term effects  
29 on the delivery of TMDL pollutants to Lake Bloomington/Money Creek resulting from this  
30 wind farm.

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## Watershed Activities

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In 2003, Both the City of Bloomington and the Town of Normal were required to submit storm water management plans in accordance with United States Environmental Protection Agency law. These documents were prepared jointly between the two communities and outline programs to develop, implement and enforce storm water management practices 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 Phase II program. These plans address 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

These storm water management plans present a mix of best management practices within each control measure to address erosion, sediment, fecal coliform, grease and oil, household and lawn/garden chemicals that could potentially end up in local streams.

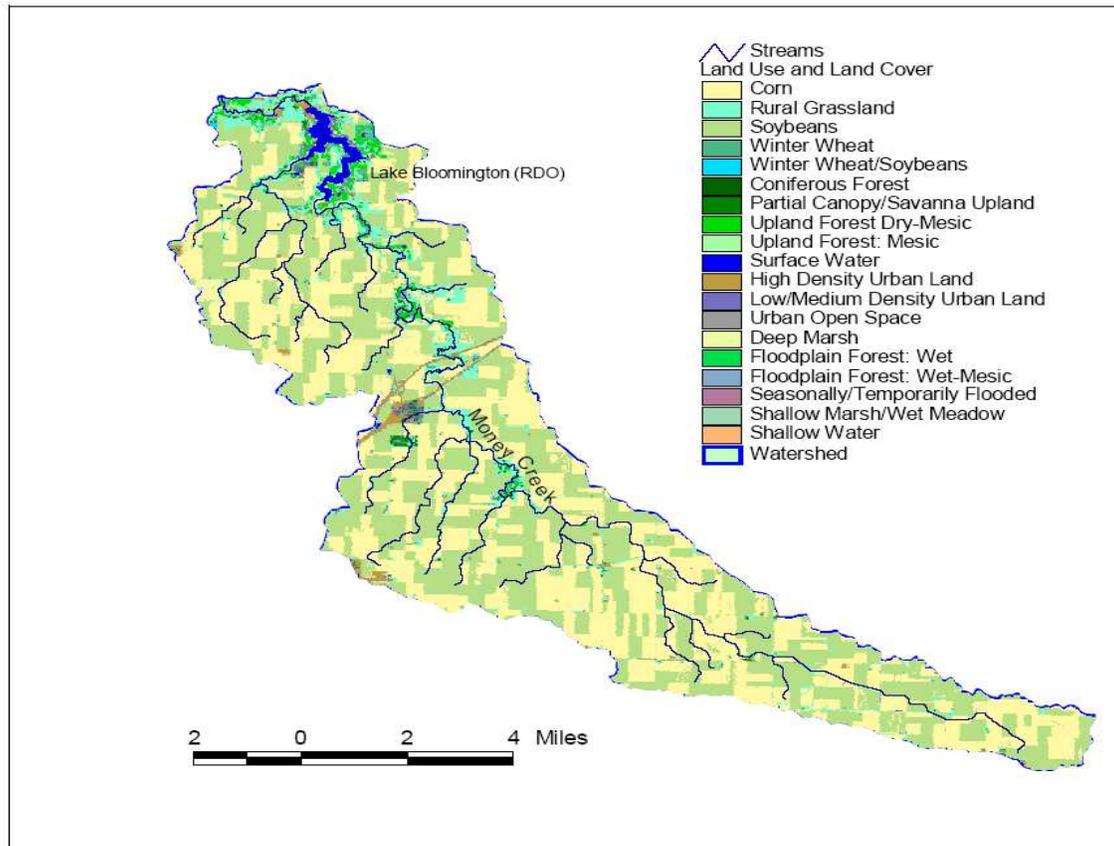
Public awareness and educational activities in the watershed include:

- Earth Express- a county wide activity for 3<sup>rd</sup> and 4<sup>th</sup> graders.
- Conservation Day- 3<sup>rd</sup> graders
- Wilderness Camp- 5<sup>th</sup> through 8<sup>th</sup> 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 McLean County at large
- Lake Fest- Family oriented single day special event providing presentations and demonstrations of Fisheries Management, Aquatic Vegetation, shoreline/streambank erosion control techniques, and lake related outdoor activities.

- 1 ● Storm Drain Stenciling
- 2 ● Lake Smart activities:
- 3 ● Clean Water School Program at Hudson, Carlock and Towanda Elementary
- 4 schools
- 5 ● Lake Smart Workshops targeting residents
- 6 ● Raingarden Workshop
- 7 ● Yard Smart Walk
- 8 ● Lake Festival
- 9 ● Production of Living on the Lake Handbook and brochures
- 10 ● Production of watershed displays
- 11
- 12 Large management and research projects include:
- 13 ● Nutrient Management Programs
- 14 ● 2000/01, 2001/02 Funded by IEPA
- 15 ● 2005/06, 2006/07 Funded by Sand County Foundation
- 16 ● Lake Bloomington Sustainable Water Program- Tile research Hoffman/Troyer
- 17 farm- City of Bloomington sampled and Illinois State University compiled data
- 18 from 1998 to date
- 19 ● Wetlands Research- Dr. David Kovasic from the University of Illinois conducted
- 20 research on City of Bloomington property from 2000 to date
- 21 ● Nitrate Research on Money Creek- Recording and compiling data on tiles,
- 22 organic use, pond data done by the City of Bloomington and ISU from 1992 to
- 23 date
- 24 ● Rain Reporters- volunteers who collect data on rainfall in McLean
- 25 county 24/7 from 1997 to date
- 26

# 1 Watershed Resource Inventory

## 2 Land Uses



**Land Use and Cover Map**

3

4 The majority of land in the Lake Bloomington watershed is used to grow row

5 crops, with soybeans covering 50 percent of the land and corn covering 33 percent,

6 according to the McLean County SWCD transect survey in 2007. Rural grassland, high

7 density (urban), and surface water each cover less than ten percent of the total surface

8 area. The T- transect has been conducted by the McLean County Soil and Water

9 Conservation District for the whole county biannually since the mid 1990's to give a

10 statistically accurate gauge of the acres in conservation tillage for the primary crops in

11 the county. The same route is completed each time in early June with a determination

12 of which crop is growing, how much residue is left on the field and if no-till, strip till,

13 mulch till or minimum tillage is used to establish the growing crop. This information

1 when combined with the soil types and slopes in each field gives an estimate for the field  
 2 if it is above or below the Tolerable soil loss or "T" hence the name T-transect.

3 In a 2007 inventory of the Lake Bloomington watershed conducted by the  
 4 McLean County SWCD there were 286 cattle and 128 other livestock animals in 25  
 5 operations in the area, a number likely to have declined over the years. This is a  
 6 relatively low livestock density and therefore does not represent a high priority source.

Land Cover Description	Watershed Area	
	Acres	Percentage
<b>AGRICULTURAL:</b>		
Corn	19,095.0	42.72
Soybeans	19,439.9	43.5
Rural Grassland	3,076.2	6.88
Winter Wheat	45.8	0.1
Winter Wheat/Soybean Double Cropped	9.3	0.02
Subtotal	<b>41,666.2</b>	<b>93.2</b>
<b>URBAN:</b>		
High Density	780.2	1.75
Low/Medium Density	263.3	0.59
Open Spaces	72.5	0.16
Subtotal	<b>1,116.0</b>	<b>2.5</b>
<b>WETLAND:</b>		
Floodplain Forest	325.8	0.73
Seasonal/Temporarily Flooded	21.6	0.05
Wetland: Shallow Water	11.8	0.03
Shallow Marsh/Wet Meadow	2.7	0.01
Deep Marsh	6.2	0.01
Dry Mesic Forest	482.2	1.08
Floodplain Wet Mesic	252.2	0.56
Subtotal	<b>1,102.5</b>	<b>2.5</b>
<b>Forest:</b>		
Partial Canopy/Savanna Upland	281.6	0.63
Coniferous	13.3	0.03
Upland	85.2	0.19
Subtotal	<b>380.1</b>	<b>0.9</b>
<b>OTHER: Surface Water</b>	428.8	0.96
<b>Total</b>	<b>44,694.2</b>	<b>100</b>

Data Date: 2000

7

8

1           The entire watershed lies within the Till Plains Section of the Central  
2 Lowland Province physiographic area. It is specifically located in the Bloomington  
3 Ridged Plain which is the unit that is more rolling and contains most of the Wisconsin  
4 glacial moraines located in Illinois. The El Paso Moraine lies to the northeast of the lake  
5 and this low ridge helps to funnel water into this watershed and direct it toward the  
6 lake. In most areas, Peoria Loess overlies glacial till of the Delavan Member of the  
7 Tiskilwa Formation of the Wedron Group (Wisconsin) that is generally loam or clay loam  
8 in texture. The Delavan Member is a brownish gray till that is calcareous and contains  
9 lenses of gravel, sand, silt and clay. The loess ranges from 4 to 6 feet in thickness  
10 over the general area, but can be thicker along the broad ridge tops and thinner on the  
11 eroded side slopes. Stream and gully dissection has exposed the underlying  
12 calcareous glacial till in a few areas along Money Creek and the major drainage ways.

13           The major stream valley is composed of deposits of Cahokia Alluvium (old) that  
14 is generally less than 20 feet thick. Sandy deposits of the Henry Formation can be  
15 below the alluvium along Money Creek but glacial till is probably below the alluvium on  
16 the upper reaches of the streams or where smaller tributaries join the main drains as  
17 they exit from the surrounding uplands. On the steeper slopes, where erosion has been  
18 more intense, the glacial till is occasionally exposed. Soils mapped in this watershed  
19 reflect the parent material differences discussed above. The surface texture of the soils  
20 in greater than 80% of the watershed is a silt loam, reflecting the characteristics of the  
21 loess cover that blankets nearly the entire region. The loess is quite erosive and is  
22 easily removed by running water. The alluvium in the stream banks can contain a  
23 variety of materials with a variety of textures and grain size content. This is especially  
24 noticeable where stones are present in the channel. Stability of the stream banks is  
25 greatly dependent on the shear characteristics of the material, and on a *watershed*  
26 scale, it is difficult to make “general” statements about overall conditions. Site specific  
27 determinations are essential for future stream bank stabilization activities. (Windhorn-  
28 Appendix III)

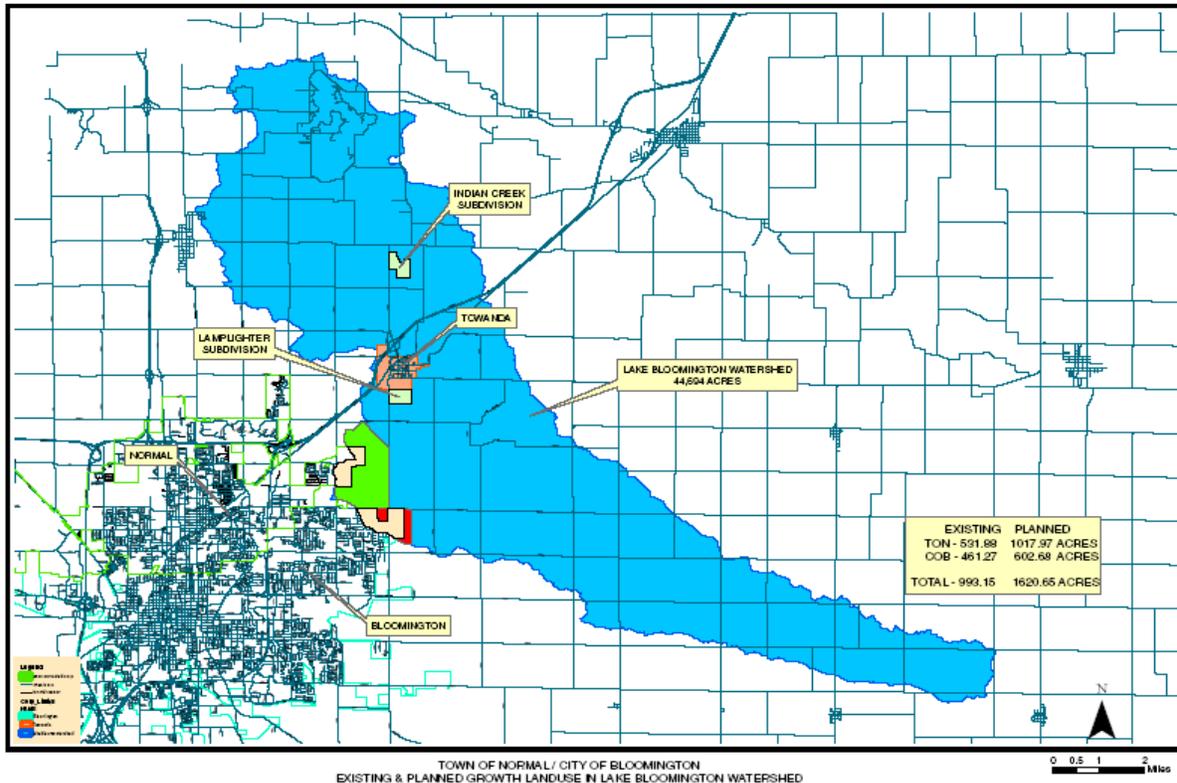
29           The most common soil type in the watershed is Sable silty clay loam, which is a  
30 byproduct of the windblown silt, called loess, distributed during glacier retreat. This soil  
31 has slow infiltration rates and a high clay content, as well as poor drainage with high  
32 runoff levels. The second most common soil is Ipava silt loam.

33           Subsurface drainage, or tiling of fields, is practiced to remove excess water  
34 from the soil. Drainage tiles are installed below the root zone and release the water into  
35 a ditch or stream. In Illinois, tiles are usually installed at a depth of 3 to 4 feet and 80 to

1 120 feet apart. Based on the amount of soil classified as poorly drained, the McLean  
 2 County SWCD estimates that 7500 acres in the watershed are tiled.

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## Effects of Urban Development



8 The majority of non-agricultural use within the Lake Bloomington Watershed is  
 9 confined to far eastern edges of the Town of Normal and City of Bloomington. Other  
 10 significant pockets of non-agricultural land use include the Village of Towanda, northern  
 11 portions of 1800 East Road and long-established residences around Lake Bloomington.  
 12 Forested areas and natural grasslands are severely limited except around Lake  
 13 Bloomington itself and a small pocket that sits within the middle of the watershed.

14

15 Urban development within the watershed will continue as the Town of Normal  
 16 and the City of Bloomington continue to expand east and northeast toward the Village of  
 17 Towanda. Sanitary sewer extension along Pipeline Road may also encourage additional  
 18 development expansion that has already taken place near the Ironwood Development  
 19 and north.

1           There are approximately 1,490 dwellings in the Lake Bloomington Watershed  
2 as found in the 2006 aerial photo. There were approximately 976 dwellings in the  
3 watershed as found in the 1994 aerial photo. This is an increase of 514 dwellings  
4 (52.7%) over this twelve year period of which 416 of these additional dwellings were built  
5 within the Bloomington/Normal urban area. Sanitary sewer effluent from these  
6 Bloomington/Normal dwellings discharges to the Bloomington Normal Water  
7 Reclamation District (BNWRD) through public sewer collection systems.

8

9           Lake Bloomington Community

10

11           There are approximately 206 dwellings located within 300 feet of Lake  
12 Bloomington as shown in the 1994 aerial photo; there are 215 dwellings shown in the  
13 2006 aerial photo. This is an increase of nine dwellings (4.4%) in this twelve year  
14 period.

15           Existing development surrounding the Lake consists primarily of residential with a  
16 few commercial establishments. Some of the main commercial establishments within  
17 this Lake community include the City of Bloomington Water Treatment Plant, two  
18 restaurants and Davis Lodge. The developed area is surrounded by agricultural land.  
19 The City of Bloomington owns all lands adjacent to the lakeshore and leases lots to  
20 homeowners.. Originally, homes were summer cottages but most have been remodeled  
21 or rebuilt to permanent homes. The City of Bloomington provides water service via  
22 publicly owned and operated water treatment and distribution system. Water services  
23 are metered and customers are charged a rate for water according to usage.  
24 (Farnsworth Group, December, 2003)

25           The Lake Bloomington area has no centralized sewer system or wastewater  
26 treatment/transfer facility. Each home on the Lake is responsible for its own wastewater  
27 treatment. Most homes have individual septic systems, which includes a septic tank  
28 discharging into leaching fields, sand filters, existing field tiles, cisterns, and/or in a few  
29 instances directly into Lake Bloomington. All septic systems ultimately discharge effluent  
30 to Lake Bloomington either through direct surface discharge or seepage to groundwater  
31 that reaches the Lake. Some homes have entire septic systems (septic tank and sand  
32 filter/leach field) on their property. A number of homes, which are built close together  
33 and/or have relatively small lots, have a septic tank on the property but have a leaching

1 field or sand filter on adjoining City-owned property (Farnsworth Group, December,  
2 2003)

3 The McLean County Environmental Health Department keeps a comprehensive  
4 record of location, condition, and number of septic systems in the County, including Lake  
5 Bloomington and the surrounding area. (Farnsworth Group, December, 2003)

6 A study conducted in 2003 by the City of Bloomington produced several  
7 alternative methods for providing conveyance and treatment of the wastewater  
8 generated by residences and public facilities surrounding the lake. The study presented  
9 a pressure sewer collection/conveyance system as being the most cost effective at a  
10 cost of \$6,400,000 in 2003 dollars. Lagoons in two forms, aerated and covered with  
11 aeration, were considered to be the most cost effective means of giving treatment with a  
12 cost of an additional \$3,400,000.

13 The second least costly option produced by the study was dependent upon  
14 construction of a pumping station by the Bloomington and Normal Water Reclamation  
15 District. This option involved pumping wastewater from the Lake Bloomington pressure  
16 collection system to a pump station owned by the Bloomington and Normal Water  
17 Reclamation District. The wastewater would then be pumped to the District's Southwest  
18 Treatment Plant. The estimated cost for this addition to the collection system resulted  
19 in a total cost of \$10,900,000.

20

21 Rural Communities and Subdivisions

22

23 The County Comprehensive Plan does not show areas of medium to high density  
24 for development in the Lake Bloomington Watershed except where adjacent to  
25 Bloomington/Normal and Towanda. Erosion control regulation in the unincorporated  
26 area of the county is triggered by the Subdivision Ordinance. The County is not likely to  
27 approve subdivisions where such development is inconsistent with the Comprehensive  
28 Plan.

29 In addition to the 416 dwellings in Bloomington/Normal and the nine dwellings  
30 adjacent to Lake Bloomington, there was a net increase of 89 dwellings (9.1%) over the  
31 remainder of the watershed over the same 12 year period.

32 As authorized by the Clean Water Act, the National Pollutant Discharge  
33 Elimination System (NPDES) controls water pollution by regulating "point sources" that  
34 discharge pollutants into water bodies. These include, but are not limited to, pipes and  
35 man-made ditches or ravines. Residences that are connected to a municipal discharge

1 system, use a septic system or do not have surface discharge do not need an NPDES  
2 permit. However, industrial, municipal and other facilities must obtain permits if  
3 discharges from the facilities are released directly into surface waters. By and large, the  
4 NPDES program is administered by authorized states. Since its introduction in 1972, the  
5 NPDES permitting program has resulted in significant improvements in water quality.  
6 *(U.S. Environmental Protection Agency – Office of Wastewater Management, 2007)*  
7 The number of active NPDES permits is sometimes an indicator of growth. As of 2007,  
8 more than 400 NPDES permits have been issued for McLean County, Illinois.

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1       Bloomington and Normal Urban Expansion

2           Approximately 993 acres or 2.2% of the total watershed area has been annexed  
3 either to the City of Bloomington or the Town of Normal and has been developed or is  
4 currently under development. Current comprehensive planning studies for both  
5 communities project that the total urban area within the watershed will increase to 1620  
6 acres or 3.6% of the total watershed area by the year 2035. (See Map Above)

7 [Lake Bloomington Community Survey](#)

---

8           On August 30, 2007 a survey was conducted at the annual dinner meeting of the  
9 Lake Bloomington Homeowners Association. The members were surveyed on their  
10 personal lawn fertilizer use. Out of 200 households, 70 responded. Results as follows:

11       **Occupancy:**

- 12       ● 54 were full time residents
- 13       ● 10 were part time
- 14       ● 6 did not indicate

15       **Lawn fertilizer use:**

- 16       ● 19 (27%) do not fertilize
- 17       ● 21 (30%) fertilize less than once per year
- 18       ● 35 (50%) fertilize at most once per year
- 19       ● 17 (24%) fertilize 3 or 4 times per year

20       **Water Usage:**

21       Even though lake residents can pump water from the lake for no charge:

- 22       ● 14 of 57 responses (24%) never water grass
- 23       ● 26 of 57 responses (46%) water rarely or never

24       **Using Lake Friendly Lawn Care:**

- 25       ● 51 of 66 (77%) are interested in learning about lake-friendly fertilizers
- 26       ● 45 of 56 (80%) would pay more for it
- 27       ● 13 of 17 (76%) of those who fertilize 3 or 4 times a year would like to learn about  
28       lake-friendly fertilizers
- 29       ● 11 of these (85%) would be willing to pay more for it

30

31

1

## 2 Lake Bloomington Shoreline Erosion



3

4 Lake Bloomington has 55,580 feet of shoreline. Areas of Lake Bloomington  
5 shoreline are eroding at significant rates resulting in loss of land and unsightly  
6 areas. Three shoreline erosion surveys have been completed in the past  
7 twenty years on Lake Bloomington. In 1989, a field reconnaissance survey of  
8 Lake Bloomington's shoreline was completed as part of the Report on  
9 Drought Emergency Water Sources and Options to Improve Existing Lake  
10 Supplies for the City of Bloomington, IL by Farnsworth & Wylie/Hanson  
11 Engineers. Roger Windhorn, NRCS Resource Soil Scientist, also completed a  
12 Shoreline study in 1998. The most recent and in-depth analysis was  
13 completed in November 2005 by Midwest Streams, Inc. under contract to the  
14 City of Bloomington.

15 Visual observations were made by Midwest Streams, Inc. of the Lake  
16 Bloomington Shoreline in October, 2005 by walking the shoreline with the  
June 12, 2008

1 water level approx. 10 to 12 feet below normal pool. In addition to the visual  
2 observations around the entire lake, a survey along the park extending along  
3 the North Shore near the spillway has been completed for approximately  
4 2900 feet. The survey shows nearly vertical eroding bank heights ranging  
5 from only 1 or 2 feet up to 10 to 12 feet. This survey allows for more accurate  
6 calculations of potential solutions and cost estimates that can then be used as  
7 a guide to other eroding sites around the Lake Bloomington shoreline.

8         The shoreline erosion has been classified in 6 categories based on the  
9 bank height and the width of eroded cobble material left in the wake of the  
10 receding bankline. Classes are related to bank height and amount of erosion,  
11 with class one being the lowest erosion and class six the most severe. This  
12 method of classification is based on two assumptions. First, the height of the  
13 eroding bank generally increases as the bankline recedes resulting in more  
14 sediment being contributed by these sites due to the increased bank height.  
15 The assumption being that the rate of erosion is determined by the  
16 combination of soils, the wave generation from long fetches, prevailing wind  
17 directions, and boat traffic. Therefore even though the bank heights are higher  
18 and the sediment contribution larger, the rate will stay fairly constant as long  
19 as these four factors remain constant.

20         Second, the cobble material eroded from the glacial till is too heavy to be  
21 transported by wave action and remains near the receding bankline. The  
22 width of the heavy cobble material left in the wake of eroding bankline  
23 therefore is a guide to the rate of past erosion. Based on the first assumption,  
24 then it is also a guide to the likely future erosion rate. One unknown factor  
25 could be the varying content of heavy cobble within the eroding bankline,  
26 however there seems to be no visual indication that there are significant  
27 changes within the glacial till and Roger Windhorn, Resource Soil Scientist  
28 with NRCS confirmed that the cobble content would not be expected to vary  
29 within the till surrounding Lake Bloomington.

30         Therefore, each segment of bankline has been classified based on the  
31 product of the bank height and the width of the heavy cobble material found

1 along the shoreline. Each segment of shoreline was recorded in GPS UTM  
 2 coordinates where the erosion rate changes based on this criteria of height  
 3 and cobble as the soils, fetch, wind direction and boat traffic are assumed to  
 4 be relatively constant over time. The GPS coordinates were plotted on maps  
 5 indicate the starting point of each erosion class with the length of each class  
 6 measured from the GPS starting point and extending toward the spillway.

7 The "Shoreline Inventory" provides the locations, lengths and erosion  
 8 class of each shoreline segment. Protected areas of shoreline in the  
 9 developed areas of Lake Bloomington's shoreline are also inventoried using a  
 10 different classification system.

11 Note: GPS points were identified with a handheld GPS unit and some  
 12 points appear to be located away from the shoreline a significant distance due  
 13 to inaccuracy of the unit. Revisiting these sites could provide better GPS  
 14 location, but has not been deemed necessary as the general locations of  
 15 erosion classes are identifiable.

#### Lake Bloomington Shoreline Erosion Summary

Erosion Rating	Erosion Class	Total length of Unprotected Bank	Percent of Total Bank
<10=	Class 1	27,962 feet*	50.30%
11-49=	Class 2	10,790 feet	19.40%
50-99=	Class 3	3,256 feet	5.90%
100-149=	Class 4	4,356 feet	7.80%
150-199=	Class 5	2,670 feet	4.80%
>200=	Class 6	6,546 feet	11.30%
<b>total</b>		<b>55,580 feet*</b>	<b>100%</b>

\*This includes 18,480 feet of protected shoreline, generally near residential areas.

16

17

18

#### 19 Residential Shoreline Inventory

20

21 Approximately 3.5 miles or 37% of the Lake Bloomington shoreline are now  
 22 residential and almost all the residential sites have a seawall of some type installed.

1 These seawalls are largely sheet piling, with some timber walls, concrete walls and a  
2 few rock bins fashioned with chain link fencing.

3



4

5

6

7 Each segment of seawall has been inventoried and located using UTM  
8 coordinates with a handheld GPS unit. As each segment was located a visual rating was  
9 assigned along with a measurement of the sheet piling to check for variation from  
10 vertical and has been classified as "Good", "Fair", "Poor" or "Critical". There are no  
11 objective standards for these ratings but they are an assessment of the overall condition  
12 of the seawall based on the observed condition of material and vertical integrity. A  
13 "Good" means that there were no observed concerns with the seawall and "Critical"  
14 means that the condition was judged to be near failure. A "Fair" rating was assigned  
15 where there were observed deficiencies in the wall that indicate some maintenance is  
16 needed. A "Poor" rating was assigned where there were numerous or serious problems  
17 developing, but the seawall was not yet in danger of failure.

18 This study provides only an inventory of observed conditions for informational  
19 purposes only, no recommendations are given for treatment or repairs to seawalls  
20 observed to be in need of maintenance. Installation and maintenance of seawalls has  
21 traditionally been the option of the tenant.

22 Approximately 48% (8,870 ft.) of the protected shoreline at Lake Bloomington  
23 was rated as Good in the 2005 Survey. 26% (4,805 ft.) of the shoreline protection was  
24 rated as fair, followed by 14% (2,587 ft.) of protection in poor condition and 11% (2,033  
25 ft.) in critical condition.

26

## 1 Streambank Erosion Study

2 Stream Technical Resource Evaluation and Management Services (STREAMS) was  
3 contracted in the fall of 2005 to conduct an inventory and evaluation of the stream  
4 network feeding Lake Bloomington. The study has been designed to:

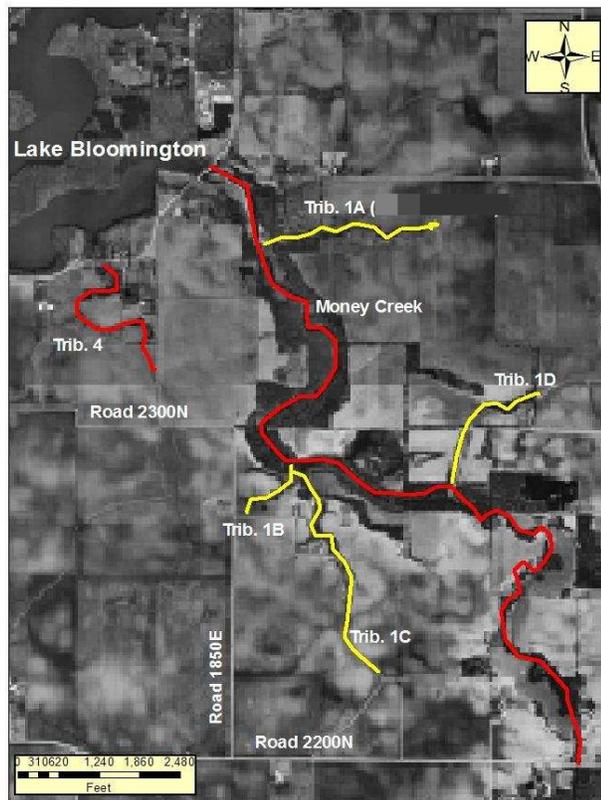
- 5 1. Quantify the sediment contributions generated from within the stream system.
- 6 2. Evaluate the stability of identified stream segments.
- 7 3. Locate and prioritize critical areas of sediment generation.
- 8 4. Provide alternative solutions to reduce the sediment contributions.
- 9 5. Develop preliminary design and cost estimate data to support the  
10 recommendations.

11

12

## 13 **Procedure for Assessment**

### **Money Creek Inventory Map --Lake Bloomington**



14

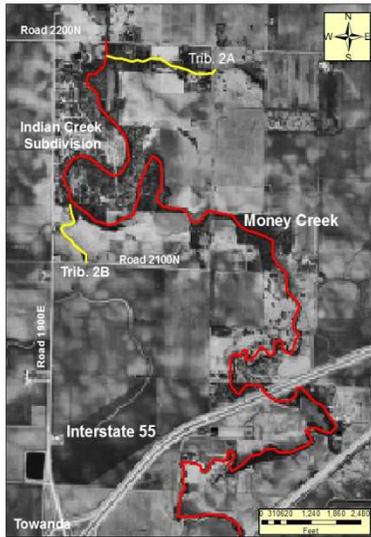
### **Illustration 1: Inventories Streams Money Creek 1**

15  
16 In October 2005, a reconnaissance survey determined that the upper reaches of  
17 the stream system appear to be maintained drainage ditches and waterways with very  
18 low sediment contributions. The lower portions of the stream system however begin

June 12, 2008

1 immediately above Lake Bloomington as natural channels and progress through various  
 2 levels of “improvements” at intermittent locations before reaching the more actively  
 3 managed drainage ditches and waterways. The study has been designed to complete a  
 4 100% inventory on the lower portions of the major channels beginning at the lake and  
 5 extending upstream to the start of the “managed” drainage system in each channel. The  
 6 length of channel inventoried is primarily on 15 miles of Money Creek above Lake  
 7 Bloomington. The smaller channels and tributaries inventoried include Big Slough and  
 8 eight additional unnamed tributaries (Illustrations 2-6)

Money Creek Inventory Map --Lake Bloomington



Money Creek Inventory Map --Lake Bloomington



9

**Illustration 2:Inventoried Streams  
 Money Creek 2**

**Illustration 3:Inventoried Streams  
 Money Creek 2**

Money Creek Inventory Map --Lake Bloomington

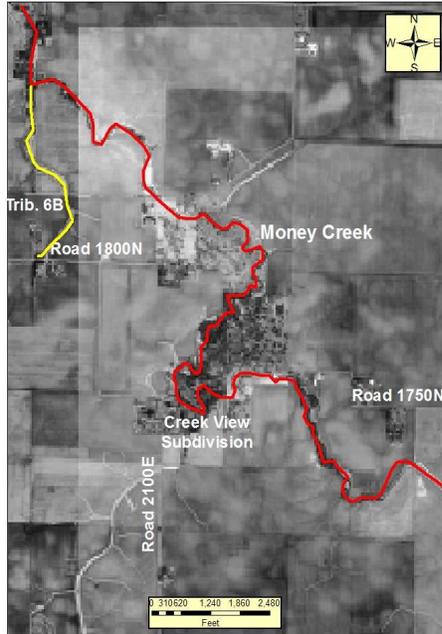


Illustration 4: Inventoried Streams Money Creek 4

1

Money Creek Inventory Map --Lake Bloomington

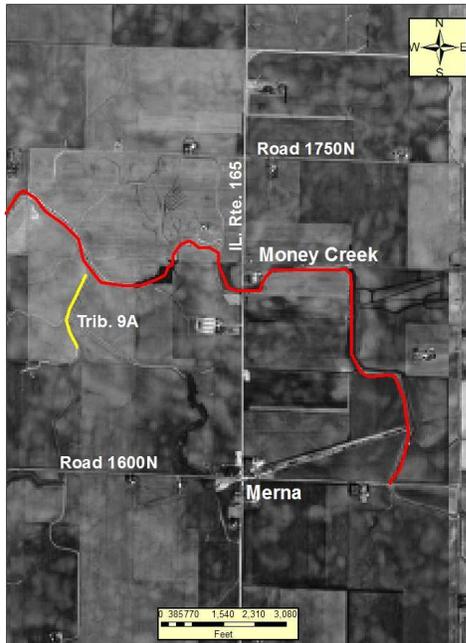
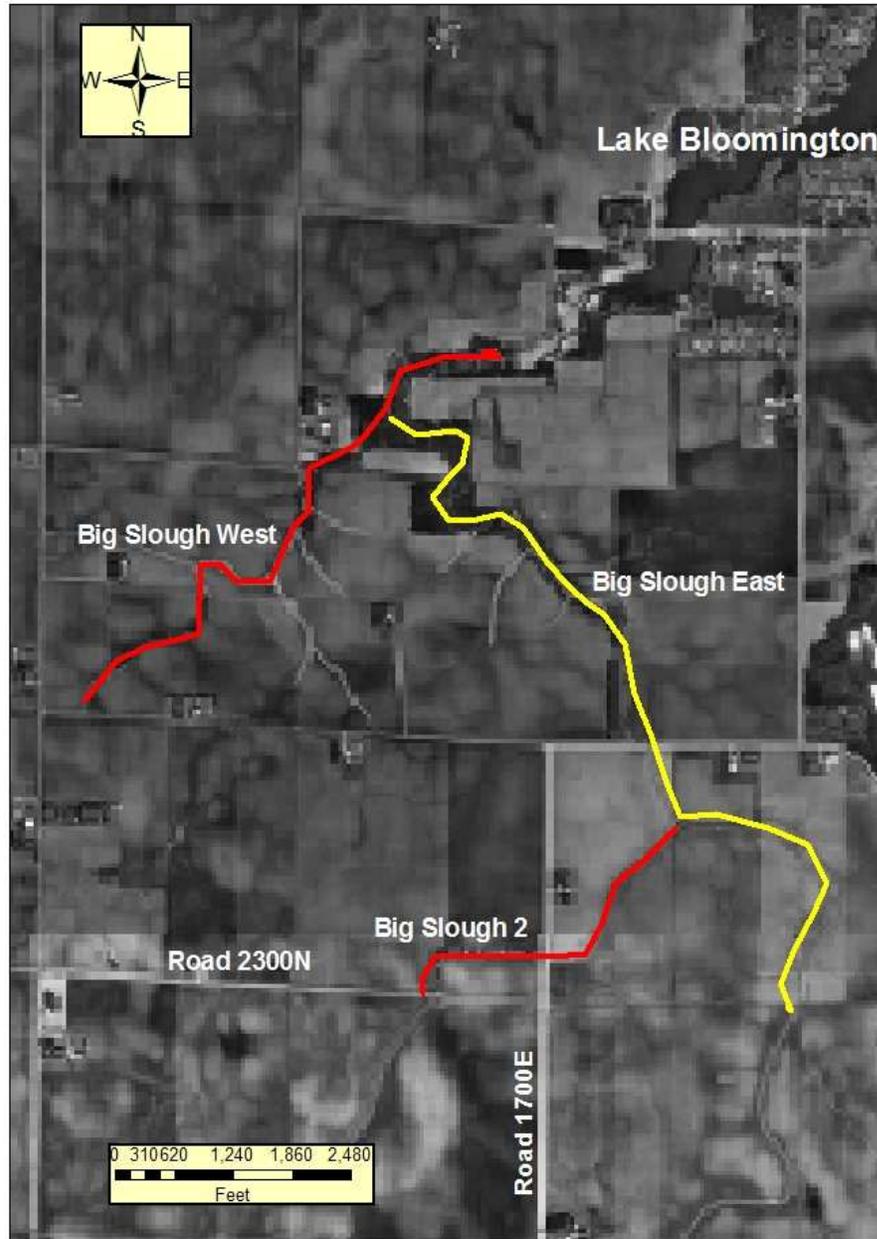


Illustration 5: Inventoried Streams Money Creek 5



Illustration 3: Inventoried Streams Big Slough

### Big Slough Inventory Map --Lake Bloomington



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The method used to inventory the channels is an expanded adaptation of the Rapid Assessment, Point Method of Erosion and Sediment Inventory Procedures for Illinois, April 2001, Natural Resources Conservation Service. The NRCS procedure is intended to use 160 acre sample plots to estimate erosion from all sources and then expand the results to a larger watershed. In this study only the “streambank” erosion section of the RAPM method was used to estimate sediment contributions. However, rather than use the 160 acre sample plots to estimate soil loss, a 100% inventory has been completed on the major streams as identified earlier. (RAP-M 2007)

A total of approx. 28 miles of channel were physically walked and streambank erosion calculated by estimating the length, height and lateral recession rate of each eroding streambank that met or exceeded the “moderate” level. Lateral recession rates were assigned based on field observations using the guidelines given in the NRCS procedure. Areas determined to have only “slight” streambank erosion were not individually inventoried however the lengths and erosion rates include estimates of contributions from these areas of “slight” erosion.

The method used to inventory the channels is an expanded adaptation of the Rapid Assessment, Point Method of Erosion and Sediment Inventory Procedures for Illinois, April 2001, Natural Resources Conservation Service. The NRCS procedure is intended to use 160 acre sample plots to estimate erosion from all sources and then expand the results to a larger watershed. In this study only the “streambank” erosion section of the RAPM method was used to estimate sediment contributions. However, rather than use the 160 acre sample plots to estimate soil loss, a 100% inventory has been completed on the major streams as identified earlier. (RAP-M 2007)

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Erosion Category Description		
Estimate d Loss (ft/yr)	Category	Description
0.03	Slight	Some bare banks but active erosion not readily apparent. No vegetative overhang. No exposed tree roots. Bank height minimal.
0.13	Moderate	Bank predominantly bare with some vegetative overhang. Some exposed tree roots. No slumping evident.
0.40	Severe	Bank is bare with very noticeable vegetative overhang. Many tree roots exposed and some fallen trees. Slumping or rotational slips present. Some changes in cultural features, such as missing fence posts and realignment of roads.
1.5	Very Severe	Bank is bare and vertical or nearly vertical. Soil material has accumulated at base of slope or in water. Many fallen trees and/or extensive vegetative overhang. Cultural features exposed or removed or extensively altered. Numerous slumps or rotational slips present. Generally silty or sandy bank material, NOT glacial till or exposed shale bedrock.

1

2

3 Bankfull discharges in Lake Bloomington watershed fall near the typical 1.5 year  
4 return interval for rural streams, which means that the height to the top of the bank of the  
5 channel is typical for a rural stream. There is little down cutting of the streambed, but  
6 lateral movement of the channel may still occur.

7 ● Over 83 percent of the sediment contributed from streambank erosion is  
8 generated from Money Creek. The streambank erosion inventory found the total  
9 sediment yield to Lake Bloomington from Money Creek alone to be approx. 1050  
10 tons of sediment delivered annually.

11 ● Stream channels inventoried are delivering to Lake Bloomington from 2 tons to  
12 78 tons of sediment per mile of stream channel. The sediment generated from  
13 streambank erosion varies widely from the lowest at 1.7 tons per sq. mi. (Trib. 6A)  
14 to the highest at 77.8 tons per sq. mi. (Trib. 1B). While Money Creek is producing  
15 the most overall sediment since it is the major channel above Lake Bloomington  
16 through which approx. 80 percent of total flow can be attributed.

17 ● Unlike Six Mile Creek above Evergreen Lake, Money Creek above Lake  
18 Bloomington does not show significant signs of downcutting. Therefore the  
19 primary source of streambank erosion comes from lateral bank migration alone.  
20 Of the 11 cross sections taken on Money Creek all were found to be in either  
21 CEM (Channel Evolution Model) stage 2 or 6, meaning there is no active  
22 degradation and/or widening within Money Creek.

- 1 ● The extent and the magnitude of the CEM Stage 2 and 6 stream segments  
2 indicate there are no “system-wide” instability problems in Money Creek.
- 3 ● Sediment delivery to Lake Bloomington from streambank erosion is significantly  
4 less than that found on Evergreen Lake. The total sediment delivered annually  
5 from streambank erosion in the Lake Bloomington watershed is estimated at 21  
6 tons per square mile of drainage area while Evergreen Lake was estimated to be  
7 delivering 53 tons per square mile.

8

### 9 RAP-M Watershed Study

---

10

11 An erosion/sedimentation inventory was conducted for all land uses in the Lake  
12 Bloomington watershed in McLean County. The watershed totals approximately  
13 43,100 acres or about 67.3 square miles. Sediment Delivery Rates (SDR) for each type  
14 of erosion occurring within the watershed were also calculated. The main goal was to  
15 estimate total sediment load to the lake from the main branch of Money Creek and the  
16 major tributaries. This study in its entirety can be found in Appendix III.

17

18

19

## 20 **SUMMARY OF EROSION AND SEDIMENTATION IN LAKE BLOOMINGTON**

21

### **WATER SHED**

22

23 In Lake Bloomington watershed, an estimated 106,800 tons of erosion occurs on  
24 an annual basis from the six major types of soil erosion: sheet, rill, ephemeral, shoreline,  
25 gully, and streambank. If this number is divided by the number of acres in the  
26 watershed, a rate of about 2.4 tons per acre per year is obtained, when ALL sources of  
27 erosion are considered. Approximately 29,900 tons of suspended and bedload  
28 sediment is actually “delivered” to the lake on a yearly basis. This estimated amount of  
29 sediment delivered is based on watershed-derived erosion and doesn’t represent a  
30 measured amount at the outlet end. This gives an overall rate of 0.69 tons per acre per  
31 year or 445 tons of sediment per square mile of watershed when the entire watershed is  
32 considered. At 30 pounds per cubic foot, this calculates to be 45.7 acre-feet of  
33 sediment deposition on an annual basis or at 40 pounds per cubic foot, it calculates to  
34 be 34.3 acre-feet of deposition per year.

June 12, 2008

1           Roughly 68% of the suspended sediment comes from sheet and rill erosion on all  
2 cropland slopes. This land makes up the majority of the watershed with B slopes, 2-5%  
3 slope, dominating the crop fields. Approximately 5% is coming from ephemeral erosion  
4 (channel) which seems a little low for this type of watershed. Gullies or concentrated  
5 flow areas are only contributing about 2% of the total suspended sediment. About 5%  
6 comes from streambank erosion (channel). Surprisingly, shore line erosion contributes  
7 nearly 14 % of the suspended sediment total. The A/B slope cropland areas appear to  
8 be contributing significant sediment but there is still much discussion on SDR rates for  
9 slopes less than 5%. It is believed presently that SDR base rates of 0.10 to 0.15 may  
10 be more appropriate. These lower rates would reduce sediment totals from the A/B  
11 slopes.

12           Bedload material is commonly sand and gravel and is very seldom measured as  
13 an output at the point of delivery, because of the cost and extensive sampling equipment  
14 that is necessary to complete this job. USGS gage stations do not routinely sample or  
15 measure this material. General estimates can be made, based on suspended sediment  
16 quantities. In Illinois, estimates of 5 to 30 percent of this total can be used. In this  
17 case, roughly 3,900 tons were added to the total suspended load delivered of 26,000  
18 tons to arrive at the total delivered sediment amount of 29,900 tons. In most cases,  
19 bedload type, composition, and grain size coming from the streambanks and shore lines  
20 is used extensively in channel design and channel geomorphology studies. The gullies,  
21 streambanks, and shore line sources contribute the majority of the bedload to the  
22 system.

23

24

#### **IN-LAKE SEDIMENT STUDY**

25           An in-lake sediment survey was completed in summer and fall of 2005 by  
26 Hanson Engineers Inc. The purpose of these surveys is multiple, but one major objective  
27 is to determine amount of sedimentation that has taken place in the lake since the dam  
28 was closed. The accompanying objective is to then determine how much storage  
29 volume remains in the lake and if long-range changes in a lake management plan are  
30 needed. They concluded that between the years of 1929 and 1999 approximately  
31 2,436 acre-feet of sediment has accumulated in the lake or about 34.8 acre-feet per year  
32 for the entire 70 years lifespan. (See complete report: "Bloomington Lake  
33 Sedimentation Survey" by Hanson Engineers Inc., January 5, 2000)

34           If we compare the sediment that has accumulated in the lake to that which is  
35 estimated by this inventory, we can validate both methods and increase the degree of

1 reliability of these projects. Bulk density of the sediment was not directly determined in  
 2 their survey. If we assume 30 pounds per cubic foot, the total from our inventory would  
 3 be 45.7 acre-feet on an average annual basis. If we assume 40 pounds per cubic foot,  
 4 our acre-feet of annual sediment accumulation would be about 34.3. It appears from  
 5 this that both the “watershed estimate” and the “sink estimate” were very similar. This  
 6 gives us a certain degree of reliability in the processes that were applied within this  
 7 watershed.

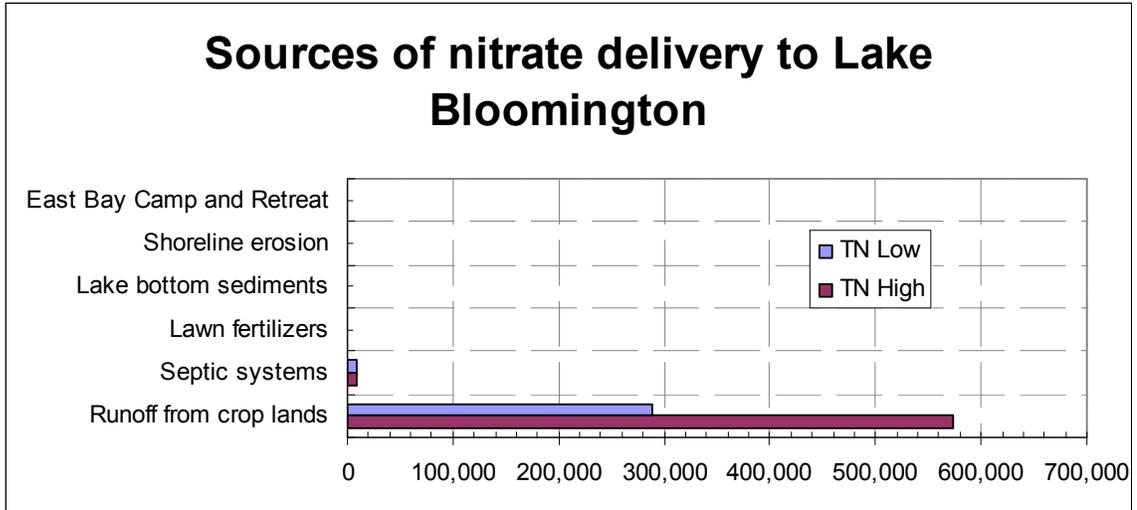
<b>Erosion and Sediment Totals for Lake Bloomington</b>			
Location	Erosion (tons)	SDR	Sediment Delivered (Tons)
Cropland A/B	93,100	0.18	16,760
Cropland C/C+	1,810	0.55	1,000
Grasslands, CRP, Etc (All Slopes)	3,100	0.25	755
Woodland (All Slopes)	860	0.60	520
Ephemeral	2,000	0.6	1,300
Gully-Lakeside	280	0.85	240
Gully- Money Creek	285	0.70	200
Streambank	1,260	1.0	1,260
Shoreline	3,756	1.0	3,760
<b>Total</b>	<b>106,800</b>		<b>26,000</b>
		<b><i>Suspended sediment</i></b>	26,000
		<b><i>Estimated Bedload (15%)</i></b>	3,900
		<b><i>Sediment transported to lake</i></b>	<b>29,900</b>

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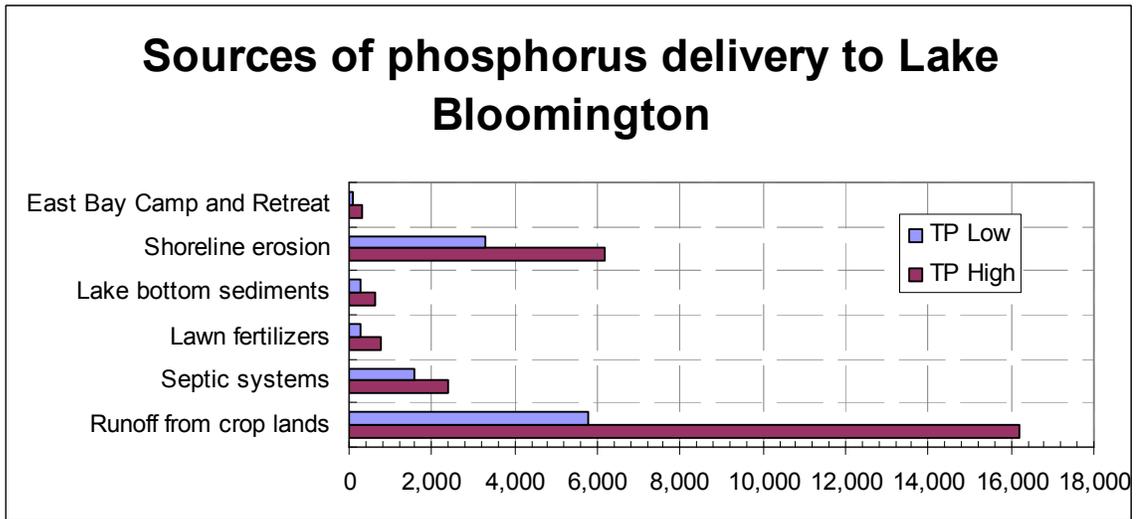
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#### 4 Water Uses

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The primary use of Lake Bloomington (572 acres) is as a reservoir for the City of Bloomington. The city has 3 pumps rated at 27.5 million gallons of water per day total pumping capacity at the lake. Pumpage levels vary widely between the years and during the year, depending on the weather and the water quality in both Lake Bloomington and Evergreen Lake, and (if other factors permit) maintenance of a water level to support recreational uses during the summer. At the current average pumping level of 11.4 million gallons per day, the lake contains enough water for approximately 250 days. In addition, leaseholders are permitted to draw water directly from the lake for irrigation purposes only.

1            Much of Lake Bloomington’s shoreline is occupied by residences and camps  
2 (three) on land leased from the City of Bloomington. In addition, several city parks are  
3 scattered around the shoreline. Accordingly, Lake Bloomington experiences  
4 considerable recreational use including motor boating, waterskiing and tubing, sailing,  
5 canoeing and kayaking, swimming and fishing. In the winter there is some ice skating,  
6 ice fishing and snowmobiling when ice thickness permits, but given central Illinois  
7 climate this usually occurs only for brief periods, if at all, each winter. While residents  
8 and their guests are the primary recreational users, a marina provides mooring for boats  
9 (primarily pontoon boats) owned and operated by non-residents and many non-residents  
10 use the boat launch to put in boats on a daily basis.

11            Boats must be registered with the lake ranger and have complete access to the  
12 lake. Motorized boats are limited to a 40 horsepower motor and jet skis are prohibited.  
13 Outside of the large basins, the lake is posted as a “no wake zone” where motors are to  
14 be operated at idle speed. Since these zones are generally narrower and shallower  
15 than the basins, this regulation has the dual purpose of helping to minimize shoreline  
16 erosion due to wake action and enhancing boating safety. Most of the shoreline area in  
17 the “no wake zones” is natural as opposed to the primarily steel seawalls that front the  
18 great majority of the residential sites.

19            Lake Bloomington is inhabited by fish species including large- and smallmouth  
20 bass, hybrid striped bass, walleye, bluegill, crappie and catfish. While some species  
21 occur naturally, the Illinois Department of Natural Resources also direct a long-term  
22 fishery management plan for the lake. Since 1984, the lake has been stocked with  
23 almost 127,000 largemouth bass fingerlings, 575,000 walleye fingerlings and 25,000  
24 hybrid striped bass fingerlings.

25

## 26 Conservation

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### 27 Conservation Practices

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29            The City of Bloomington, Pheasants Forever, and the McLean County Soil & Water  
30 Conservation District (SWCD) have provided funds for filter strips along waterways in  
31 both the Evergreen Lake and Lake Bloomington watersheds. Filter strips, an important  
32 Best Management Practice (BMP) and easily installed, had 213 acres formerly enrolled  
33 in the Lake Bloomington watershed in the Conservation Reserve Program (CRP) by  
34 the beginning of 2007.



1

2 The city of Bloomington has installed interlocking concrete blocks and seawall  
3 protection as erosion control measures around Lake Bloomington and plans to  
4 implement extensive shoreline stabilization measures, possibly to include riprap and  
5 plantings as described in the implementation section of this plan.

6

## 7 Nature Preserves in the Watershed

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8

9 The Lake Bloomington/Money Creek Watershed contains some lands that are  
10 protected as nature preserves in which the emphasis is maintaining and restoring native  
11 vegetation. Such lands are very important in reducing the inputs of TMDL pollutants  
12 because they keep portions of the watershed in a native vegetational condition. Two  
13 entities have worked to establish such nature preserves: ParkLands Foundation and the  
14 Indian Creek Homeowners Association. In total, these preserves protect approximately  
15 122 acres.

16

### 17 1. Parklands Foundation

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18

1 ParkLands Foundation ([www.parklandsfoundation.org](http://www.parklandsfoundation.org)) is a nonprofit, public  
2 membership land trust dedicated to acquiring, preserving and restoring natural areas in  
3 central Illinois since 1967. ParkLands manages over 1,500 acres of its own land,  
4 including the Merwin Nature Preserve along the Mackinaw River in McLean County, and  
5 also assists with the management of The Nature Conservancy's (TNC) Chinquapin  
6 Bluffs Natural Area in Woodford County.

7 Within the Lake Bloomington/Money Creek watershed, ParkLands Foundation  
8 owns 102 acres of lands that it manages and restores into native vegetational  
9 communities such as tallgrass prairie and deciduous woodlands.

10 The Moon Tract Nature Preserve consists of 42 acres of a former farm  
11 field/pasture that is located one-half mile east of Carver Corner on the north side of the  
12 road, on the central-west side of Lake Bloomington. The goal for this preserve is to  
13 restore the site to high-quality tallgrass prairie and oak savanna woodland through  
14 planting a diverse assemblage of native wildflowers, grasses, and trees using local  
15 ecotypes whenever possible.

16 The Breen Woods I Preserve consists of 38 acres of woodlands southwest of the  
17 East Bay Camp on the east side of Lake Bloomington. The site consists of a scotch  
18 pine plantation and an old field that is regenerating in trees. The goal for this preserve  
19 is to restore the site to native deciduous woodlands.

20 The Breen Woods II Preserve consists of two separate tracts totaling 22 acres  
21 and are located on the south side of the P.J. Kellar Blacktop approximately one mile east  
22 of the Lake Bloomington dam. The tracts are interspersed with land owned by East Bay  
23 Camp. The tracts consist of a high quality deciduous woodland dominated by oaks.  
24 Management is needed to prevent the invasion of maple trees that are displacing the  
25 higher quality oaks and hickory which provide more value to wildlife.

26

## 27 [2. Indian Creek Homeowners Association](#)

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28

29 The Indian Creek Homeowners Association ([www.frontiernet.net/~indiancreek](http://www.frontiernet.net/~indiancreek)) is  
30 a group of nearly 100 homeowners making up the Indian Creek subdivision. The  
31 wooded, rural subdivision is located within the Lake Bloomington/Money Creek  
32 watershed two miles due north of Towanda on the east side of County Road 1900. It  
33 straddles Money Creek about 3 miles southeast of where it enters Lake Bloomington.

34 The Indian Creek subdivision consists of approximately 160 acres of former  
35 farmland, pasture, and deciduous woodland, including approximately 60 acres of

1 common ground that was deemed unsuitable for home construction. Approximately 20  
2 acres of this common ground are being maintained by the residents as a private nature  
3 area with hiking trails along Money Creek. Management efforts carried out entirely by  
4 resident volunteers include trail maintenance, exotic species control, placement of bird  
5 houses, tree identification tags, and removal of "weed" trees in areas where older oak  
6 and hickory trees are still found. Future goals include continued restoration of the  
7 woodland, and establishment of a prairie in an open area that had previously been used  
8 as a soccer practice field.

9

## Problem Statements

The primary problems in the Lake Bloomington watershed are that the level of phosphorus and nitrates are too high, and that sedimentation of the lake is occurring. The Lake Bloomington Steering and TAC Committees have addressed the sources of phosphorus, sedimentation, and nitrates and prioritized them.

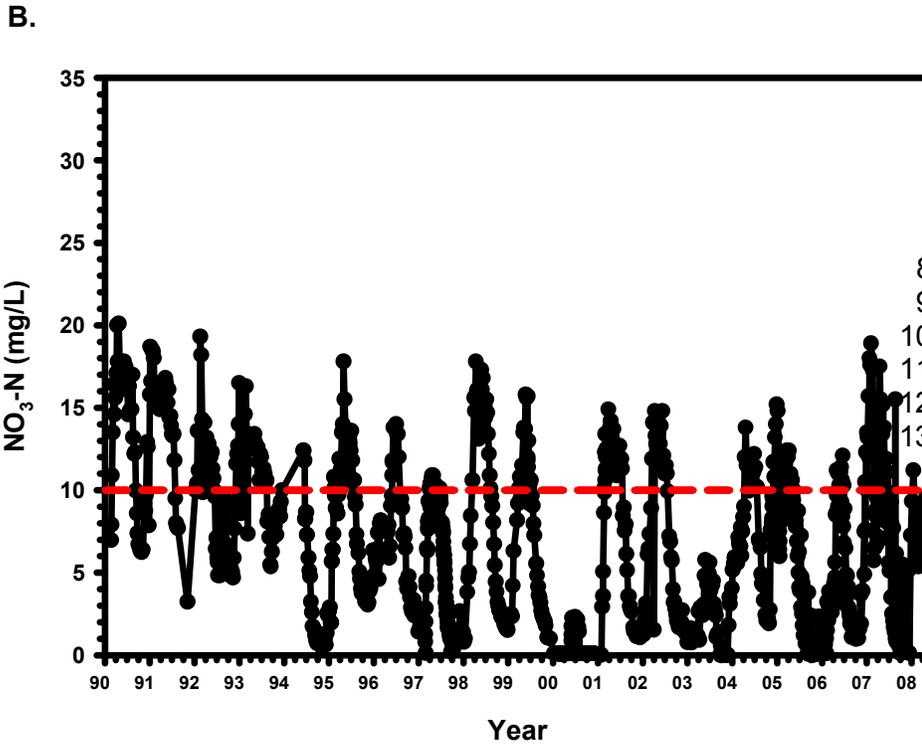
### A. Inconsistent water supply to the City of Bloomington:

The IEPA TMDL phosphorus limit level (0.05 mg/l) 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. The IEPA TMDL nitrate level is 10ppm. Sedimentation and/or turbidity does not have a mandated level. 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.

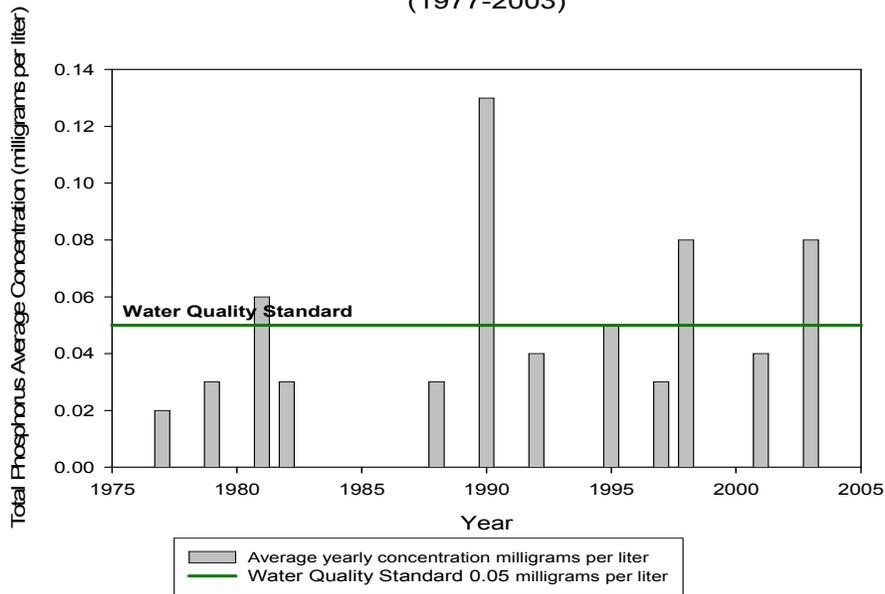
TOTAL PHOSPHORUS AVERAGE CONCENTRATIONS & RANGES LAKE BLOOMINGTON 1977-2003

Year	Average Yearly Concentration (milligrams per liter)	Minimum – Maximum Concentration (milligrams per liter)
1977	0.02	0.01 – 0.04
1979	0.03	0.01 – 0.05
1981	0.06	0.01 – 0.2
1982	0.03	0.01 – 0.04
1988	0.03	0.02 – 0.22
1990	0.13	0.02 – 0.51
1992	0.04	0.02 – 0.09
1995	0.05	0.02 – 0.11
1997	0.03	0.01– 0.06
1999	0.02	0.02 – 0.22

### Lake Bloomington Nitrate-N Concentrations

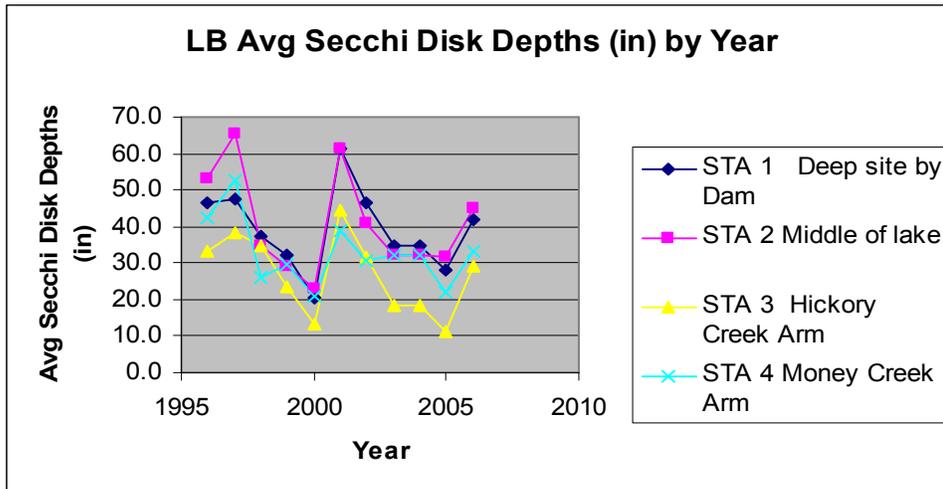


Total Phosphorus Average Concentrations Lake Bloomington (1977-2003)



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1 Water Clarity  
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4 Water clarity is a commonly used indicator of lake water quality. Water clarity  
5 (also called transparency) is measured in lakes using a Secchi disk. The 20 centimeter  
6 diameter disk is lowered into the lake and recording the depth at which it disappears  
7 from view.

8 Regular measurements of Secchi disk transparency are taken over the course of  
9 the summer and over many years. The general trend in transparency over the years  
10 gives an indication of the trend in water quality for the lake. Increasing water clarity  
11 indicates decreases in suspended sediment or decreases in nutrients entering the lake.  
12 Decreasing clarity indicates increases in suspended sediment or nutrients.

13

14 **Continued shoreline, streambank, and sheet and rill erosion**

15

16 An estimated 106,800 tons of erosion occurs on an annual basis from the six major  
17 types of soil erosion within the Lake Bloomington watershed. Approximately 29,900  
18 tons of suspended and bedload sediment is actually “delivered” to the lake on a yearly  
19 basis.

20 The 2005 study by Wayne Kinney predicts approximately 3800 tons of  
21 sediment are generated annually in Lake Bloomington shoreline erosion.

22

23 **C. Volume loss of Lake Bloomington by sedimentation**

24

25 After the 1958 raising of the dam, at normal level Lake Bloomington held  
7352 acre/feet of water. Since then 33% of the volume of the lake has been lost

1 due to sedimentation. Overall, 2436 acre/feet of sediment has entered the lake,  
2 with the average of 0.4% loss every year.

#### 3 4 **D. Nutrient impacts (high nitrates, phosphorus, algae, sedimentation)**

5 1. Upland erosion from cropland is carrying phosphorus into the feeder  
6 streams.

- 7 ● Studies done by local fertilizer dealers show an average phosphorus level  
8 in area agricultural land is 37-42 pounds per acre.
- 9 ● Nitrogen from agricultural land is released by fertilizers applied to  
10 enhance crop production as well as being released naturally from the soil  
11 profile.

12 2. Agricultural animals in the watershed are contributing phosphorus  
13 through their waste.

- 14 ● There are 414 head of livestock in the watershed in 25 operations.
  - 15 ○ 286 cattle (6 operations)
  - 16 ○ 6 swine (2 operations)
  - 17 ○ 42 Horses (18 operations)
  - 18 ○ 80 sheep (8 operations)
  - 19 ○

#### 20 **E. Effects of Urban Development**

21 1. Older or malfunctioning septic systems discharge nutrients to the watershed.

- 22 ● 1,600-2400 lbs. of phosphorous per year.
- 23 ● 8,400-9,500 lbs of ammonia per year

24 2. Urban lawn fertilization adds nutrients to the watershed.

- 25 ● 7/10th of 1% (302 acres) of the watershed is urban lawn area
- 26 ● total input data is unavailable, but data from studies indicates that urban  
27 fertilization has less than 1% of the nutrient load to the watershed.

28 3. Urban construction runoff contributes excessive sediment and phosphorus to  
29 surrounding surface waters.

- 30 ● Construction sites that are mass graded are often left free from protection the  
31 entire year
- 32 ● Rich black soils high in organic matter are stripped off and expose highly  
33 susceptible subsoils to erosive elements
- 34 ● Compacted soils on construction sites reduce infiltration of rainwater and  
35 contribute more runoff and therefore erosion of highly susceptible soils

- 1 • Rain events occurring on one acre of a construction site can contribute 20 times  
2 the sediment or more that of typical agricultural lands of same soil type and  
3 grade if not protected using proper soil erosion and sediment control BMP.
- 4 • The lbs of Phosphorus contributed by these lands is only obtainable through  
5 specific analysis of soils data and compliance with recommended NPDES Phase  
6 II requirements for construction site BMPs.
- 7 • Nitrogen, associated with eroded soil, from construction sites results in a  
8 negligible amount of nitrate input to surrounding surface waters.

#### 9 4. Increase in impervious surfaces

- 10 • Reduced groundwater recharge
- 11 • Increased flashiness in receiving water bodies
- 12 • Increased flow/velocity in receiving streams
- 13 • Increased temperature of receiving waters
- 14 • Increased delivery of urban pollutants

15

#### 16 **F. Impacts to recreational resources and wildlife habitat**

- 17 1. Fish survey data indicates that Money Creek has an IBI index of 24-30,  
18 which indicates it is Class Low.
- 19 2. Game fish management objectives have not been met in Lake  
20 Bloomington due to contributions of sedimentation and water level  
21 fluctuations.
- 22 3. Studies have shown that carp in the lake increase turbidity and resuspend  
23 phosphorus in the lake.

24

#### 25 **G. Gaps in scientific information**

26 1. Biota information.-Further information on the plants and animals of the  
27 watershed is needed to:

- 28 • track changes in water quality;
- 29 • improve knowledge of the presence and health of any Illinois listed  
30 species (Illinois Species in Greatest Need of Conservation, Illinois  
31 Threatened, Illinois Endangered);
- 32 • counteract current ecological degradation.

33 Regular stream surveys of mussels, fishes, and EPTs (invertebrate  
34 groups ephemeroptera, plecoptera, and trichoptera) will provide an important  
35 biotic index of water quality. Surveys searching for and restoring listed

1 species will ensure that our natural biotic legacy is known, appreciated and  
2 protected. Ecological health surveys and ecological restoration of public  
3 land and cooperating private land will help reverse the negative impacts of  
4 invasive species (e.g., garlic mustard) and overabundant native species (e.g.,  
5 maple trees, white-tailed deer) that are degrading the native ecosystems,  
6 thereby reducing their ability to retard soil erosion, ameliorate high and low  
7 flows, and act as a natural water purification agent.

8 2. Tile information in watershed is incomplete and not collected in an  
9 organized coordinated manner.

10 3. Discharge from onsite waste systems from homes adjacent to Lake  
11 Bloomington is not measured in any manner at this time.

12 4. Gauging stations from Money and Hickory creeks needs to be restored to  
13 collect current data.

14 5. Inadequacies in the modeling.

15 Future modeling efforts can benefit from improvements in data collection.

16 Some specific data needs that need to be considered are:

- 17 • local measurements of precipitation and pan evaporation;
- 18 • updated measurements of flow from Money, Hickory and other  
19 creeks;
- 20 • direct measurements of septic flow along the lake boundary.

21 In addition, there should be coordination with The Nature Conservancy's  
22 modeling efforts in the Mackinaw River valley that includes this watershed.

23 Finally, expert watershed modelers should be consulted to establish the key  
24 parameters that need measurement for future modeling efforts and assist in  
25 choosing the most appropriate models for this type of watershed.

26

27

28

## 29 **H. Adequacy of knowledge, awareness of, and incentives to implement** 30 **BMP's and other suggested strategies in the watershed**

31 There are numerous challenges for the implementations of best management  
32 practices (BMPs) including, for example, funding challenges, staffing challenges and  
33 educational challenges. While the Lake Bloomington watershed employs some BMPs,  
34 including nutrient management programs and filter strips coordinated through the NRCS,  
35 more BMPs could be employed.

1           While not measurable, anecdotal evidence suggests significant outreach  
2 programs (i.e. education and marketing) result in higher utilization of both existing and  
3 proposed programs.

4           Ongoing education and information to stakeholders of the Lake Bloomington  
5 watershed, including but not limited to funding agencies, is imperative to implement  
6 BMPs in the watershed.

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## Goals/Objectives

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3 There are three water quality issues in Lake Bloomington: nitrate/nitrite levels,  
4 phosphorus levels, and overall increased sedimentation. The goals are geared toward  
5 reductions in these areas. Goals are divided as to the three geographical areas in the  
6 watershed: the Riparian Area, which included the lake itself and all shoreline, stream  
7 banks, and feeder streams; The Urban Area, which includes all urban high density  
8 developments in the watershed; and the Agricultural Area which is the majority of the  
9 watershed land use.

10

### **Riparian Area Goals:**

#### 12 1. Streambank erosion

13 Stabilizing the streambank erosion on the lake feeder streams will reduce  
14 the amount of phosphorus entering the lake by 20%.

#### 15 1. Lakeshore erosion

16 Controlling lake shore erosion will reduce the amount of phosphorus  
17 entering the lake by 60%.

#### 18 2. Internal Loading

19 The destratifier is presently responsible for reducing the amount of  
20 phosphorus held in the deep zone of the lake. We would expect that the  
21 effectiveness of the destratifier would continue. The destratifier increases the  
22 oxygenated zone from 16 ft to 30 ft. The oxygenated zone has  
23 approximately 65% less phosphorus than the anoxic zone.

24

### **Urban Area Goals:**

#### 26 1. Development of Construction Erosion and Sediment controls

27 Develop and enforce ordinances to control the discharge of sediment with  
28 associated phosphorus so that water leaving these sites does not contribute  
29 to the turbidity of receiving water bodies.

#### 30 2. Urban Lawn fertilizer reduction

31 An increase in educational programs will raise awareness in the  
32 community to low or non-chemical lawn care.

#### 33 3. Urban Septic system replacement and inspection

34 a. Replacement of inadequate septic systems as detected by

1 inspections would reduce the amount of phosphorus and nitrates entering the  
2 watershed.

3 b. Attaching the Lake Bloomington developed area to the Bloomington-  
4 Normal Water Reclamation District would reduce phosphorus and nitrates  
5 from onsite waste delivery entering the watershed by 100%.

6  
7 **Agricultural Area Goals:**

8 1. Voluntary nutrient management plan. (Specific goals articulated in the table  
9 following.)

10 2. Upland Cropland erosion

11 a. Reduce delivery of sediment from upland erosion caused by sheet  
12 and rill, and ephemeral erosion by 21% in the next 10 years to the lake if  
13 there is 100% compliance. The expected compliance is 25%. This will  
14 be accomplished through implementation of agricultural Best  
15 Management Practices such as no-till/strip-till, grassed waterways,  
16 terraces and water and sediment control basins, filter strips and field  
17 borders. Along Agricultural corridors, reduce streambank and shoreline  
18 erosion and the accompanying sediment delivery to the lake by 16%, at  
19 100% compliance, through streambank and shoreline stabilization  
20 projects. The expected compliance is 20%. These practices will include  
21 rock riffles, stream barbs and longitudinal peak stone toe protection.

22 3. Livestock Management Plan

23 a. The estimated phosphorus load created by livestock operations in  
24 the Lake Bloomington Watershed is 1503 pounds. Based on NRCS staff  
25 surveys of the 6 livestock producers in the watershed, it is believed that  
26 17% of the producers would voluntarily engage in BMPs. However  
27 engaging this 17% would eliminate approximately 25% or 376 pounds of  
28 phosphorus.

29 4. Tile Drainage

30 Based on a study by David Kovacic, it is estimated if 5% of the  
31 estimated tile area that is drained in the watershed is converted to  
32 wetlands (382 acres), then a 46% reduction of nitrogen load would be  
33 obtained, which would be 95% of the required reduction of TMDL  
34 requirements. NRCS/SWCD staff has estimated that 20 acres of  
35 constructed wetland would be realistic.

1  
2

<b>Lake Bloomington Nitrate/Nitrite Reduction Goals</b>				
<b>Source</b>	<b>Estimated Nitrate Load (tons)</b>	<b>Estimated participation Per unit</b>	<b>Estimated reduction of existing load</b>	<b>Projected reduction percentage</b>
Field Tile runoff	72,000	63%	50% (36,000 lbs)	5.8%
Post-construction urban runoff	Data not available			
Septic tank Ammonia	8,700	See Problem Statement		
Agricultural Livestock	41,338	25%	25% (1034.5 lbs)	1.6%
Feeder stream delivery	591,319	8%	5% (29,825 lbs)	4.8%
Estimated Total	718,544	----- -	66,859 .5 lbs	9.3%
<b>Mandated Reduction Total</b>	-----	----- -	<b>622,441 lb/yr</b>	<b>48%</b>

<b>Lake Bloomington Sedimentation Reduction Goals</b>				
<b>Source</b>	<b>Estimated Sediment Load (tons)</b>	<b>Estimated participation per unit</b>	<b>Estimated reduction of existing load</b>	<b>Projected reduction tons</b>
Streambank erosion	1,260	5,434/217,360 feet	20%	315
Sheet and rill erosion	20,355	18,000/36,000 acres	5%	1,018
Shoreline erosion	3,688	6,546/55,580 feet	20%	738
Post-construction urban runoff	Data not available			
Urban construction runoff	Data not available			
<b>Estimated Reduction Total</b>		<b>N/A</b>		<b>2,071</b>

<b>Lake Bloomington Phosphorus Reduction Goals</b>				
<b>Source</b>	<b>Estimated Phosphorus load (lbs)</b>	<b>Estimated participation per unit</b>	<b>Estimated reduction of existing load</b>	<b>Percentage Of Mandated Reduction</b>
Streambank erosion	1,237	5,434/217,360 feet	20% (247 lbs)	3.65
Sheet and rill erosion	19,988	18,000/36,000 acres	5% (999 lbs)	14.5
Shoreline erosion	3,087	6,546/55,580 feet	60% (1852 lbs)	27.4
Field tile runoff	198	15,360/36,000 acres	50% (94 lbs)	1.5
Agricultural livestock	1,503	1 / 4 operations	50% (376 lbs)	5.6
Post-construction urban runoff	Data not available			
Urban Lawn fertilizer	Data not available			
Internal lake loading	351	100%/ 1 unit	65% (228 lbs.)	3.3%
Urban septic system	2,000	See Problem Statement		
Estimated Reduction Total	---	---	3,568 lbs	52.7%
<b>Mandated Reduction Total (89% of existing load)</b>			<b>6,762 lb/yr</b>	

June 12, 2008

1 An error was found in the original Lake Bloomington TMDL report estimating the  
2 needed reductions to meet Illinois Environmental Protection Agency water quality  
3 standards. This errata sheet is dated February 19, 2008; therefore, the errors were  
4 found after we had completed our calculations for this watershed plan. TetraTech  
5 recalculated the needed reductions based on their revised load estimates, with the new  
6 reductions for the watershed now estimated to be 34% for nitrate-N and 66% for total P.  
7 We report these new reductions for information only, and have not adjusted our  
8 estimates.

## 9 Best Management Practices

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### 10 Riparian Practices

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#### 11 Lakeshore Erosion Control

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12 Solutions considered to halt the bank recession in this area are evaluated in this  
13 report based on seven factors.

14 1. The solution should first provide long term control of the receding bankline,  
15 in excess of 50 years.

16 2. The solution must be socially acceptable and aesthetically pleasing given  
17 the public use of these areas.

18 3. The solution must allow for installation during normal lake operation levels.

19 4. Contamination of the lake during construction should be at the lowest  
20 possible level.

21 5. If possible it should enhance the aquatic habitat and improve fisheries in  
22 the lake.

23 6. Cost per foot of bank is always a consideration.

24 7. The solution should maintain as much lake volume as possible.

25 8. All erosion class 2 to class 6 shoreline (27,618 feet) would benefit from  
26 stabilization.

27  
28 Using these criteria, the tradition method of bank control using "sheet  
29 piling" in the residential portion of the lake has not been considered due to  
30 cost and aesthetics, assuming a more natural looking bankline is the desired  
31 result. Six alternative approaches were considered in the 2005 Study.

1 All six traditional alternatives would utilize a stone bankline below the  
2 waterline and extending approximately 2 ft. above the waterline. While there  
3 is not a comprehensive study of the wave action on Lake Bloomington, this  
4 height proved to be sufficient in the study conducted on Evergreen Lake and  
5 given the similar size and orientation the Evergreen Lake results will be  
6 applied to Lake Bloomington. This stone bankline will provide the bank  
7 stability to prevent additional bank recession and will be constructed of RR-5  
8 stone which will provide a rocky substrate as an additional element useful for  
9 aquatic habitat enhancement.

10 Initial consideration was given to utilizing the existing cobble eroded  
11 from the bankline to supplement the stone requirements of the bank  
12 protection measures. However, discussions with fisheries biologist, Mike  
13 Garthaus from IDNR suggest that the cobble found in the lake provides a  
14 useful habitat element that should be left in place for fish enhancement. The  
15 shallow water depths found along the eroding banks are also a negative  
16 factor for fisheries; however the alternatives proposed will all reduce the  
17 extent of the shallow water area near the bank by placing fill material within  
18 the lake near the present shoreline.

19

#### 20 **Armor Stone Breakwaters with Transitional Wetland Alternative**

21 An additional alternative to the traditional shoreline protection alternative selected  
22 in the 2005 report is Armor Stone Breakwaters with Transitional Wetlands. Normally  
23 recommended for reservoir shorelines where the fore slope has been reduced to at least  
24 8h:1v. Toe protection for the breakwater is generally provided by a riprap apron placed  
25 on the fore slope.

26 A proposed armor stone breakwater is sometimes considered to be a hazard to  
27 boating, however, when located near the original shoreline, the structure is in shallow  
28 water where an operating power boat would be in imminent danger of running aground  
29 regardless of the existence of a breakwater. A shallow water location also minimizes  
30 the required quantity of stone.

31 An armor stone breakwater stops shoreline retreat, provides an area of quiet  
32 water near shore where a beneficial wetland habitat can flourish and space is available  
33 for the back slope to attain it's angle of repose.

June 12, 2008



1

2

3 At Kinkaid Lake in Jackson County, IL , just a few years after it began, armor  
4 stone breakwater shoreline work already is reaping clear benefits. New wetlands created  
5 between the rock berms and the shore are filled with vegetation and aquatic life where  
6 bare dirt once existed. Biologists report 121 species, including two state-threatened  
7 species, have moved in to colonize those new wetlands. Even the view from above looks  
8 different as water clarity improves. (IDNR, Outdoor Highlights, 7/07)

9 Traditional, shoreline stabilization has been accomplished by using heavy  
10 construction equipment to build temporary roads, reshape the eroded shoreline, and  
11 place riprap. This method can be destructive to valuable woodland habitat and steep  
12 slopes, particularly in areas where there are no existing roads. Armor Stone Breakwaters  
13 can also be developed using construction methods that utilize boats to deliver materials  
14 to remote shorelines without damaging the woodland habitat or steep slopes. The Armor  
15 Stone Breakwaters do not require reshaping the shoreline and facilitate a diverse  
16 shoreline habitat.

### 17 [Streambank Erosion Control](#)

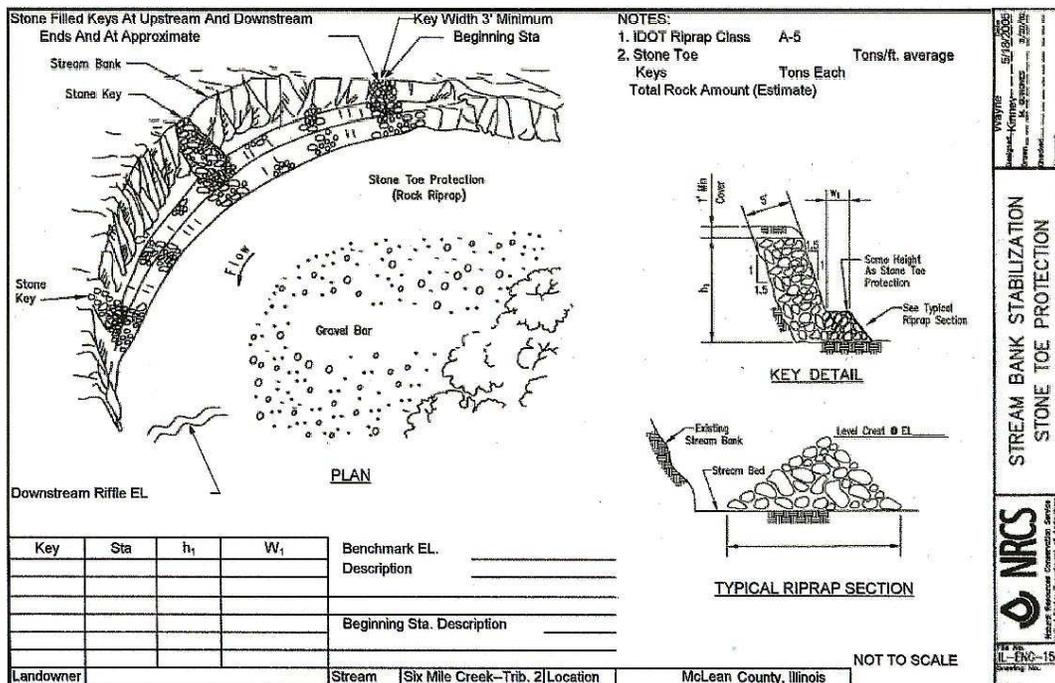
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18 The Bankfull Width over Bankfull Depth ratios (W/D) range between 8 and 15  
19 with the exception of Cross Section #2 on Big Slough East with W/D ratio of 5.5.  
20 Therefore the recommendation is to avoid use of Stream Barbs and/or Bendway Weirs  
21 to redirect flow from eroding banks. Use of these techniques is only applicable to wider  
22 W/D ratio channels with significant bar material that can be easily moved by the channel  
23 flow. The most effective and economical treatment in the majority of locations within the  
24 Lake Bloomington watershed will be to “harden the toe” of the eroding banks to prevent  
25 continued undercutting and slumping of banks. In isolated cases there will be a need for  
26 limited use of “grade control” to halt active downcutting. Stone Toe protection (STP) and  
27 Rock Riffles (RR) are the preferred methods recommended.

28

1 **Stone Toe Protection (STP):** (Fig. Below) Each eroding bank can be protected with  
 2 non-erodible materials. Typically meandering bends similar to those in the Lake  
 3 Bloomington watershed can be stabilized by placing the hard armor only on the toe of  
 4 the bank. The most common method is to use quarry stone properly sized to resist  
 5 movement and placed on the lower one third of the bank in a windrow fashion. This  
 6 technique is called Stone Toe Protection (STP) and is widely accepted and successful.

7 There are a few obstacles to overcome in this watershed to make use of STP  
 8 successful. First, some of the bends in the channel are “unstable” having a radius of  
 9 curvature less than 1.5 times the channel width. Research has shown that bends with a  
 10 radius of less than about 1.8 times the bankfull width are unstable and tend to “cutoff”. In  
 11 order to use STP successfully under these conditions the channel would need to be  
 12 “realigned” in order to produce a radius of curvature that falls within the range of “stable”  
 13 geometric planforms. Installing STP without making these channel adjustments would be  
 14 to risk failure of the STP and encourage channel cutoffs leaving the STP application in  
 15 an “abandoned” reach of channel. Second, the total amount of eroding bank will require  
 16 many sections of the stream to have STP on one side or the other, resulting in extensive  
 17 use of STP and a very costly application.



18 NRCS Standard Drawing of Stone Toe Protection  
 19  
 20

21 **Rock Riffle Grade Control (RR):** (Fig. below) Use of loose rock grade control structures  
 22 at the “natural” riffle locations in a stream will create or enhance the “riffle-pool” flow  
 23 sequence found in natural channels. In stable systems this alternating “riffle-pool”



1           The destratifier is presently responsible for reducing the amount of phosphorus  
2 held in the deep zone of the lake. We would expect that the effectiveness of the  
3 destratifier would continue. The destratifier increases the oxygenated zone from 16 ft to  
4 30 ft. in the entire volume of the lake. The oxygenated zone has approximately 70% less  
5 phosphorus than the anoxic zone.

## 7 *Agricultural Practices*

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8           There are several Agricultural BMP's that are proven to reduce sedimentation,  
9 nitrate and phosphorous levels. They include nutrient management developed by TSPs  
10 (Technical Service Providers) based on proven recommendations that manage the  
11 amount, form, timing and placement of nutrients, so nutrients are available for plants and  
12 least likely to leave the farm. Other non-structural practices that can benefit the  
13 streams, Lake Bloomington and overall environment are no-till and strip-till on cropland  
14 areas and filter strips, and riparian buffers along field borders, windbreaks and streams.  
15 Structural practices that can reduce nutrient inputs include wetlands, grassed  
16 waterways, grade stabilization structures and drainage water management.

17  
18           Wetlands are a Best Management Practice (BMP) that is proven to reduce nitrate  
19 and phosphorous levels entering lakes and streams. Wetlands in the watershed near  
20 agricultural lands that intercept tile drainage are a practical and simple tool to improve  
21 water quality. The logistics of siting wetlands that have tile outletting into them are  
22 challenging in many locations, while the cost of wetland installation can be considerable.  
23 Landowners are not always receptive to implementing wetlands because of production  
24 mindsets to drain cropland and the long term loss of production cropland to ag wetlands.

## 25 *Urban practices*

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### 26 *Lawn Chemical Application*

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27  
28           There are several straightforward solutions to the use of lawn chemicals in the Lake  
29 Bloomington Watershed, particularly in the "shoreland buffer," the very sensitive strip of  
30 land along the edge of the lake.

- 31           • Rely exclusively on fertilizers with no phosphorous and shift from the use of  
32           synthetic, fast-release N fertilizers to slow-release synthetics or organic  
33           fertilizers.

- 1 • Shift from pure cool-season turfgrass lawns to mixed clover-turfgrass lawns by  
2 overseeding existing lawns with white clover.
- 3 • Reduce the amount of lawn through conversion of sections of grass to rain  
4 gardens and/or beds of wildflower and native grasses. Rain gardens or swales  
5 and berms would be particularly helpful along sloping shoreline and between  
6 downspouts and the lake.
- 7 • Rain barrels would also help to reduce downspout flows into the lake.
- 8 • Go entirely native, especially along the shoreline buffer along the water's edge.  
9 All turfgrass could be replaced with sedges, native grasses, wildflowers,  
10 groundcovers, shrubs and trees.

11

1

2

## Implementation strategies/Alternatives

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3

### Riparian Implementation:

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4

#### Lakeshore developed areas implementation strategies

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5

Use North Park, Riley Starkey, and Association Park, as the equivalent of agricultural experiment stations to develop examples of best practices landscaping for the environmentally sensitive shores of Lake Bloomington. North Park could play a particularly important role in experiments with a shoreland buffer of prairie grasses and wildflowers. We also need to determine whether there is a temperate region equivalent to vetiver grass that could be planted directly into the bare soil in the steep banks. Vetiver grass has an extensive record of success in land reclamation projects in the tropics and semi-tropics, so a temperate climate equivalent would greatly assist in efforts to stabilize steep banks with exposed soil.

14

The sun burnt areas of both North Park and Association Park can be used for experimentation with white clover/turf grass mixes. The parks can also allow demonstrations of berm and swale rain gardens, and trials of dry, shade tolerant groundcovers (e.g, Adonis amurensis, Epimedium, Pulmonaria saccharata, Symphytum grandiflorum, Vinca). Better yet, go native and use various prairie/woodland sedges (Carex jamesii, Carex, pensylvanica, Carex bicknellii) and woodland groundcovers and plants, such as sharp-lobed hepatica (Hepatica acutiloba), prairie smoke (Geum trifolium), flowering spurge (Euphorbia coreolata), etc., to cover the presently barren, erosion-prone soil.

23

After experiencing successes in the pocket parks and the Keller Park, turn the grounds of the Davis Lodge into a model of ecologically sound lakeside landscaping.

25

Among other things, this would likely involve:

26

27

28

29

30

31

- Creating swales and berms along sloping areas of lake frontage with water-loving prairie grasses, sedges, and wildflowers planted in the swales. Swales and berms function in a manner analogous to buffer strips between agricultural land and streams (Hemenway 2000:83-86). These “rain gardens” would capture any run off and filter the water before it reaches the lake (Bannerman and Considine 2003).



1 Once successful examples of mixed clover/turf grass lawns exist, create incentives  
2 for the use of best management practices and disincentives for the use of fertilizers with  
3 phosphorus, fast-release sources of N (e.g., urea, ammonium nitrate, ammonium  
4 sulfate, liquid fish solutions), and pesticides (e.g., “weed ‘n feed” mixes); encourage non-  
5 pesticide fertilizers with slow-release sources of N (coated ureas, urea formaldehyde);  
6 and create incentives for the use of slow-release organic fertilizers (corn gluten pellets,  
7 soy, etc.).

## 8 Lakeshore Erosion Implementation

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9  
10 Due to the steep, high banks, and extreme fluctuations in water levels,  
11 biotechnical means of shoreline stabilization were excluded from consideration. The  
12 recommended alternative selected in the 2005 Study, based upon cost and impact upon  
13 near shore woodland cover is Stone Toe Protection (STP) which when applied  
14 along the eroding sections to an elevation of 721.5 will provide the stability  
15 needed to protect the base of the bank and prevent any additional recession  
16 of the bank line. The STP will be placed at a distance from the eroding bank  
17 to allow for the bank to be sloped on a 2:1 slope and vegetated by balancing  
18 the cuts and fills so that no material need be transported to or from the site.

19 This alternative has the advantage of allowing initial placement of the  
20 STP from the top bank before any earthwork begins, drastically reducing the  
21 opportunity for lake contamination. The use of STP also places the maximum  
22 volume of stone at the base of the slope where erosion is most severe. This  
23 provides additional safety and effectiveness to the use of STP as there is  
24 sufficient stone to launch into any area that may erode on the lake side of the  
25 STP and still maintain protection of the shoreline. The disadvantage of this  
26 treatment is the volume of stone needed and the loss of vegetation along the  
27 top bank.

28 The advantages STP treatment are:

- 29 1. No net loss of lake volume as excavated volume will exceed the volume displaced  
30 by STP.
- 31 2. Reduced volume of material needed from top bank to create 2: 1 slope.
- 32 3. Preservation of more existing vegetation on top bank.
- 33 4. Lake levels normally reach the level needed each year to make this alternative

1           feasible.

2           5. Construction during low lake levels will keep contamination to an absolute  
3           minimum as no equipment will need to be in the water for construction.

4           6. STP can be placed prior to excavating lake bed to prevent silt from re-entering the  
5           lake.

6           7. The 12 to 15 foot bench along the lake side of the STP for equipment operation  
7           will prevent any excessive undercutting of the STP by equipment operators or future  
8           erosion.

9           8. Cost is reduced while preserving the advantage of durability and long term  
10          protection with little need for maintenance.

11          9. Cut slope above 721.5 can be easily vegetated and maintained to provide a  
12          natural looking bank that will be aesthetically pleasing.

13          10. Excavation in the lake will reduce the area of shallow water which will enhance  
14          the aquatic habitat within the lake. Additional enhancements within the deepened water  
15          areas can be added during construction as recommended by the IDNR Fisheries  
16          Biologist.

17          The recommended treatment is applicable to all sites and discussions with  
18          Richard Twait, Superintendent of Water Purification, indicate that fluctuations in Lake  
19          Bloomington during normal operations will provide ample opportunity for installation  
20          during low water periods. The choice of Stone Toe Protection is recommended  
21          primarily because of the additional durability and safety of the design.

## 22   Streambank Erosion Implementation

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### 23    **Brief Narrative of Stream Segments and Treatment Recommendations:**

24          While there is significant streambank erosion in the Lake Bloomington  
25          Watershed, it is not as critical nor as severe as that found in the Evergreen Lake  
26          Watershed. Money Creek and its tributaries lack evidence of widespread systematic  
27          stream instability. This makes the treatment recommendations easier to apply in that  
28          there are no negative consequences to making channel improvements in a random  
29          piecemeal manner as landowner interest may dictate. With no system wide problems,  
30          there is little danger of stream channel protection projects being negatively impacted by  
31          changes in the channel characteristics and adjustments taking place upstream or  
32          downstream. There are a few exceptions to this generalization where Rock Riffle grade  
33          controls have been recommended, however these sites are relatively small and the  
34          degradation is not severe, nor rapid, therefore many opportunities are available to work  
35          in and around these sites with willing landowners.

1 Money Creek and Big Slough East should be the top priority for streambank  
2 stabilization with the highest priority given to sites rated with “severe” erosion closest to  
3 Lake Bloomington. Second priority would be “severe” erosion sites on tributaries to  
4 Money Creek.

#### 5 **Money Creek**

6 No active degradation is occurring and no significant degradation has occurred in  
7 the past. Lateral bank protection is only needed in eroding areas where the channel is  
8 meandering by undercutting existing banks causing bank slumping. Use of Stone Toe  
9 Protection (STP) at 0.75 ton per foot is the general recommendation.

#### 10 **Tributary 1A**

11 No inventory or recommendations will be made because information concerning  
12 this tributary is not available.

#### 13 **Tributary 1B (1,320 feet)**

14 This is a very small tributary draining only about 30 acres. There is however a  
15 significant degradation problem about midway on this tributary. Use of Rock Riffle grade  
16 control or a traditional waterway or dry dam would be alternatives to treat this segment.

#### 17 **Tributary 1C (2,640 feet)**

18 The lower end of this tributary has been extensively channelized in the past with  
19 one segment having been moved several hundred feet by cutting through a high ridge.  
20 Since the drainage area is only 1.4 sq. miles the existing channel in this reach has  
21 developed a small floodplain to reach CEM stage 6, i.e. it is stable with an active  
22 floodplain. Treatment recommendations are limited to STP where lateral migration is  
23 occurring.

#### 24 **Tributary 1D (2,376 feet)**

25 The lower end of the tributary has been extensively modified and there is some  
26 evidence of downcutting from just above the confluence with Money Creek to a point  
27 approx. 0.25 mile upstream. This lower segment would be benefited by Rock Riffle  
28 Grade control structures. Above this point only STP is needed for lateral migration  
29 control.

#### 30 **Tributary 2A (2,640 feet)**

31 This tributary is degrading on the lower 0.25 mile above Money Creek and would  
32 benefit from Rock Riffle Grade control structures. The area is heavily wooded and  
33 access will be difficult. Above the actively degrading section only STP for lateral  
34 migration is recommended.

#### 35 **Tributary 2B (1,848 feet)**

1 This tributary has minor degradation problems on the lower 0.35 mile above  
2 Money Creek. A combination of Rock Riffle Grade controls and STP is recommended for  
3 this segment. Above this reach the channel is well maintained and no treatment is  
4 recommended.

5 **Tributary 4** (2,904 feet)

6 This is a direct tributary to Lake Bloomington with a very steep gradient on the  
7 lower 0.5 mile above the lake. A combination of Rock Riffle Grade control structures and  
8 STP is recommended for this segment. Above this reach the channel is well maintained  
9 and no treatment is recommended.

10 **Tributary 5A** (15,576 feet)

11 This tributary drains the village of Towanda. Between Towanda and Lamplighter  
12 Subdivision the channel has been “cleaned and shaped” in the fall or winter of  
13 2005/2006. This segment is completely devoid of vegetation and was a potential source  
14 of large sediment loads during the spring of 2006. A significant headcut exists at the  
15 north edge of the subdivision, however it appears that there are plans to continue with  
16 the “cleaning and shaping” through the subdivision.

17 The recent channel work makes it difficult to determine the future needs of this  
18 segment; however use of STP will certainly be required to halt lateral migration through  
19 the entire inventoried reach. It is possible that Rock Riffle grade controls will also be  
20 needed after construction and an inspection of the area has been completed.

21 **Tributary 6A** (4,480 feet)

22 This is a well maintained “open drainage” ditch with sloped and maintained  
23 sideslopes. No treatment recommendations are made for this segment.

24 **Tributary 6B** (4,224 feet)

25 This tributary has no degradation problems, therefore the recommendation is to  
26 use STP only where lateral migration is occurring.

27 **Tributary 9A** (10,296 feet)

28 This is a well maintained “open drainage” ditch with a heavy stand of Reed  
29 Canarygrass. No treatment recommendations are made for this segment.

30 **Big Slough East** (25,080 feet)

31 This is a direct tributary to Lake Bloomington and there is some degradation  
32 occurring midway between Road 2350 North and the Lake. The recommendation is to  
33 use Rock Riffle Grade control and STP below Road 2350 North and STP only above  
34 Road 2350 North for lateral migration.

35 **Big Slough 2** (7,392 feet)

1 This is a tributary to Big Slough East with no degradation. STP for lateral  
2 migration only is the recommended treatment.

3 **Big Slough West (6,705 feet)**

4 This is also a tributary to Big Slough East with no degradation. STP for lateral  
5 migration only is the recommended treatment.

6 **Destratification**

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7  
8

9 On June 20, 1996, destratifier units were placed on the bottom of Lakes  
10 Bloomington and Evergreen. The units are designed to maintain adequate dissolved  
11 oxygen levels in the lakes. The City of Bloomington installed the units as part of its  
12 overall lake management program. The Illinois State Water Survey Office of Water  
13 Quality Management recommended the system.

14 Dissolved oxygen is an extremely important substance in lakes. Dissolved  
15 oxygen (D.O.) is essential for fish and other organisms to survive. Lake water can gain  
16 D.O. through the release of oxygen by algae and other submerged aquatic plants.  
17 Another major source of oxygen transfer occurs at the lake surface, where oxygen from  
18 the atmosphere can diffuse into the water.

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

June 12, 2008

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

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

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

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

23 In order to arrive at a crude, conservative, estimate of internal loading of  
24 phosphorus due to anoxic conditions in the lake and to estimate the load reduction due  
25 to destratification, several assumptions were made. The first assumption was that all of  
26 the phosphorus loading from anoxic release of P occurs during fall overturn. The second  
27 assumption was that elevated P concentrations only occur in an anoxic zone extending  
28 two feet above the sediment surface, with chemical precipitation and other processes  
29 keeping P concentrations near background levels in zones extending greater than 2 feet  
30 above the sediment. The Total P concentration for the bottom 2 foot layer for October  
31 2005 was estimated as the average of the concentrations for the 1 foot and 3 feet  
32 samples (0.32 mg/l P).

33 Using the depth volume relationship developed in the Hanson Engineering  
34 sedimentation survey of 1999, 0-2ft above the sediment surface water volumes were  
35 calculated for each 2 foot depth increment and multiplied by the 0.32 mg/l total P

1 concentration. The pounds of phosphorus contained in each 2 foot “ring” were then  
2 summed for a total of the pounds of phosphorus in the anoxic zone of the lake.

3 For the October, 2005, samples, the calculated mass of phosphorus was 147  
4 pounds. If the destratifier was not operating and the anoxic zone started at 15 feet, the  
5 calculations would result in a mass of 797 pounds of phosphorus. The P load reduction  
6 from the destratifier would then be approximately 650 pounds per year. The destratifier  
7 operated on an intermittent basis over the last few years. The unit operated continuously  
8 during the summer of 2007.

9

## 10 Wetlands

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11 The City of Bloomington has been concerned with high nitrate concentrations (at  
12 or near the 10ppm EPA limit) in drinking water for several decades. The following  
13 excerpts from Rutherford and Twait (2005) (Title: Source Water Protection and  
14 Watershed Management:

15 A Rural and Water Supply Perspective, Governor’s Conference on the  
16 Management of the Illinois River System, October 2005) describe some of actions the  
17 City and cooperating agencies have taken to deal with the nitrate problem.

18 Examination of the existing historical nitrate data shows that the highest nitrate  
19 levels came after the drought of 1988-89. High levels of nitrates, due to lack of uptake  
20 by crops, accumulated in the soil and leached out quickly with the first significant rainfall  
21 after the drought. Low water levels provided little dilution for the high nitrate runoff  
22 entering the reservoirs. Future droughts may result in similar conditions.

23 City staff had assumed that the nitrate problem was mainly related to agricultural  
24 fertilizer. Other possible sources included onsite waste system discharges from villages  
25 and homes within the watershed and from residences around Lake Bloomington.  
26 Relative contributions of the various possible sources needed to be determined before  
27 any possible solutions could be implemented.

28 In 1992, the City asked the SWCD and Watershed Conservationist to locate sites  
29 and get permission to sample from different locations in the Money Creek watershed.  
30 Money Creek is the main tributary to Lake Bloomington. Samples were collected and  
31 analyzed for nitrate by City staff from drainage tile outlets, surface runoff, and from  
32 various points along Money Creek.

1           The sampling program expanded in 1993, when the City entered into an  
2 agreement with Dr. Ken Smiciklas, of the College of Agriculture at Illinois State  
3 University, to study the nitrate problem. Students from ISU collected samples from the  
4 expanded sites and delivered them to the water treatment plant for analysis. The results  
5 from the sampling program showed that the most of the nitrates entering Lake  
6 Bloomington came from field tiles (1). The City resumed sampling responsibilities in  
7 2003.

8           In order to keep the watershed stakeholders involved and informed about the  
9 study, Professor Aaron Moore, also of the College of Agricultural at Illinois State  
10 University, sent out a semi-annual newsletter. He also performed annual surveys of the  
11 farm operators throughout the watershed for their current and intended farming  
12 practices, including details of their proposed nitrogen fertilizer application. Group  
13 meetings with people from the watershed have also been held to answer their questions  
14 and give them information about the study.

15           The next phase of with the study with Illinois State University was to determine if  
16 different agricultural practices could help reduce the amount of nitrates leaving the fields  
17 through the drainage tiles. In early spring, 1997, the City, with the McLean County Soil  
18 and Water Conservation District and ISU, installed individual tile drainage networks for  
19 six 5-acre test plots in a farm field next to City property at the upper end of Lake  
20 Bloomington. The test plots were developed on a privately owned field that was  
21 previously only minimally tiled.

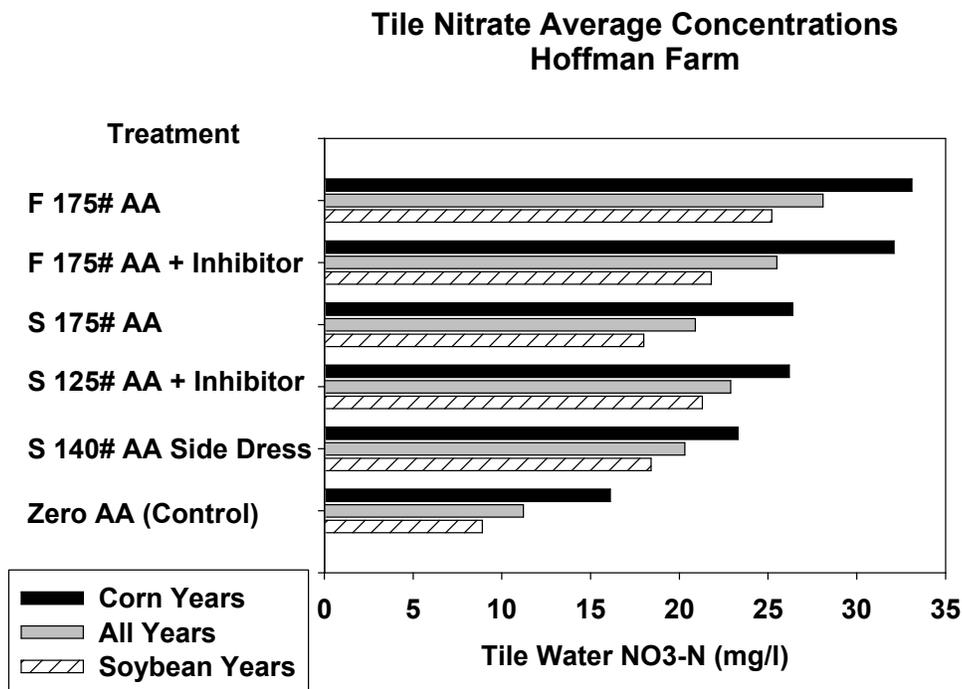
22           The City entered into an agreement with the landowner and farm operator to  
23 continue the traditional corn/soybean planting rotation, but to vary the timing, rate, and  
24 use of nitrification inhibitors on individual test plots. The treatments are fall application of  
25 anhydrous ammonia, one field with and one field without inhibitor, spring applications  
26 with and without inhibitor, one post emergent side dress application, and a control plot  
27 which receives no anhydrous ammonia. Nitrate concentrations in tile drainage from each  
28 of the fields are measured, along with harvest quantities and plant conditions.

29           So far, the clearest results are that fields with fall application of anhydrous  
30 ammonia experience higher nitrate losses than from spring applications. Yields are  
31 drastically reduced from the field where no ammonia is applied. Since weather patterns  
32 exert such a large effect upon crop growth and harvest, and corn is only planted every  
33 other year, the City will continue to work with the landowner and farm operator on the

1 study to get a better idea of the effects of soybean nitrogen fixation and carryover and  
2 the effectiveness of inhibitors on productivity and nitrate losses.

3 A third part of the City's study is to determine if there are natural ways to remove  
4 nitrates from the water between the discharge points of field tiles and the intakes for the  
5 Water Treatment Plant. In conjunction with the tile study, another study was started with  
6 Dr. Dave Kovacic of the Department of Landscape Architecture at the University of  
7 Illinois. Dr. Kovacic is studying the use of created wetlands nitrate removal and removal  
8 of other nutrients. Dr. Kovacic has done similar studies in other areas of Illinois and has  
9 documented 36% nitrogen removals from wetlands. He has also documented that buffer  
10 or filter strips alongside tributary streams can remove another 9% of the nitrogen from  
11 the water that flows across the strips (Kovacic, D.A., and Mark B. David, Lowell E.  
12 Gentry, and Karen M. Starks. 1999. Use of Constructed Wetlands to Reduce Nitrogen  
13 and Phosphorus Export From Agricultural Tile Drainage. Journal of Environmental  
14 Quality.).

1 City property along Money Creek adjoins the private land containing the  
 2 experimental tile fields. Experimental wetlands were constructed on the City property in  
 3 the fall of 1997. Tile flow from the experimental fields and surface flow from the fields is  
 4 directed into the wetlands through control structures equipped with flow monitors and  
 5 samplers. By knowing the exact quantity and quality of the water coming into the  
 6 wetlands as well as the quantity and quality of water leaving the wetlands, the  
 7 effectiveness of the wetland in removing nitrates can be determined. By knowing the  
 8 exact area of agricultural land draining into the experimental wetlands, size requirements



9 for additional wetlands can be determined. The wetlands were shown to be effective in  
 10 removing both nitrogen and phosphorus from the inflowing drainage.

11 Kovacic, et.al.,2006 (Kovacic, David A., Richard M. Twait, Michael P. Wallace,  
 12 and Juliane M. Bowling. 2006. Use of created wetlands to improve water quality in the  
 13 Midwest – Lake Bloomington case study. Ecological Engineering 28 (2006) 258-270)  
 14 determined that nitrogen was reduced by 36% in the wetlands, and 53% of the total  
 15 phosphorus entering the wetlands was retained. Much of the P retention was due to  
 16 sedimentation within the wetlands.

17

18 Agricultural Implementation:

1        Agricultural implementation plans are those most commonly practiced in proactive  
2        Midwestern agricultural areas. These practices are:

- 3
- 4        • Nutrient Management - Managing the amount, source, placement, form, and  
5        timing of the application of plant nutrients and soil amendments
- 6        • No-till and strip till - Managing the amount, orientation and distribution of crop  
7        and other plant residue on the soil surface year round while limiting soil  
8        disturbing activities to only those necessary to place nutrients, condition residue  
9        and plant crops.
- 10       • Riparian Forest Buffer - An area of predominantly trees and/or shrubs located  
11       adjacent to and upgradient from watercourses or water bodies
- 12       • Contour Buffers - Narrow strips of permanent, herbaceous vegetative cover  
13       established across the slope and alternated down the slope with parallel, wider  
14       cropped strips
- 15       • Field Border - A strip of permanent vegetation established at the edge or around  
16       the perimeter of a field.
- 17       • Field Windbreaks - Linear plantings of single or multiple rows of trees or shrubs  
18       or sets of linear plantings
- 19       • Wetlands - The rehabilitation of a degraded wetland or the reestablishment of a  
20       wetland so that soils, hydrology, vegetative community, and habitat are a close  
21       approximation of the original natural condition that existed prior to modification to  
22       the extent practicable.
- 23       • Developing Incentives – New and innovative practices that may be forthcoming  
24       to address current and future conservation needs.
- 25       • Grade Stabilization Structure - A structure used to control the grade and head  
26       cutting in natural or artificial channels.
- 27       • Grassed Waterway - A natural or constructed channel that is shaped or graded to  
28       required dimensions and established with suitable vegetation
- 29       • Conservation Cover - Establishing and maintaining permanent vegetative cover  
30       to protect soil and water resources.
- 31       • Prescribed Grazing - The controlled harvest of vegetation with grazing or  
32       browsing animals, managed with the intent to achieve a specified objective
- 33       • Drainage Water Management - The process of managing the water table  
34       elevation and the timing of water discharges from surface and subsurface  
35       agricultural drainage systems.

1 Conservation programs available to producers include the Federal programs  
2 such as Conservation Reserve Program (CRP), ), Environmental Quality Incentives  
3 Program (EQIP), Wildlife Habitat Incentive Program (WHIP), and the Wetlands  
4 Reserve Program (WRP). Federal and state partnerships such as the Conservation  
5 Reserve Enhancement Program (CREP) and state and locally administered  
6 programs such as the Stream bank Stabilization and Restoration Program (SSRP)  
7 and Conservation Project Practices (CPP)

8

## 9 Urban Implementation:

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### 10 Monitoring System

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

14 The primary purpose of the Urban Monitoring program is to measure  
15 contributions in runoff quantity and quality emanating from the urban development sites  
16 within the Money Creek watershed. Storm water runoff from urban and urbanizing areas  
17 is recognized as a cause of water pollution. Seven locations along Money Creek and its  
18 tributaries would monitor the effects of urban and suburban effects on the watershed.

### 19 Education and public awareness

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20 This control measure will target homeowners, restaurateurs, industry and  
21 the general public. An informed and knowledgeable community is crucial to the  
22 success of storm water management. As the public becomes aware of the personal  
23 responsibilities expected of them and others in the community, including the individual  
24 actions they can take to protect or improve the quality of area waters, a greater  
25 compliance with the storm water program will result. The

26 plan has two major initiatives: the formation of partnerships and the use of  
27 educational materials.

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

1 recycling and opportunities for enhancing greenways. The educational materials will  
2 include, but will not be limited to, the following:

3

4 Brochures

- 5 ● Alternative information sources (websites, bumper stickers, posters etc.)
- 6 ● A library of educational materials
- 7 ● Summer camp/club programs
- 8 ● Portable Storm Water Informational Display/Exhibit

9 The public education program will use a variety of strategies in which to reach a  
10 diverse audience. Mass media campaigns will use a mix of media to generate a  
11 watershed message to our audience. Our local strategies will use television and radio  
12 ads, including multilingual posters.

13 The school education program will target school age children. The programs will  
14 teach students the water cycle, the watershed, the benefits of composting and storm  
15 water runoff. In addition, Project WET training classes will be held by Heartland  
16 Community College for educators in district 540.

17 The education effort would target homeowners about proper septic system  
18 maintenance, proper disposal of used motor oil, chemicals pesticides and household  
19 products. As noted by the IEPA, septic systems are a potential source of non-point  
20 source phosphorus loading. A long range solution to failing septic systems is  
21 connections to a municipal sanitary sewer system. Installation of a sanitary sewer will  
22 reduce existing nutrient sources by replacing failing septic systems and will allow  
23 development without further contribution of phosphorus loads to Lake Bloomington.  
24 Costs for the installation are generally paid over a period of several years (average of 20  
25 years) instead of forcing homeowners to shoulder the entire cost of installing a new  
26 septic system. In addition, costs are sometimes shared between the lake community and  
27 the utility responsible for treating the wastewater generated from replacing the septic  
28 tanks. The planning process is involved and requires participation from townships, cities,  
29 counties, lake associations, and citizens.

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

34

35

## 1 Public Participation/Involvement

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

4 Community cleanup projects for local streams, riparian corridors, trails, highways,  
5 streets, open space and parks will be targeted.

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

9 Both Bloomington and Normal have established storm water phone hotlines to  
10 aid enforcement authorities in the identification of polluters.

11 "Adopt a Storm Drain" program, will offer individuals and groups an opportunity to  
12 monitor what is entering through our waterways.

13 Storm water inlet stenciling programs in both Bloomington and Normal have been  
14 initiated to help raise community awareness.

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

18 Rural communities and rural subdivisions in the watershed will be included in  
19 educational programs and implementation planning. Rural communities will be  
20 encouraged to adopt sediment, erosion control and stream bank buffer ordinances like  
21 those of the nearby urban areas and the county at large.

## 22 Illicit Discharge Detection/Elimination

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

27 The local Geographic Information System (GIS) will be used to map the location  
28 of all storm sewer outfalls and all the waters that receive storm water discharges. The  
29 GIS will also allow the input of citizen complaints and dry weather screening and  
30 monitoring data.

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## 1 Construction Site Runoff Control

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2  
3 It is recognized that construction sites can deposit a significant amount of silts  
4 and sediments in a short period of time. The City of Bloomington has adopted and the  
5 Town of Normal will adopt an Erosion and Sediment Control (ESC) Ordinance to reduce  
6 construction pollutants in its storm water runoff. (Appendix IV) The ordinance will  
7 require that land disturbance of 5,000 square feet or more will be regulated. It requires  
8 developers, builders or owners to submit a plan that contains measures to reduce soil  
9 erosion and practices to control sediments. Additionally, ESC requires the submittal of  
10 construction plans prior to ground being broken. Once a plan is reviewed and approved,  
11 staff will endeavor to ensure that the ESC plan is followed. The ordinance then requires  
12 the developer, builders or owners to install and maintain those specified measures and  
13 practices agreed to in the plan. Sites may be inspected for compliance and if found  
14 lacking, an inspector may issue a permit violation, stop work order, fine or other measure  
15 to ensure compliance.

16 McLean County is considering a separate erosion control ordinance apart from  
17 the Manual Practice of the Subdivision Ordinance, but does not have one at this time.  
18 (Manual Practice Ordinance can be found in Appendix VI)

19

## 20 Post Construction Runoff Control

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21  
22 Both the City of Bloomington and the Town of Normal propose to address the  
23 post-construction runoff with structural and non-structural management practices. The  
24 controls seek to reduce the amount of impervious cover, by increasing natural land set  
25 aside for conservation and to use pervious areas for more effective storm water  
26 management. The Town of Normal has looked at a variety of ways to increase green  
27 spaces. For example, Normal has new landscaping requirements for parking lots.

28 Jointly the County, the City and the Town are developing a Stream Buffer  
29 Ordinance for developing areas, which includes, but is not limited to, the 100-year flood  
30 plain. (Appendix IV)

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

35

## 1 Pollution Prevention/Good Housekeeping

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- Pollution prevention/good housekeeping measures 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 the amount of oil, grease, and fluid leaks.

6

7

- Street sweeping has become more frequent in high traffic areas.

8

- A program for the inspection of storm drains has been developed.

9

- An Integrated Pest Management program (IPM) will be developed and offered.

10

The program will train municipal employees on current best management

11

practices for pest management. Lawn pesticide application classes will be

12

offered to municipal employees and city residents.

## 13 Septic System Improvements

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14

Septic tanks generally remove 20% to 30% of the influent phosphorus

15

(Lombardo, 2006). Crites and Tchobanoglous (1998) reported average septic tank

16

effluent concentrations of 68 mg/l total Nitrogen (as N) and 16 mg/l total phosphorus (as

17

P). The amount of nutrients delivered to a lake or stream from an onsite system depends

18

greatly on the type and condition of the septic tank effluent dispersal system.

19

Leach (or seepage) fields disperse the septic tank effluent through the soil

20

column, ultimately reaching the water table or seep into a lake or stream. Phosphorus is

21

removed through absorption to the soil or through the formation of mineral precipitates.

22

Ideally, all of the phosphorus is removed in the seepage field, but many factors influence

23

the system's effectiveness.

24

The amount of water that can flow through a particular soil type over time is

25

referred to as the soil's hydraulic conductivity. The lower the hydraulic conductivity, the

26

larger the seepage field area is required. Most of the soils surrounding Lake

27

Bloomington have very low hydraulic conductivity, necessitating seepage field sizes that

28

cannot be accommodated within the small lots leased by the City.

29

Hydraulic conductivity can decrease over time through compaction of the soil by

30

foot and vehicle traffic, through clogging of the pore spaces in the soil by precipitates or

31

from solids carryover from a malfunctioning or overloaded septic tank, and other factors.

32

When the loading rate exceeds the hydraulic conductivity, the soil becomes saturated

33

and the septic tank effluent can flow upwards to the soil surface or flow horizontally

34

along preferential flow paths. The horizontal flow can discharge into a stream or lake if

1 the failing system is close to the waterbody. The Onsite Wastewater Treatment Systems  
2 Manual (USEPA, 2002) discusses soil properties and design considerations for seepage  
3 systems.

4 Sand filters remove 10-20% total phosphorus and 18-33% total nitrogen from the  
5 septic tank effluent. Health Department regulations require chlorination of sand filter  
6 effluents, which helps to remove microbial contamination and can remove some  
7 ammonia nitrogen through the process of breakpoint chlorination. The City of  
8 Bloomington requires a 50 foot gravel effluent receiving trench prior to discharge. The  
9 effect of the trenches on reducing nutrient loading is not known.

### 10 **Estimating Phosphorus and Nitrogen Loading by Onsite Systems**

11 Several assumptions are necessary in order to estimate the nutrient loads from  
12 the onsite waste systems in the Lake Bloomington watershed. First, the systems closest  
13 to the lake deliver their entire nutrient load to the lake. Second, 25% of the seepage field  
14 systems deliver partially treated septic tank effluent to the lake (Lindsay Knitt,  
15 Farnsworth Group, personal communication, 2007). This relatively high percentage was  
16 chosen due to the low hydraulic conductivity of the soils, the close proximity of many of  
17 the leach fields to the lake, and the observation of nutrient rich effluent at the base of  
18 many of the shoreline protection systems during low water periods.

19 Water usage values and house occupancy was estimated using USEPA system  
20 design numbers (70 gallons per day per person equivalent and 3.5 person equivalents  
21 per home). Average septic tank effluent concentrations of 68 mg/l total nitrogen and 16  
22 mg/l total phosphorus, along with the water usage figures listed above, were used to  
23 estimate the nutrient loading per household prior to treatment by the dispersal systems.  
24 Total nitrogen loading was estimated at 50.6 pounds per year and total phosphorus at  
25 11.9 pounds per year per household before secondary treatment.

26 The 402 homes closest to the lake, 249 with seepage fields and 153 with sand  
27 filters, were included in the loading analysis. The residences with sand filters were  
28 estimated to contribute 5,200-6,400 lb/year total N and 1,500-1,700 lb/year total P.

29 Additional assumptions were made for the loading estimates for failed or short  
30 circuited seepage fields. First, no removal of nitrogen occurs in a failed seepage system  
31 and phosphorus removal can range from zero to eighty percent. Using those  
32 assumptions, seepage field loadings are estimated at 3,150 lb/yr total N and 150-740  
33 lb/yr total P.

1 Combined, nutrient loading to Lake Bloomington from onsite waste systems is  
2 estimated at 8,400-9,500 lb/yr total N and 1,600-2,400 lb/yr total P. These loadings  
3 represent around 1% of the required N reduction and 23.4-35.5% of the required total P  
4 loading reductions.

5 The loading estimates can be refined by using actual water consumption data  
6 and by sampling a representative number of onsite waste system effluents over time.  
7 Loadings from failed or short circuited seepage systems will be more difficult to detect  
8 and measure.

9 This analysis utilizes numbers that likely result in an overestimate of  
10 the actual contribution from septic systems at Lake Bloomington. For example, we  
11 suspect that both the water usage and house occupancy (number of person equivalents  
12 per dwelling) values are less than the USEPA figures used. For example, neither the  
13 number of homes used as weekend and/or vacation and/or summer-only residence nor  
14 the number of older, childless residents are factored into the numbers used. These  
15 factors are expected to lower the final loading contribution estimate. A future site-  
16 specific assessment incorporating these factors is needed to provide a more precise  
17 site-specific estimate.

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## Cost Summary

### Riparian Erosion Control Costs

#### Priority Shoreline Protection Areas:

Based on the erosion classes assigned during the shoreline erosion inventory the highest priority sites would be those in Erosion Class 6. These sites represent less than 12% of the unprotected shoreline, but produce nearly 60% of the sediment generated annually by shoreline erosion on Lake Bloomington. The Class 6 sites also represent by far the most cost effective treatment areas with the cost of a ton of soil saved at \$151.37 for treatment or \$3.03 per ton over a 50 year life of the shoreline protection. The next highest priority would be Erosion Class 5 and so on until all erosion classes are treated. There is limited benefit to treating the 50% of Lake Bloomington shoreline in Class 1 that produces only 3% of the annual sediment contribution from shoreline erosion. The table below shows the cost estimate per foot of bank treated for each Erosion Class and also the cost per ton of soil saved by Erosion Class.

#### Summary of Treatment Costs by Erosion Class

ESTIMATED COST OF ALTERNATIVE #6 FOR EACH EROSION CLASS							
Erosion Class	Total Length (ft.)	Total Tons Soil Erosion Annually	% Total Shoreline Erosion	Total Cost	Cost per Foot	Cost per Ton Soil	Cost per ton soil over 50 yr. life
1	27,962	114.5	3.03%	\$316,364.00	\$11.31	\$2,763.00	\$55.26
2	10,790	266.5	7.05%	\$287,880.00	\$26.68	\$1,080.23	\$21.60
3	3,256	235.6	6.23%	\$148,616.00	\$45.64	\$630.80	\$12.62
4	4,356	504.3	13.34%	\$203,298.00	\$46.67	\$403.13	\$8.06
5	2,670	413.9	10.94%	\$134,404.00	\$50.34	\$324.73	\$6.49
6	6,546	2246.9	59.42%	\$340,110.00	\$51.96	\$151.37	\$3.03
<b>Totals</b>	<b>55,580</b>	<b>3781.7</b>	<b>100.00%</b>	<b>\$1,430,672.00</b>			

Table 16 Summary of Estimated Cost by Erosion Class

The Erosion Classes as defined reflect the severity of the erosion, but severity does not necessarily correlate well with treatment cost. This is mainly due to the fact that the lateral recession rate is a large factor in determining the Erosion Class, but the bank height and water depth at the shore are much

1 larger factors in determining treatment cost. In Lake Bloomington the water  
2 depth near the shore does not vary a great deal.

3           The 2005 Study predicts approximately 3800 tons of sediment are generated  
4 annually in Lake Bloomington shoreline erosion. Nearly 60% of the sediment generated  
5 is coming from less than 12% (1.2 miles) of the unprotected shoreline classified as Class  
6 6 Erosion. While study methods differ, the prediction of 3800 tons annual is very close to  
7 the 3950 tons predicted by Roger Windhorn, NRCS Resource Soil Scientist, in 1998.

8           Thus the study methods and assumptions made in the 2005 study seem to  
9 produce results consistent with earlier methods, yet provide a more detailed analysis of  
10 sites which will enable the City of Bloomington to direct resources where the most  
11 benefit will be achieved. By treating the Class 6 Erosion sites this study shows that  
12 nearly 60% of the sediment can be stopped by treating only 12% of the shoreline at an  
13 estimated cost of \$340,000. If taken over the expected 50 year life of the shoreline  
14 protection the cost per ton of soil is only \$3.03, while other less severely eroding sites  
15 have per ton cost 2 to 18 times higher. Erosion Classes 4 and 5, the next classes in  
16 order of severity can be treated for \$338,000 to stop an additional 24% of the sediment  
17 produced by shoreline erosion; however the cost per ton saved will increase by about  
18 250% to \$7.60 per ton over the 50 year lifespan.

19           The recommended alternative is estimated cost of approx. \$135,000 to treat the  
20 2900 ft. of bank along the park area and roadway immediately East of the spillway. The  
21 average cost per foot is \$46.55.

22           The cost of Armor Stone Breakwaters with Transitional Wetlands is  
23 approximately \$60.00 per linear foot (IDNR, Outdoor Highlights, 7/07). The cost is  
24 comparable but higher than the traditional shoreline protection method recommended in  
25 the 2005 Study. In addition, the Armor Stone Breakwaters alternative can be installed  
26 at normal water levels, eliminating the need for significant draw-downs which can  
27 negatively impact recreational activity and reduce the City's on-hand water supply.

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## 1 Streambank Stabilization Cost Estimates

<b>LAKE BLOOMINGTON STREAM TREATMENT</b>									
<b>Preliminary Estimates of Quantities and Cost for Treatment</b>									
<b>Stream Segment</b>	<b>Length (feet)</b>	<b>Alt. No.</b>	<b>STP (feet)</b>	<b>Quantity Stone (tons)</b>	<b>Estimated Cost</b>	<b>Riffles (no.)</b>	<b>Quantity Stone (tons)</b>	<b>Estimated Cost</b>	<b>Total Cost Segment</b>
Money	129,879	1	71975	53980	\$1,619,400.00	0	0	\$0.00	\$1,619,400.00
Trib 1B	1320	1	260	130	\$3,900.00	6	300	\$9,000.00	\$12,900.00
Trib 1C	2640	1	650	325	\$9,750.00	0	0	\$0.00	\$9,750.00
Trib. 1D	2376	1	520	260	\$7,800.00	5	500	\$15,000.00	\$22,800.00
Trib. 2A	2640	1	730	365	\$10,950.00	8	560	\$16,800.00	\$27,750.00
Trib. 2B	1848	1	875	438	\$13,140.00	6	500	\$15,000.00	\$28,140.00
Trib. 4	2904	1	290	145	\$4,350.00	8	560	\$16,800.00	\$21,150.00
Trib. 5A	15576	1	1055	530	\$15,900.00	0	0	\$0.00	\$15,900.00
Trib. 6A	4480	1	0	0	\$0.00	0	0	\$0.00	\$0.00
Trib. 6B	4224	1	410	205	\$6,150.00	0	0	\$0.00	\$6,150.00
Trib. 9A	10296	1	0	0	\$0.00	0	0	\$0.00	\$0.00
Big Slough East	25080	1	4535	2725	\$81,750.00	14	1400	\$42,000.00	\$123,750.00
Big Slough 2	7392	1	685	411	\$12,330.00	0	0	\$0.00	\$12,330.00
Big Slough West	6705	1	1465	880	\$26,400.00	0	0	\$0.00	\$26,400.00
<b>Totals</b>	<b>217,360</b>		<b>83450</b>	<b>60394</b>	<b>\$1,811,820.00</b>	<b>47</b>	<b>3820</b>	<b>\$114,600.00</b>	<b>\$1,926,420.00</b>
Estimates based on Stone Cost of \$30.00 per ton delivered and installed									

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## 9 Agricultural BMP Costs

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11 The cost summary for agricultural related practices would be just under \$1.3  
 12 million over a fifteen year period from all funding sources. Much of the funding is  
 13 government supported with landowner costs ranging from a stipend payment to a 50-  
 14 90% cost share with the land owner, depending on the program.

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<b>Program</b>	<b>Current average per year</b>	<b>Cost</b>	<b>Goal</b>	<b>Total Cost</b>
Nutrient Management	10,000 acres	\$12 per acre	15,000 acres per year	\$540,000
No-Till and Strip-Till on cropland		\$15 per acre,	6,000 acres	\$90,000
Filter Strips	213 acres	\$50 per acre, (10 Year) \$75 per acre, (15 years)	150 acres 50 acres	\$7,500 \$3,750
Riparian Forest Buffers	6 acres	\$200 per acre	5 acres	\$1000
Contour Buffers		\$50 per acre	10 acres	\$500
Field Border	31.3 acres	\$60 per acre	30 acres	\$1,800
Windbreaks	9.7 acres	\$50 per acre	10 acres	\$500
Wetlands	12 acres	\$3000 per acre	20 acres	\$60,000 (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	10 units 30 units	\$180,000 (75/25 cost share)
Grassed Waterways	39.8 acres	\$2000 per acre	1100 acres	\$220,000 (75/25 cost share)
Conservation Cover	68 acres	\$200 per acre (10 year)	100 acres	\$200,000
Prescribed Grazing	60 acres	\$25 per acre (3 years)	100 acres	\$7,500
Drainage/ Water Management		\$30 per acre (3 years)	100 acres	9,000

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## 1 *Urban Cost*

### 2 *Urban Program Costs*

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3 On April 17, 2006 the Normal Town Council adopted an ordinance establishing a  
4 storm water utility fee payable by all property owners within the Town of Normal to  
5 generate funds to meet the regulatory requirements, goals and objectives of the storm  
6 water management plan. It is estimated that nearly \$1.7 million in new annual revenue  
7 will be generated to offset cost to fully implement the storm water management plan.

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

11

12 Initial one time costs:

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



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

<b>INITIAL COSTS</b>	<b>ANNUAL COSTS</b>	<b>OVER 5 YEARS</b>
Stream Flow Monitors- 7 @ \$6,000 = \$42,000	Supplies: \$14,000	Initial Costs:  \$67,000
Samplers-7 = \$25,000	Research Assistant: \$12,000	Annual Costs for Five years- \$310,000
	Usage and maintenance= \$36,000	
Total: \$67,000	Total: \$62,000	Total: \$377,000

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4

Other urban alternatives include building a sewage treatment lagoon cluster system for the Lake Bloomington community and developed areas north of the Town of Normal incorporated areas. This alternative would cost over \$9,000,000. A second alternative would be to connect the Lake Bloomington and suburban developments to the existing Bloomington Normal Water Reclamation District. This alternative would be over \$10,000,000. The specific details of these two alternatives can be found in the Farnsworth plan in Appendix V.

11

<b>Total costs for all suggested implementations</b>	
Riparian	\$ 5,410,350
Agricultural	\$ 635,950
Urban (without alternative sewer systems)	\$ 377,000
<b>Total</b>	<b>\$ 6,423,300</b>

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## 1 Selection of Implementation Strategies/Alternatives

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2 The majority of the following implementation strategies will represent start dates for  
 3 ongoing programs. Detailed strategies for implementation are found in the  
 4 Implementation section of this plan.

5  
 6 The timeline for implementation (**pending funding**) is as follows:

### 7 Riparian Area :

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#### 8 Shoreline/streambank stabilization

- 9 • Development of updated streambank stabilization survey- 2010
- 10 • Development of headcut area survey- 2010
- 11 • Design of headcut stabilization- ongoing
- 12 • Lakeshore stabilization-
- 13 • Plans for lakeshore stabilization-2009
- 14 • Construction begins phase 1 (class 6)- 2010
- 15 • Streambank stabilization- 2011
- 16 • Headcut construction completed – 2011
- 17 • Inspection of construction on Tributary 5A- south edge of Towanda
- 18 drainage area- 2008

#### 19 Destratification

- 20 ● Presently ongoing.

#### 21 Wetlands-

- 22 • Identify potential partnerships- 2008
- 23 • Survey and inventory- 2008
- 24 • Site selection and planning – 2009
- 25 • Construction begins- 2011

#### 26 Lake Parks BMPs

- 27 • Identify rain garden potential sites-2008
- 28 • Rain gardens construction -2009-11
- 29 • Start removal of invasives- 2008
- 30 • Start native plantings- 2008

### 31 Urban Area:

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#### 32 Public Education/Outreach

- 33 • Educational programs

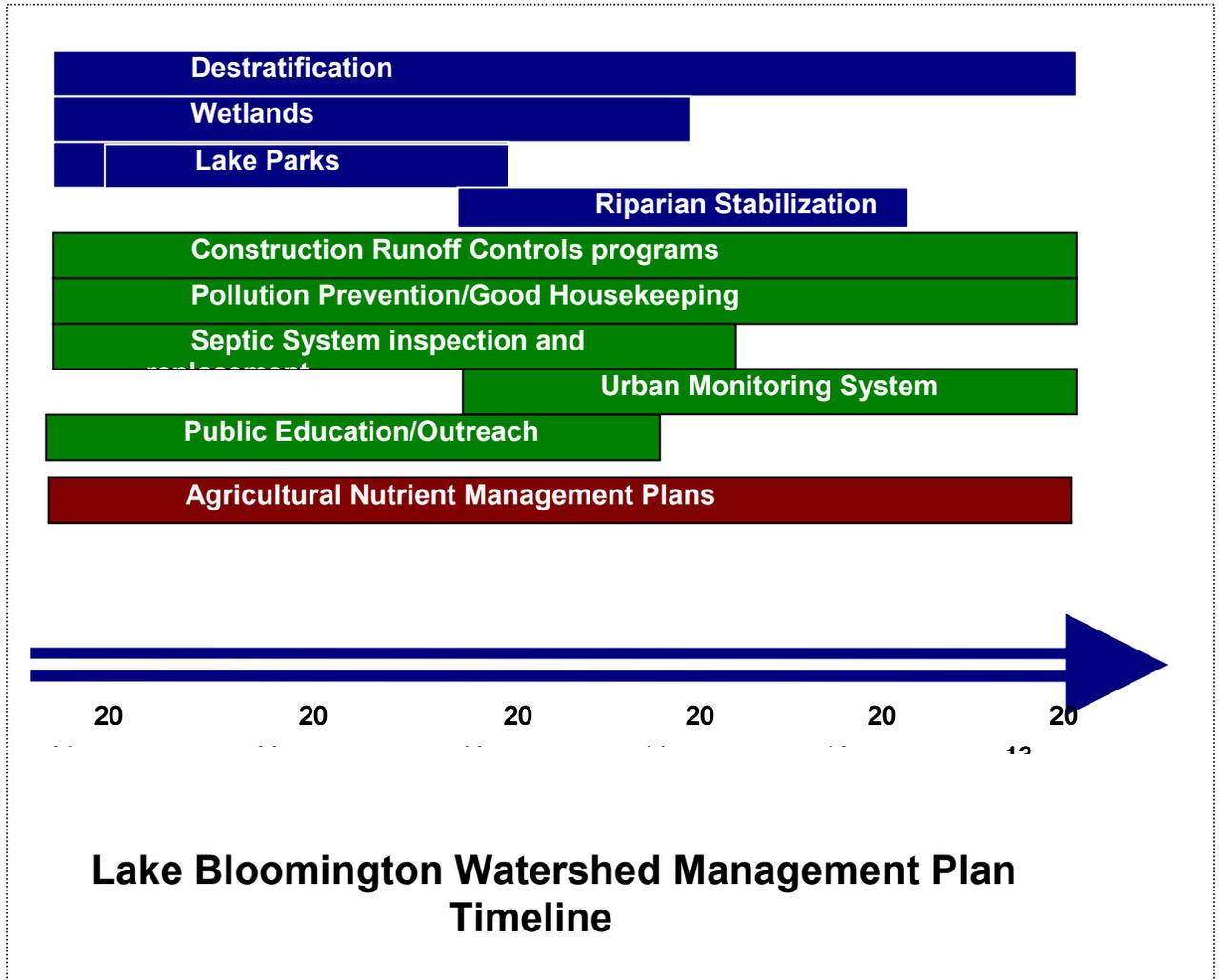
- 1                   ○ Lake Bloomington specific programs - 2008
- 2                   ○ General public programs-2008
- 3           Public Participation/Involvement
- 4           • Storm water hotline (Normal) - 2007
- 5           • Expansion of storm water inlet stenciling program - 2008
- 6           • Formation:
  - 7                   ○ Watershed(s) implementation committee - 2008
- 8           Illicit Discharge Detection/Elimination
- 9           • Continue GIS mapping of storm sewer outfalls- (begun 2007)
- 10          Construction Site Runoff Control
- 11          • Erosion & Sediment Control Ordinance (ESC) - 2008
- 12          • (ESC) permit & inspection program (Normal) -2008
- 13          • Explore possibility of County-wide ESC permit & inspection program-
- 14                  2008
- 15          Post Construction Runoff Control
- 16          • Stream Buffer Ordinance - 2008
- 17          Pollution Prevention/Good Housekeeping
- 18          • Continue enhanced street sweeping program
- 19          • Continue storm drain inspection program
- 20          • Begin to install stream gauging/sampling stations- 2008
- 21          • Continue Integrated Pest Management certification for public employees.
- 22          Construction of sewer linkage from Lake Bloomington to BNWRD
- 23          • Alternative long range plan
- 24          Septic system inspection and replacement -
- 25          • Inspection and replacement for lease transfers- 2008
- 26          • Inspection for new construction- 2008
- 27          • Investigation of other BMPs used at other lake communities -2008
- 28

## 29 Agricultural Area:

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- 30           Continue nutrient management- 2008
- 31           • No-Till and Strip-till on cropland-
- 32           • Filter Strips-
- 33           • Riparian forest buffers-
- 34           • Contour buffers-

- 1 • Field borders-
- 2 • Windbreaks-
- 3 • Developing landowner incentives-
- 4 • Grade stabilization program-
- 5 • Grassed waterways



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## *Measuring Progress/Success*

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

5

6 A secondary issue stemming from urban runoff is that there is very little  
7 monitoring of this runoff. An increased monitoring system is needed to pinpoint  
8 problems in the urban areas so further plans can be developed.

8

9 The primary purpose of an urban monitoring program is to measure contributions  
10 in runoff quantity and quality emanating from the urban development sites within the  
11 watershed. Storm water runoff from urban and urbanizing areas is recognized as a  
12 cause of water pollution.

12

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

16

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

23

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

25

26 A major component to the overall success of this plan is the appointing of an  
27 intergovernmental commission to oversee all watershed issues that affect McLean  
28 County. This committee will include representatives of all municipalities and community  
29 members to oversee the coordination, implementation, and updating of this and any  
30 other watershed plans as required.

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## Appendix I- Committee members

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### **Lake Bloomington Planning Committee**

Committee Chair:

Brian Brakebill, City of Bloomington

Co-Chair:

Bill Wasson, McLean County Parks and Rec

Secretary:

Judy Wilson, McLean County SWCD

Technical Writer:

Janet Beach Davis, Heartland Community College

Members:

Jill Mayes, City of Bloomington/Lake Bloomington

Rick Twait, City of Bloomington/Lake Bloomington

Kyle Haynes, City of Bloomington/Lake Bloomington

Jim Nelson, Association of Illinois Soil & Water Conservation Districts

Mike Hall, Town of Normal

Jennifer Sicks, McLean County Regional Planning

Rick Nolan, McLean County Regional Planning

Michelle Covi, Ecology Action Center

Caroline Wade, Illinois State University

William Rau, Illinois State University

Angelo Capparella, John Wesley Powell Audubon Society

Mary Jo Adams, Mackinaw River Partnership

Ken Browning, Lake Bloomington Homeowner's Association

Arnie Sepke, Lake Bloomington Homeowner's Association

Jeff Tracy, McLean County Highway Department

Mike Callahan, B/N Water Reclamation District

Randy Stein, B/N Water Reclamation District

Mark Beach, B/N Water Reclamation District

Bob Carter, B/N Water Reclamation District

John Hendershott, McLean County Health Department

Jim Rutherford, McLean County Soil & Water Conservation District

Kent Bohnhoff, Natural Resource Conservation Service

Jody Rendziak, Natural Resource Conservation Service

Randy McCormack, Natural Resource Conservation Service

Mike Garthaus, Illinois Department of Natural Resources

Maria Lemke, The Nature Conservancy

Tom Guth, Landowner/operator

Scott Clement, Landowner/operator

Greg Kelley, Landowner/operator

Terry Giannoni, Money Creek Township

**Lake Bloomington Technical Advisory Committee**

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Chairman:

Rick Twait, City of Bloomington/Lake Bloomington

Co-Chair:

Mary Jo Adams, Mackinaw River Partnership

Members:

Brian Brakebill, City of Bloomington

Bill Wasson, McLean County Parks and Rec

Jill Mayes, City of Bloomington/Lake Bloomington

Kyle Haynes, City of Bloomington/Lake Bloomington

Mike Hall, Town of Normal

Angelo Capparella, John Wesley Powell Audubon Society

Janet Beach Davis, Heartland Community College

Rick Nolan, McLean County Regional Planning

Phil Dick, McLean County Building and Zoning

Darryl Coates, Illinois Department of Natural Resources

Mike Garthaus, Illinois Department of Natural Resources

Jim Nelson, Association of Illinois Soil & Water Conservation District

Linda Olson, McLean County Farm Bureau

Brian Lambert, McLean County U of I Extension

Joe Bybee, Illinois Department of Agriculture, Bureau of Land and Water

Jody Rendziak, Natural Resources Conservation Service

Kent Sims, Natural Resources Conservation Service

Keith Eichorst, Natural Resources Conservation Service

Kent Bohnhoff, Natural Resources Conservation Service

Randy McCormack, Natural Resources Conservation Service

Jim Rutherford, McLean County Soil & Water Conservation District

Judy Wilson, McLean County Soil & Water Conservation District

Maria Lemke, The Nature Conservancy

Bob Carter, B/N Water Reclamation District

Caroline Wade, Illinois State University

Bob Fish, Myers, Inc.

Ken Browning, Lake Bloomington Homeowner's Association

Arnie Sepke, Lake Bloomington Homeowner's Association

Larry Troyer, Landowner/operator

Terry Giannoni, Money Creek Township

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## Appendix III- RAP-M

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## Appendix IV- Stormwater Ordinance

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2 **Appendix V- Lake Bloomington Sewage Management**  
3 **Report**

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## Appendix VII- Public Comments

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