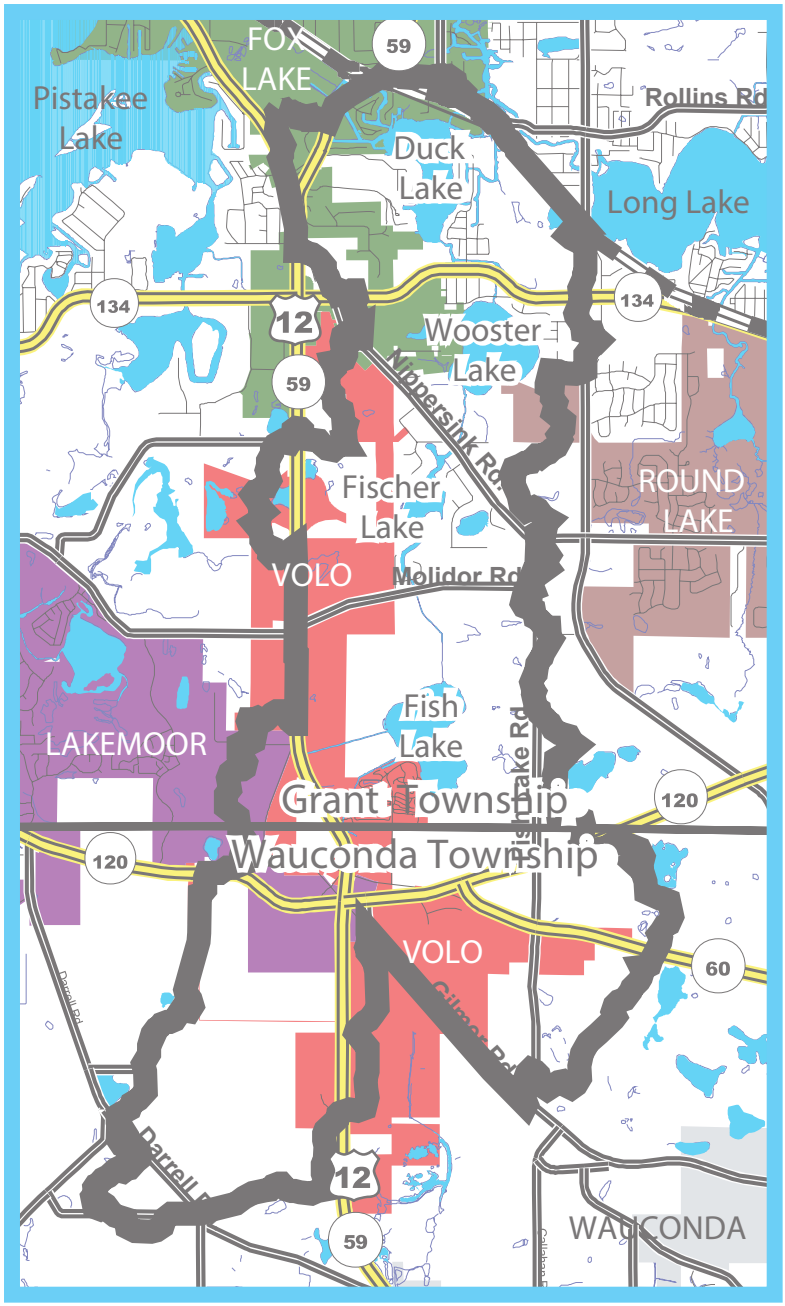
Fish Lake Drain Watershed Management Plan

"Our mission is
to develop a watershed management plan
that balances all of the uses and demands
on the watershed's natural resources
in a manner that preserves and enhances
a healthy environment, improves water
quality, and reduces flood damages
through education and involvement at the
individual level, community level,
municipal level, and regional level."

~ Fish Lake Drain Watershed
Planning Committee



September 2004
Updated February 2008

prepared for:

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION

prepared by:

CONSERVATION DESIGN FORUM

I Introduction

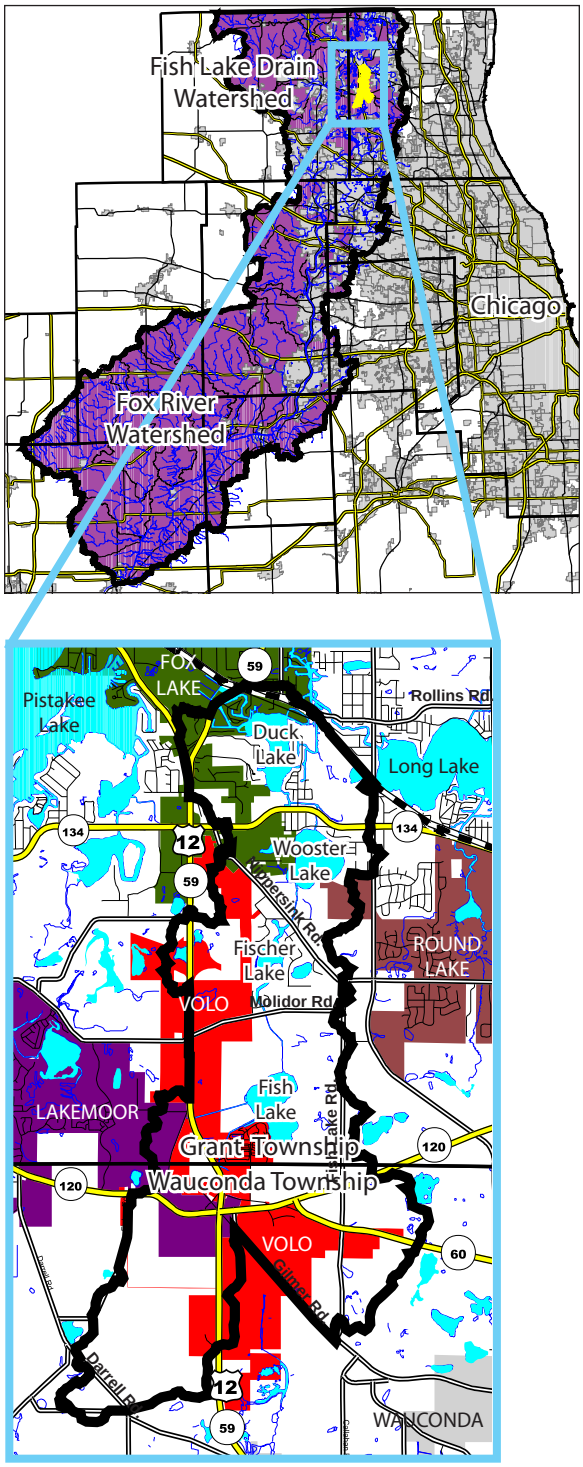
The Fish Lake Drain Watershed is located near the west border of Lake County, in northeast Illinois, and within the upper basin of the regional Fox River Watershed. The Fox River Watershed in Lake County was identified in the draft Lake County Flood Hazard Mitigation Plan (June 1999) as having the most flood problem sites of the four major basins in the county. The Fish Lake Drain subwatershed contains only six of the 180 sites identified in the Mitigation Plan and only two of the sites are located outside the mapped floodplain.

Although flooding problems exist in the Fish Lake Drain Watershed, they are generally concentrated in one area. Greater concern has been expressed for potential future flooding as the watershed urbanizes. The existing and future quality of the watershed's lakes, streams, and wetlands has also been identified as an issue. These concerns prompted preparation of this Watershed-Based Management Plan.

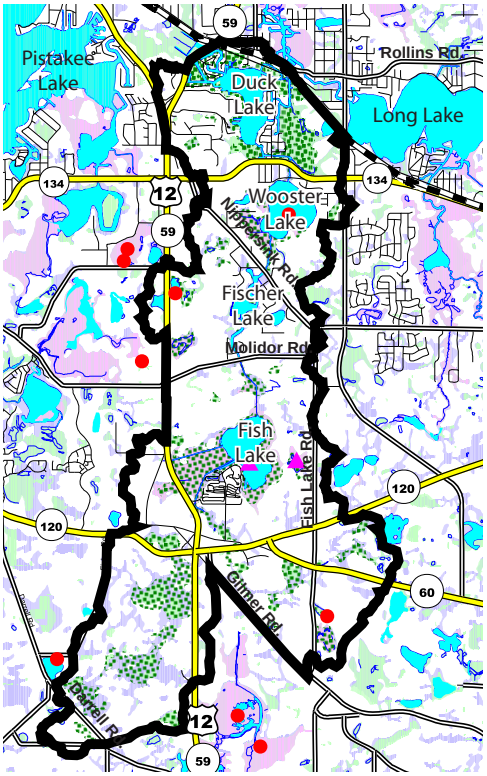
The Fish Lake Drain Watershed includes four major lakes, numerous large wetlands, several high quality Advanced Identification (ADID) wetlands, and a few threatened and endangered species recognized by the State of Illinois.

Based on projections by the Northeastern Illinois Planning Commission (NIPC), it is estimated that the population of the watershed could increase by 275% by the year 2020. The substantial increase in urbanization, implied by the projected population growth, has the potential to cause significant degradation of watershed resources. Based on urban impacts in other watersheds, future impacts to the Fish Lake Drain Watershed could include: increased flooding and streambank erosion; degradation of water quality, aquatic habitat, and floristic diversity; and loss, as well as fragmentation, of senstive open space.

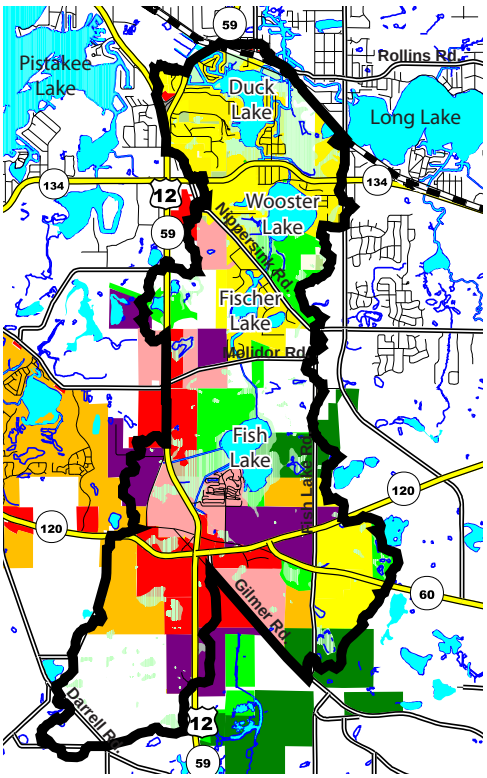
This Plan includes five chapters. This chapter provides an overview of watershed conditions, the planning process used to develop the Plan, and the concerns identified by watershed stakeholders. Subsequent chapters provide greater detail on watershed conditions and recommendations for future actions to address the identified concerns and problems.



Location Map



Natural Features Map



Future Land Use Map

A. About the Watershed

Location

The Fish Lake Drain Watershed is located along the west border of Lake County within the upper basin of the regional Fox River Watershed, and is approximately 8.7 square miles, or 5,530 acres, in size. Fish Lake Drain is a man-made channel connecting Fish Lake, Fischer Lake, Wooster Lake, and Duck Lake from south to north. The Drain joins Squaw Creek, and just downstream of Squaw Creek, discharges to Fox Lake in the Village of Fox Lake. However, the downstream watershed boundary for Fish Lake Drain has been defined to be the railroad culvert, south of Rollins Road, upstream of the confluence with Squaw Creek. Although there are tributaries to Fish Lake, the Drain essentially begins at Fish Lake.

Municipalities

The Fish Lake Drain Watershed is home to two townships and four municipalities. The municipalities from north to south include Fox Lake, Round Lake, Volo, and Lakemoor. The two townships are Grant and Wauconda. The Village of Fox Lake in the north, the Village of Volo in the middle and south portions, and unincorporated Lake County collectively occupy nearly 90% of the watershed area.

Through annexations, land use decisions, and development standards and controls, the municipalities and Lake County have the power to determine the future of the Fish Lake Drain Watershed. For this reason, watershed stakeholder meetings were conducted to seek consensus on watershed management goals and objectives and to initiate collaborative efforts to implement watershed management actions to achieve watershed goals.

Environmental Context

Fish Lake Drain, though altered by human activities, follows a natural drainageway characterized by hydric soils. The watershed contains a diverse and unique range of cultural and ecological resources with wetlands, threatened and endangered species, and other critical natural features. These natural features are intermixed with man-made drainage and rural, small town, and suburban development. The watershed includes several high quality wetlands, identified as part of the ADID wetlands study lead by NIPC, updated by Lake County, and funded by the U.S. EPA.
Due to the poorly defined drainage system, the Fish Lake Drain Watershed is naturally wet in many areas, with

nearly 19% of the watershed classified as either water or wetland. In particular, there are several topographic depressional areas in the watershed.

Wetlands consist of both riparian wetlands well connected to Fish Lake Drain and its lakes, and depressional wetlands scattered throughout the remainder of the watershed. Prior to European settlement, woodlands, savannas, prairies, marshes, forested bogs, wet prairies, and lakes were the primary land covers in the watershed. Around the turn of the last century, the towns of Fox Lake and Volo became incorporated. Consequently, many acres of land in the vicinity of these town centers were converted to cropland, residential, industrial, office, and commercial land uses, which created new types of pressures on the ecologic and hydrologic systems in the watershed.

Development Patterns

The first European settlement in Lake County dates to 1834, soon after the City of Chicago was established (Lake County Regional Framework Plan). By 1990, 45% of the County's 136,263 acres were developed. Over the past decades, Lake County has continued to experience growth. Lake County has an attractive mix of rural, agricultural, natural, and urban settings with easy access to railroads and highways that continues to draw residents from the Chicago metropolitan area. Based on population projections from NIPC*, it is estimated that population in the Fish Lake Drain Watershed area will increase 275% by the year 2020 (see table below). This increase to nearly four times the current population indicates significant land development pressure, which could result in negative impacts to the hydrologic and ecologic systems of the watershed and the natural resources that depend on those systems.

Fish Lake Drain Watershed Area Population Overview

1970 Population	1722
1980 Population	2001
1990 Population	2102
2000 Population*	2251
2020 Forecasted Population**	**8434**

*based on US Census 2000 Census blocks
**improved existing airport alternative

Development Impacts

Under natural conditions, most of the precipitation that falls on landscapes is used by plants, evaporates or transpires back into the air, or percolates deeper into the soil. Water that percolates into the soil becomes active groundwater that slowly drains to the streams, wetlands, and lakes of the watershed. During spring, stream flows often exceed their banks and expand out into floodplains. Floodplains function as a buffer to accommodate the greater flow rates, reduce erosive pressure, and support unique ecological niches.

As a watershed is developed, natural areas are first converted into agricultural fields; subsequently, these become lawns and impervious roofs, roads, and parking lots. Less and less rainwater percolates into the ground, which in turn creates additional surface runoff. Further, drainage is altered with the addition of agricultural tiles, excavation of channels, and installation of storm sewers and road side ditches. As a result, water temperatures are increased and pollutants that accumulate on these surfaces are washed off and quickly conveyed to lakes, streams, and wetlands. Streams, wetlands, and lakes that previously received a majority of their water from groundwater seepage, now receive it as surface drainage in large pulses, which results in more frequent flooding. If development has occurred within the floodplain itself, the excess water has no buffer zone to flood but instead inundates houses and infrastructure within the floodplain.

Typical stormwater management methods convey runoff through storm sewer systems and discharge the polluted stormwater into streams, lakes, and wetlands, and often results in their degradation. Although regulations that restrict detention release rates have reduced these impacts, stream banks continue to be eroded, habitats continue to be degraded, groundwater recharge continues to decrease, and the costs associated with flooding continue to increase.

The Lake County Stormwater Management Commission Watershed Development Ordinance has standards to prevent many of these negative development impacts.

Purpose of Watershed Planning

While most planning is done according to the corporate boundaries of municipalities and counties, watershed planning is based on hydrologic boundaries. The watershed boundary is the logical unit on which to plan for the purpose of addressing water quality, flooding, and aquatic ecosystems. Watershed planning has the added benefit of bringing numerous communities together to plan for the greater good and providing them with an opportunity to coordinate activities. These activities can address watershed issues as well as natural and cultural resources within the region of the watershed.

B. About the Project

Funding

The original project was initiated and funded by the Lake County Stormwater Management Commission (LCSMC). Funding for this 2008 revision was provided through Section 319 of the Clean Water Act by the Illinois Environmental Protection Agency (IEPA) and Chicago Metropolitan Agency for Planning (CMAP). Participating municipalities and interest groups included the Village of Fox Lake, Village of Volo, Village of Lakemoor, Grant Township, Waukonda Township, Lake County Health Department (LCHD), Lake County Forest Preserve District (LCFPD), the Grant Township Territory Association, and the Wooster Lake Association.

Table I-1 Stakeholder Committee Meetings Schedule

Subject	No.	Date	Topic	Presenter / Hosts	Appendix 1 Page No.
Kick-off Meeting	1	7/10/2002	Concerns and Issues	LCSMC/CDF	2
Education	2	8/7/2002	Lake studies in the Fish Lake Drain Watershed Area	LCHD	5
	3	9/4/2002	Ecology of Northern Fox Valley in Lake County	CDF	9
	4	10/2/2002	Sustainable Site Planning and Design	CDF	12
	5	11/6/2002	Flood Problem Worksheet Workshop	LCSMC	15
Plan Visions	6	12/4/2002	Mission Statement	LCSMC/CDF	16
Inventory and Analysis	7	1/8/2003	Inventory and Analysis Results	LCSMC/CDF	20
Goals and Objectives	8	2/5/2003	Goals & Objectives	LCSMC/CDF	23
	9	4/2/2003	Goals & Objectives	LCSMC/CDF	25
Action Plan	10	5/7/2003	Draft Action Plan	LCSMC/CDF	28
	11	6/4/2003	Draft Action Plan	LCSMC/CDF	30
	12	0702/03	Funding Resources	NRCS/LCSW/ CD/LCSMC	33
Draft Final Plan Presentation	13	8/13/2003	Final Draft Report	CDF	37
Plan Review	14	9/3/2003	Final Draft Report	LCSMC	N/A
	15	10/1/2003	Final Draft Report	LCSMC	N/A
	16	11/5/2003	Final Draft Report	LCSMC	N/A
	17	12/3/2003	Final Draft Report	LCSMC	N/A
	18	2/4/2004	Final Draft Report	LCSMC	N/A
	19	3/4/2004	Final Draft Report	LCSMC	N/A
Plan Upgrade	20	1/26/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	21	4/5/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	22	5/24/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	23	6/21/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	24	7/19/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	25	9/20/06	Watershed Planning / Plan Revisions	LCSMC	N/A

Project Purpose

The goal for the watershed planning process was to better understand the watershed and to identify actions to improve the quality of life through the reduction of flood risks and protection of water quality. The Watershed-Based Management Plan is intended to address preventive needs to avoid negative impacts from new development and remedial needs to resolve or alleviate current issues. To ensure implementation of the Plan, establishment of long-term stewardship of the watershed through cooperative efforts between municipalities, townships, the County, and watershed property owners is critical. The primary purpose of the Plan is to provide a "roadmap" for watershed management activities that will accomplish the goals and objectives established for the watershed. The plan was revised in 2008 to include the nine watershed plan elements required by the US Environmental Protection Agency, described below.

Project Process

- Watershed Stakeholder Committee Meetings

A critical element of a successful watershed management plan is engagement by watershed stakeholders. To encourage stakeholder involvement, the project included public meetings to which residents, the LCSMC, LCHD, LCFPD, the Grant and Wauconda Township Boards, the municipal Boards of Volo, Fox Lake, Lakemoor, and Round Lake, the Grant Township Territory Association, and several homeowners associations were invited. These stakeholders participated in watershed meetings to varying degrees.

Stakeholder meetings were held regularly on the first Wednesday of the month, beginning July 2002. Each meeting emphasized one topic. Meeting topics included: concerns and issues in the watershed; watershed inventory and assessment

Table I-2 Watershed Issues and Concerns Initial Prioritization

Issue	Total Voters	Total Points
A. Preventing additional flooding due to development	10	37
D. Water quality in Wooster Lake (ADID area)	8	31
R. Increased enforcement ability and improvement of enforcement procedures	8	24
C. Effect of changes to drainage network on lake water quality	6	17
B. Development effect on streambank erosion	5	17
F. Development respecting natural resources	5	17
Q. More compliant development	6	14
E. Increasing phosphorus levels causing increases in aquatic plant growth	4	12
I. Lack of interagency cooperation	4	10
V. Lack of education by residents on individual stormwater management opportunities	4	8
L. Maintain, create, and restore natural shorelines	2	8
N. Changing flow direction, including groundwater infiltration becomes surface water	3	6
H. Developments using township right-of-ways for drainage-responsibility for problems	2	6
F.F. Information on Illinois drainage law	2	6
G. Shoreline erosion	1	4
T. Potential development area at upstream part of watershed (affects downstream)	2	3
D.D. Education of general public on what to look for throughout watershed	1	3
U. Need to identify high-quality natural areas in watershed	2	2
J. Ridge issue adjacent to Wooster Lake (drainage divide change)	0	0
K. Maintenance and enhancement of Forest Preserve property (habitat, etc.)	0	0
M. Funding for lake restoration, specifically for smaller community groups	0	0
O. Additional water quality testing in water bodies	0	0
P. Debris accumulation in waterways	0	0
S. Road runoff effect on water quality	0	0
W. Establish additional guidelines for development (water quality)	0	0
X. Resource/contact list for watershed issues	0	0
Y. Impact of nursery operations on runoff	0	0
Z. Powerboat and jet ski traffic on lakes (water quality impacts)	0	0
A.A. Identify depressional areas	0	0
B.B. Runoff volume (lack of controls in WDO, UDO)	0	0
C.C. Lack of numerical water quality standards in countywide regulations (WDO, UDO)	0	0
E.E. Funding for implementation of Watershed Management Plan	0	0
G.G. Compensatory storage issues - review regulations	0	0

findings; development of goals and objectives; and discussions of the prioritized action plan. The date, subject, and presenter or hosts for each meeting are listed in Table I-1. Subsequent to August 2003, the stakeholders continue to meet monthly to review and comment on the Plan. Meeting minutes are provided in Appendix 1 of this report.

During the first meeting, each stakeholder had the opportunity to communicate their concerns and issues. After all the issues and concerns were identified, each attendee was given 5 votes, with varying point values from 5 (highest) to 1 (lowest) to assign to issues and concerns of their choosing. A summary of the list of concerns and initial prioritization results is provided in Table I-2.

Based on the results, the issues and concerns for the Fish Lake Drain Watershed can be categorized as follows:

1. Flood prevention
2. Water quality protection and enhancement
3. Streambank erosion
4. Natural areas protection
5. Regulatory standards and enforcement
6. Education

These results became the foundation for developing watershed management goals and objectives, which are listed at the end of this chapter.

- Watershed Inventory and Analysis

One of the major tasks of this project was to update the Stream Inventory and Flood Problem Areas Inventory (FPAI) data, as well as to identify significant depressional storage areas and pollutant loads for existing land uses.

FPAI data sheets were distributed to each community and stakeholder, however, none were returned. This suggests that the information in the original inventory is still valid and/or flooding problems are not particularly severe.

In addition to the FPAI, stream and wetland inventories were conducted in June and July 2002 along Fish Lake Drain and around the major wetlands. Several key factors that indicate varying levels of water quality along the stream corridor were identified, such as stream bank erosion, riparian corridor conditions, algae, and macroinvertebrate community quality.

In addition to the first-hand data collection, geographic information system (GIS) data of baseline information was collected and used to create a series of maps. These maps included the watershed boundary, municipal boundaries, highways, roads, streams and lakes, natural features including wetlands, hydric soils, draft updated floodplains, drainage tiles, and land use/ land cover. Some residents were surprised to see that the draft LCSMC floodplain mapping indicated that the floodplain was more extensive in some areas and less in others.

Finally, reports and studies relevant to watershed management goals and objectives were reviewed as part of this effort, including regional planning reports and flooding problem and natural features studies. The documents reviewed included: the Lake County Regional Framework Plan (draft 2001); Lake County Flood Hazard Mitigation Plan (draft June 1999); Fish Lake Drain Floodplain Study (draft 2003); Fish Lake Water Quality Report (1997); Summary Reports of Fischer Lake (2001), Wooster Lake (1999), and Duck Lake (2001); Lake County ADID Wetlands Study (1992); and Illinois EPA's Water Quality Assessment (305b) Report (2002).

The detailed watershed assessments are discussed in Chapter II, Watershed Inventory and Analysis, and the stream and wetlands inventory reports and data can be found in Appendices 2 and 3.

- Watershed Management Toolbox

In 2000, the LCSMC drafted an outline for the North Branch of the Chicago River Watershed Assessment and Management Plan for Lake County, Illinois. That project was funded by the U.S. EPA under Section 319 of the Clean Water Act, through the Illinois EPA. Chapter 4 of that document, "Watershed Restoration and Management Techniques", included several strategies and techniques, referred to as a "Toolbox" for watershed management. This Toolbox included preventative and remedial measures. As part of the Fish Lake Drain Watershed project, the Toolbox was reviewed and updated and the opportunity was taken to improve its user-friendliness. The Toolbox components are described in Chapter III, Watershed Management Toolbox. The full Toolbox from the previous watershed planning efforts can be found in Appendix 4.

The two components of the Toolbox of Chapter III are:

Green Infrastructure Plan:
This is a hydrologic and aquatic systems-based open space plan that designates critical natural areas for preservation, protection, and restoration. Based on the watershed inventory and assessment findings, the green infrastructure plan integrates natural flood storage areas, wetland restoration sites, and sensitive areas (streams, lakes, and wetlands) into an open space network.

Stormwater Best Management Practices Tools:
This is a summary of innovative stormwater management Best Management Practices (BMPs) that can be implemented in the Fish Lake Drain Watershed. The tools illustrate the characteristics, applicability, effectiveness, and design considerations of each BMP.

- Watershed Management Recommendations

In addition to the general watershed management strategies and practices provided in the Toolbox, action items and recommendations specific to the Fish Lake Drain Watershed were developed. Watershed management recommendations are described in detail in Chapter IV in two sections.

Watershed Action Items:
The goals and objectives of the Fish Lake Drain Watershed Management-Baed Plan were developed by the stakeholder committee during the monthly meetings, based on issues and concerns of the watershed. Action items were then generated to achieve these goals and objectives. The action items are organized by goal and objective.

Watershed Management Units Assessments and Recommendations:
Watershed management units were delineated based on subwatershed boundaries. The purpose of creating watershed management units was to organize the watershed into smaller areas to simplify implementation by the stakeholders and communities. Assessments and recommendations are provided for each management unit. Within the management units, site-specific recommendations for stream corridors, wetlands, and lakes were developed based on the project goals and objectives, as well as the data collected from the inventories and assessments.

- Prioritized Action Plan and Implementation

Watershed management action items and watershed management unit recommendations were prioritized with highest priority given to preventive actions and measures to address active sources of water quality degradation. Estimated budgets, possible funding sources, and recommendations for primary and contributing implementors were also included. The prioritized action plan is presented in Chapter V.

Fish Lake Drain Watershed-Based Plan Update

The first draft of this plan was developed in 2004. Subsequently, the US Environmental Protection Agency developed a set of nine watershed plan elements that would be required for a plan to be formally accepted as a watershed-based plan. The original 2004 plan was then revised to include updated information that would satisfy the following nine required elements.

1. The causes and sources of water pollution.
2. Estimate of water quality improvement expected from implementing plan recommendations.
3. Describe best management practices and critical areas where those practices are needed.
4. Estimate the amount of technical and financial assistance needed to implement the plan.
5. Public information & education component.
6. Plan implementation schedule.
7. Set of milestones for measuring plan implementation progress.
8. Set of indicators to determine whether loading reductions are being achieved.
9. Monitoring component to evaluate the effectiveness of the implementation efforts.

C. Goals and Objectives

Based on the issues and concerns identified at the first stakeholder meeting and the resources and conditions of the watershed, the following goals and objectives were established:

Goal 1: Improve Water Quality and Stream, Lake, and Wetland Resources

Objective 1:
Perform in-lake management measures to improve water quality and aquatic habitat of the watershed lakes.

Objective 2:
Restore and enhance water quality and habitat of existing drainage corridors.

Objective 3:
Restore and enhance water quality, habitat, and floristic quality of existing and former watershed wetlands.

Objective 4:
Address the quality and quantity of runoff from existing development.

Objective 5:
Address the quality and quantity of runoff from agricultural land uses.

Objective 6:
Implement a Green Infrastructure Plan to guide preservation, restoration, and management activities.

Objective 7:
Develop and maintain a database of water quality assessment information and collect additional data.

Goal 2: Identify and Mitigate Existing Watershed Flooding Problems

Objective 1:
Identify existing overbank flooding sources, properties that flood, and damages associated with flooding.

Objective 2:
Identify existing local drainage flooding sources, properties that flood, and damages associated with flooding.

Objective 3:
Reduce existing flooding through the implementation of flood damage reduction projects that lower flood water levels.

Objective 4:
Reduce existing flood damage potential by floodproofing structures.

Goal 3: Prevent Negative Impacts of New Development on Flooding and Watershed Resources

Objective 1:
Discourage development in flood-prone areas.

Objective 2:
Protect existing floodplain and depressional storage.

Objective 3:
Protect stream and wetland resources from unnecessary modifications, and mitigate all necessary modifications and impacts.

Objective 4:
Minimize increases in runoff rates and volumes (as conditions allow) associated with new development.

Objective 5:
Minimize water quality impacts of new development.

Objective 6:
Evaluate and, where feasible, adopt win-win strategies to enhance existing natural resources in concert with new development.

Objective 7:
Identify and implement additional regulatory standards and enforcement needs.

Goal 4: Provide Tools to Implement Watershed Protection and Enhancement Measures

Objective 1:
Identify and secure resources to implement Plan recommendations and action items.

Objective 2:
Continually pursue strategies for facilitating Plan implementation.

Objective 3:
Improve coordination between municipalities and Lake County agencies in watershed planning and protection.

Objective 4:
Provide municipalities with sources for, and/or copies of, watershed-beneficial regulatory standards and land use planning methods.

Objective 5:
Educate local officials, planners, and engineers on the benefits and methods of conservation planning and development.

Objective 6:
Provide educational, management, and restoration opportunities for residents to foster watershed stewardship.

Objective 7:
Educate residents on source control and runoff reduction measures that may be used on their properties.

Goal 5: Evaluate Success in Plan Implementation

Objective 1:
Monitor implementation of recommendations.

Objective 2:
Perform hydrologic, water quality, and biological monitoring of the watershed to evaluate success in meeting watershed goals and objectives.

The watershed goals were used to guide identification of watershed recommendations and served as the framework for general watershed action items as presented in Chapter IV.

II Watershed Inventory & Analysis

A. Watershed Conditions

The Fish Lake Drain Watershed lies within the Fox River Watershed in Lake County, Illinois. The watershed is bounded approximately by Rollins Road to the north, IL-120 to the south, US-12/IL-59 to the west, and Fish Lake Road and Wilson Road to the east, plus two lobes: the southwest lobe is bounded by US-12/IL-59, Fisher Road, and Darrell Road; the southeast lobe is bounded by IL-120, Gilmer Road, and about 1 mile west of Wilson Road. The watershed is approximately 8.7 square miles in size. Major water bodies within the Fish Lake Drain Watershed area, proceeding from north to south, include Duck Lake, Wooster Lake, Fischer Lake, and Fish Lake.

The Fish Lake Drain Watershed is bisected by one railroad, three state highways, and several major and minor roads. A Metra commuter railroad line passes through the north border of the watershed, and there is a stop at Ingleside Station, north of Duck Lake. The main east-west highways passing through the area are State Routes IL-120 and IL-134. The main highway through the watershed from north to south is US-12/IL-59. The railroad and highways provide major points of access to this watershed and will continue to serve as conduits for growth.

This section of the watershed inventory outlines the existing watershed conditions for hydrology, topography, soils, natural features, land use/land cover, and parks/open space in the Fish Lake Drain Watershed.

Hydrology

Fish Lake Drain flows generally from south to north and includes approximately 2.5 miles of stream channel (not including distances across the lakes) downstream of Fish Lake. It connects Fish Lake, Fischer Lake, Wooster Lake, and Duck Lake, respectively, from south to north before crossing Rollins Road and ending at its confluence with Squaw Creek, which drains shortly thereafter into Fox Lake. However, the downstream watershed boundary is located at the railroad culvert south of Rollins Road, upstream of the confluence with Squaw Creek.

Watershed soils and topography suggest that, historically, the watershed lakes were not connected by a distinct channel. Rather, the broad wet areas between the lakes likely served as an overflow route during wet springtime conditions. Fischer Lake was excavated in the 1970s within one of the larger wetland areas downstream of Fish Lake and upstream of Wooster Lake.

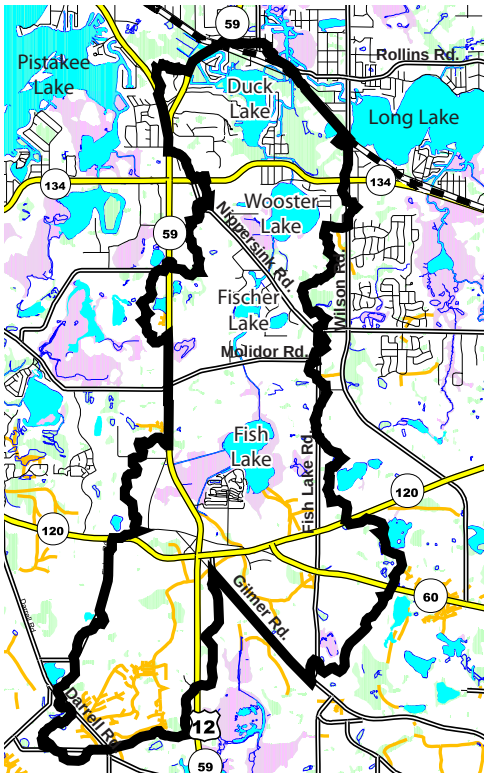


Figure II-1 Hydrology Map

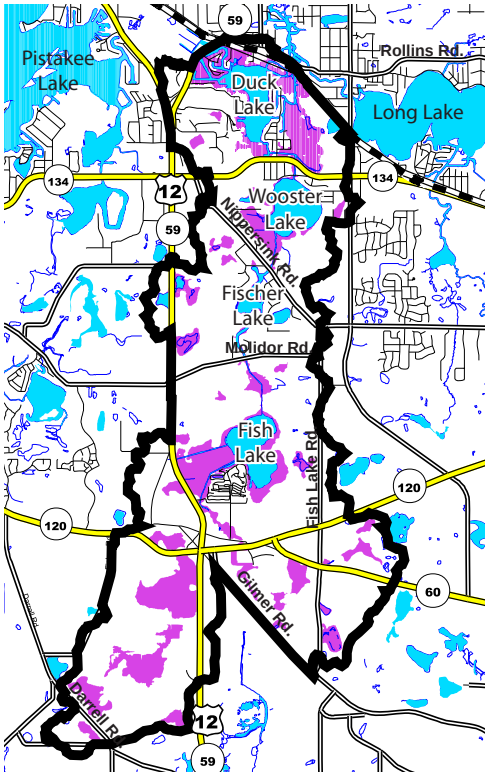


Figure II-2 LCSMC Floodplain

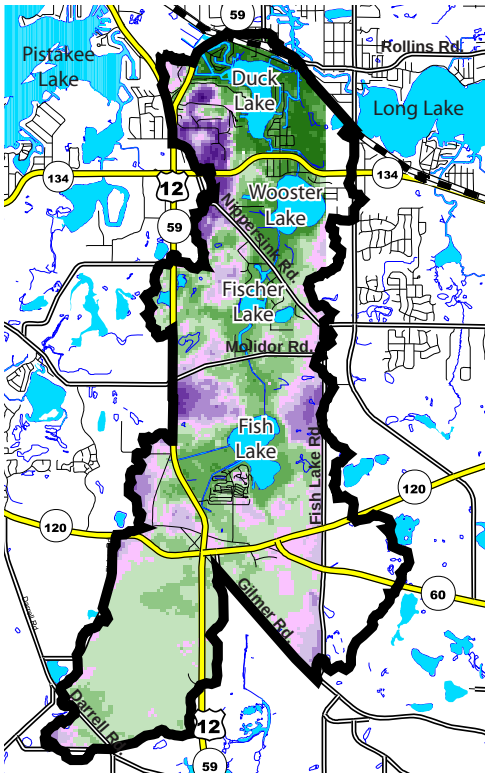
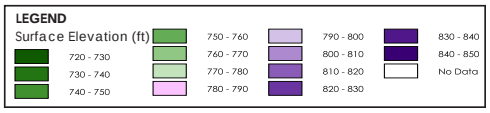


Figure II-3 Topography Map



As shown in Figure II-1, there are many wetlands of varying quality within the watershed, including some high quality ADID wetlands. Many of the wetlands are riparian located along the Drain and around Fish Lake, Wooster Lake, and Duck Lake, but many others are depressional wetlands scattered throughout the watershed. In addition, numerous drainage tiles occur, primarily in the headwaters south of IL-120.

Streams, lakes, and wetlands provide important aquatic habitat for a myriad of plants and animals. They can also help to mitigate hydrologic and water quality impacts of agricultural and urban development, providing water quality improvement, conveyance, and flood attenuation. To the degree that wetlands are required to mitigate for the impacts of urban and agricultural development, however, the biodiversity of these features will diminish.

Many of the wetlands within the Fish Lake Drain Watershed, particularly the ones along the lakes, are located within the mapped 100-year floodplain. Floodplains are shown on the Figure II-2 to the left; and are identified on Figure II-18, which will be discussed in detail later in this chapter in section E, Flooding Assessment. Floodplains are an important component of stream ecology and also serve to moderate flow rates and stream energy during high flow runoff conditions. When floodplain areas and volumes are reduced, additional flood potential as well as increased streambank erosion can occur.

The floodplain depicted in Figure II-2 is currently draft and not the regulatory floodplain boundary at this time. However, it is the best available information and was used in this Plan for identifying potential flooding issues and developing Plan recommendations.

Hydrology data for streams, wetlands, and lakes was provided by Lake County, and draft floodplain data was provided by LCSMC.

Topography

The topography of the Fish Lake Drain Watershed ranges from nearly flat (0-2% slopes) in the southwest and along the drainageway, to steeply sloping (over 12%) in many areas of the northern portion of the watershed and along the western border. Fish Lake Drain drops in elevation only about 40 feet along its length, from approximately 760 feet above sea level to 720 feet. However, the elevation drop from the top of the valley on the west to the watershed outlet is nearly 100 feet. In Figure II-3 to the left, the higher the elevation, the darker the color purple and the lower the elevation, the darker the color green. White represents areas outside the zone of terrain mapping.

Topography defines the boundaries of the watershed, and within the watershed, elevation data was used to determine areas of regionally significant depressional water storage areas. Numerous depressional areas were identified in the watershed. Details about regionally significant depression areas are discussed in this chapter in Section D, Drainage System Analysis. Topography data was provided by LCSMC.

Soils

Three categories of soil characteristics were investigated and mapped. These were hydric soils, hydrologic soil group, and soil erodibility.

- Hydric Soils

Hydric soils occur throughout the Fish Lake Drain Watershed. The greatest concentration is along the drainageway itself, around Fish Lake and Duck Lake, and much of the watershed south of IL-120. These hydric soils, in their natural state, were poorly drained soils originally associated with wet prairies and wetlands.

Knowledge of the location of hydric soils is important for a number of reasons. Hydric soils provide an indication of historic wetlands and locations for potential wetland restoration. Hydric soils also are areas that may be prone to flooding or otherwise wet conditions if the infrastructure that drains the soil (tiles and ditches) is not maintained. Hydric soils occur along natural drainageways and therefore can be useful in identifying natural connections between isolated wetlands and to restore wetland complexes and functioning ecological and hydrological networks. Locations of hydric soils in the Fish Lake Drain Watershed are mapped on the Figure II-4. The hydric soils data was provided by Lake County.

- Hydrologic Soil Group (HSG)

A soils analysis was performed for the Fish Lake Drain Watershed for the purpose of identifying the NRCS hydrologic soil group (HSG) and understanding runoff potential. HSG is classified into 4 categories, A, B, C, and D, based on soil texture and characteristics associated with permeability and level of drainage and are used to determine runoff potential. In general, Group A has the least runoff potential whereas Group D has the highest runoff potential. For hydric soils, the runoff potential depends on the level of drainage of the soils. In their drained state (such as by tiles), the soils have the runoff potential indicated on the map. In their undrained state, these soils are generally assumed to have the runoff potential of HSG D soils.

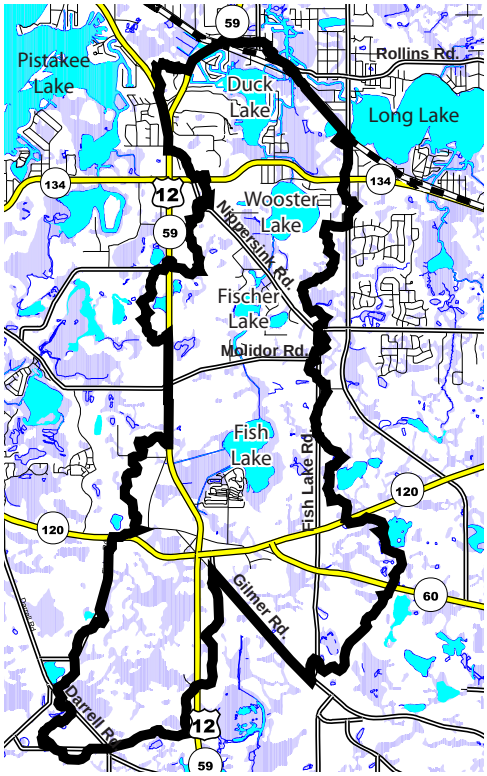


Figure II-4 Hydric Soil Map

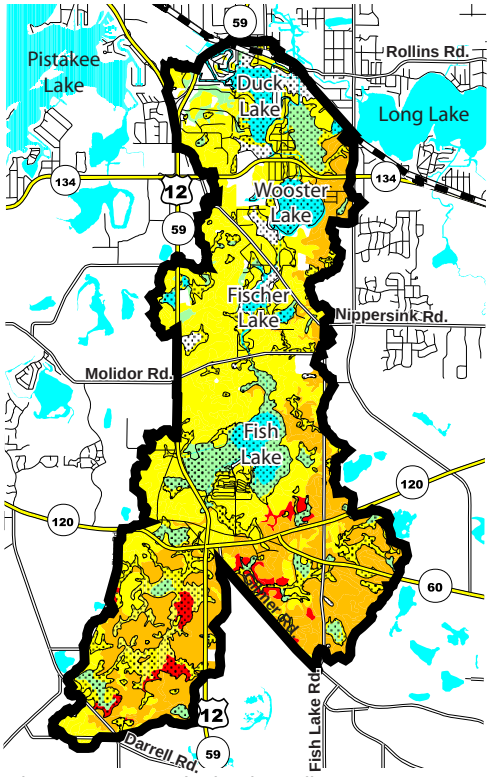


Figure II-5 Hydrologic Soil Group Map

LEGEND
Hydric Soil
HSG A B C D

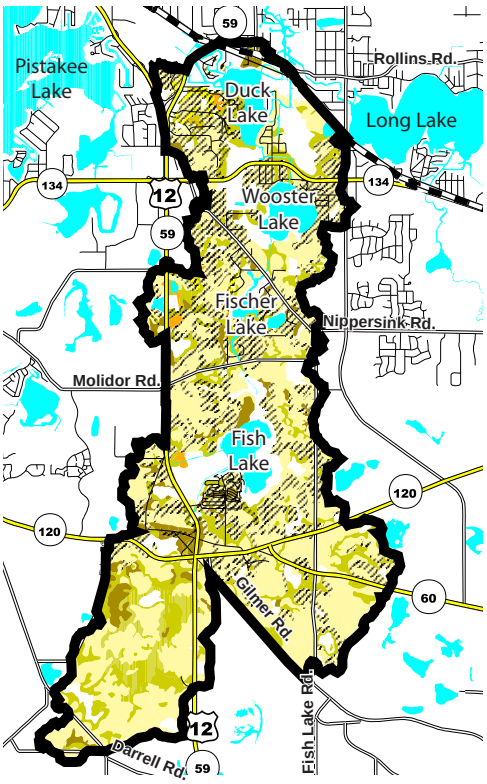
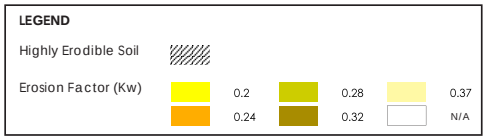


Figure II-6 Soil Erodibility Map



The percentages of each HSG in the watershed are as follows:

- HSG A 10%
- HSG B 58%
- HSG C 29%
- HSG D 2%

As indictated on Figure II-5, a majority of the soils north of IL-120 that are not hydric are HSG B soils (moderate runoff potential). South of IL-120, most of the soils, both hydric and non-hydric are HSG C soils with greater runoff potential. It should be noted, however, that the watershed south of IL-120 is also very flat and the surface drainage system is not well defined; thus, the actual runoff from this area is not as great as the hydrologic soil group alone might suggest. This is discussed further under Drainage System Analysis in Section D of this chapter.

- Soil Erodibility

Classification of a soil as highly erodible is dependent on both the erosion factor of the soil and the ground slope. Erosion factor "Kw" is a measure of a soil's susceptibility to detachment and transport by rainfall. Factor K is one of several factors used to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

In the Fish Lake Drain Watershed, more than half (59%) of the soils have the highest Kw factor (0.37) for the watershed.

Slope is also an important determinant of erosion potential. Erosion potential increases (for a given erosion factor) when slope increases. The Kw and slope together were used to identify highly erodible soils as defined by the US Department of Agriculture, Soil Conservation Service. In general, soils with a Kw factor equal or greater than 0.37 with slopes greater than 4% were identified as highly erodible soils in the Fish Lake Drain Watershed. Approximately 25% of the watershed soils were classified as highly erodible. The only portion of the watershed that does not have significant highly erodible soil is the southwest lobe, due to the flatness in this area.

Threatened & Endangered Species

A total of 9 state-listed species (both plants and animals) have been identified within or adjacent to the project area (mostly within the ADID wetland sites).
These species include the following:

- Plants
  - Chamaedaphne calycuylata – Leatherleaf
  - Larix laricina – American Larch

- Birds
  - Chlidonias niger – Black Tern
  - Ixobrychus exilis – Least Bittern
  - Podilymbus podiceps – Pied-billed Grebe
  - Xanthocephalus xanthocephalus – Yellow-headed Blackbird
- Fish
  - Notropis heterodon – Blackchin Shiner
  - Notropis heterolepis – Blacknose Shiner
  - Etheostoma exile – Iowa Darter

No federally threatened or endangered species are known to occur in the watershed.

Land Use/Land Cover

The pre-European settlement land cover map (Figure II-7) was derived from the US General Land Survey Office surveyor's field notes. The map shows that in the early 1800s, the majority of the Fish Lake Drain Watershed area was covered by savanna, which generally is a mix of scattered oak trees and prairies. This ecosystem type, which is now globally rare, occurred along the intersection of the great Eastern forests and the Midwestern open prairies. Its open, pleasant character, and fertile soils resulted in mass conversion of these lands for agriculture and settlement; only small isolated pockets of surviving remnants of this ecosystem are known to occur in the watershed.

The southwest lobe of the watershed contained a large section of open prairie, with scattered pockets of marsh and wet prairie; which would have been wetter than areas indicated as savanna or oak woodland. Prairie, wet prairie, and marsh were also scattered throughout the watershed, generally conforming to areas of hydric soil. Many of these wetter areas have survived to the present day, as can be seen by comparing Figure II-7 to the existing land use map of Figure II-8. Oak woodlands were located in a couple small pockets of the watershed. Oak woodland landscapes were more densely wooded than savanna, but would have still been considered open by today's standards, and with an understory of grasses and forbs.

The existing land use/land cover in the Fish Lake Drain Watershed is primarily agricultural or open space in the southern half of the watershed, and primarily residential in the northern half (see Figure II-8).

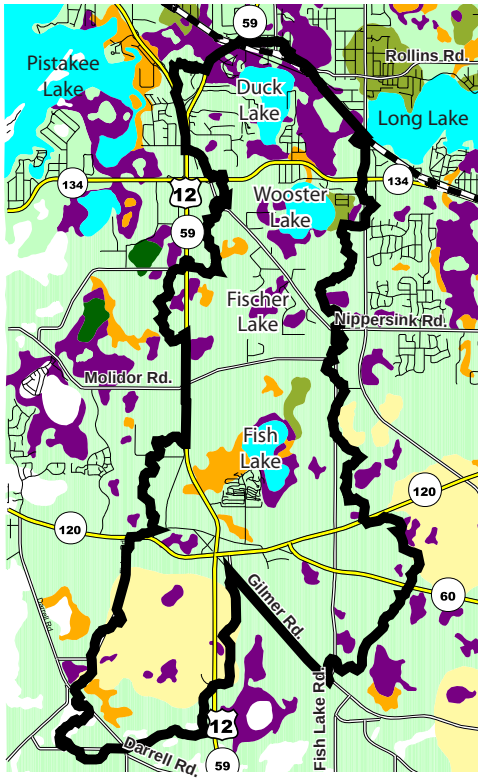
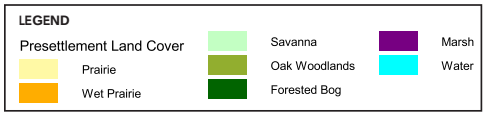


Figure II-7 Pre-European Settlement Land Cover Map (1838-1840)



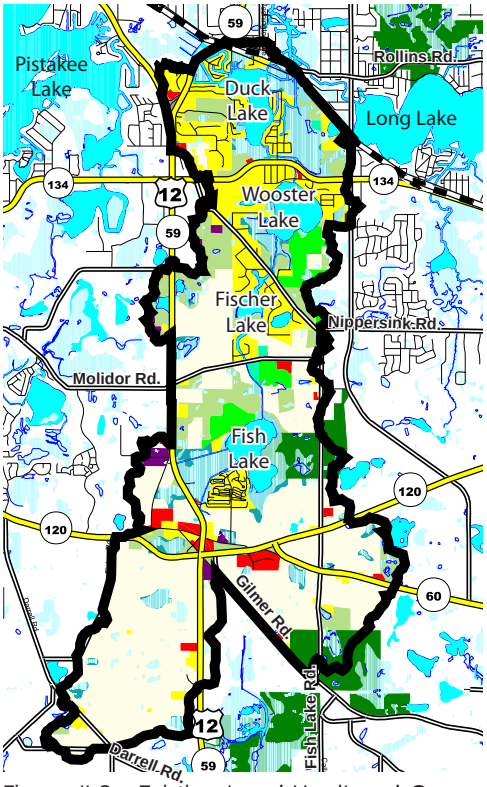
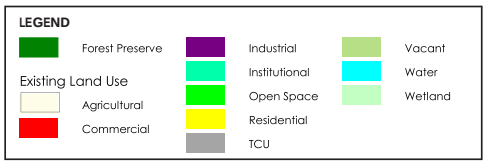


Figure II-8 Existing Land Use/Land Cover Map (1995)



The overall composition of land uses in the watershed area is categorized as following:

- Commercial/Industrial 4.8%
- Institutional 0.4%
- Residential 17.3%
- Agricultural 43.5%
- Vacant/Open Space 15.1%
- Water/Wetlands 18.9%

In the southern part of the watershed, near the intersection of IL-120 with US-12/IL-59, there is a strip of commercial and some limited industrial development. A number of the more scattered commercial developments are agricultural related, such as plant nurseries. There are significant areas of open space in the vicinity of each of the lakes, particularly Fish, Wooster, and Duck Lakes.

The Future Land Use/Land Cover Map (Figure II-9) was synthesized and digitized based on the available municipal and County comprehensive land use plans, including the Villages of Lakemoor and Volo. Where there were discrepancies between the County and municipal plans, the municipal plans were given precedence in the Future Land Use/Land Cover Map.

The Villages of Lakemoor and Volo are planning to convert large areas of agriculture to urban uses such as commercial, industrial, and mixed use. These changes are planned to occur in the central and southern parts of the watershed. The Village of Fox Lake, in the northernmost part of the watershed, is currently built out as residential development and is expected to grow in the vicinity of Duck Lake.

These land use plans indicate that there will be a significant increase in urban uses in the watershed, which could have significant impacts on flooding, water quality, and land use attainment.

The Fish Lake Drain Watershed consists of a number of open space areas and Forest Preserves. Marl Flat Forest Preserve is due east of Fish Lake and contains high quality wetlands that are home to diverse communities of plants and animals. The southeastern lobe of the watershed encompasses part of the Singing Hills Forest Preserve. There are several remnant woodlots that provide open space and wildlife habitat. Other significant areas of open space include two private campgrounds, one on the west side of Fish Lake and the other southeast of Wooster Lake.

There are a few undeveloped parcels identified in municipal/County plans as parks/open space scattered in the watershed. These include: an area south of Wooster Lake and north of Nippersink Road; a natural area associated with a wetland along IL-59 and south of Brandenberg Road; parcels located around Fish Lake; and a natural area associated with a wetland south of IL-60 and west of Callahan Road.

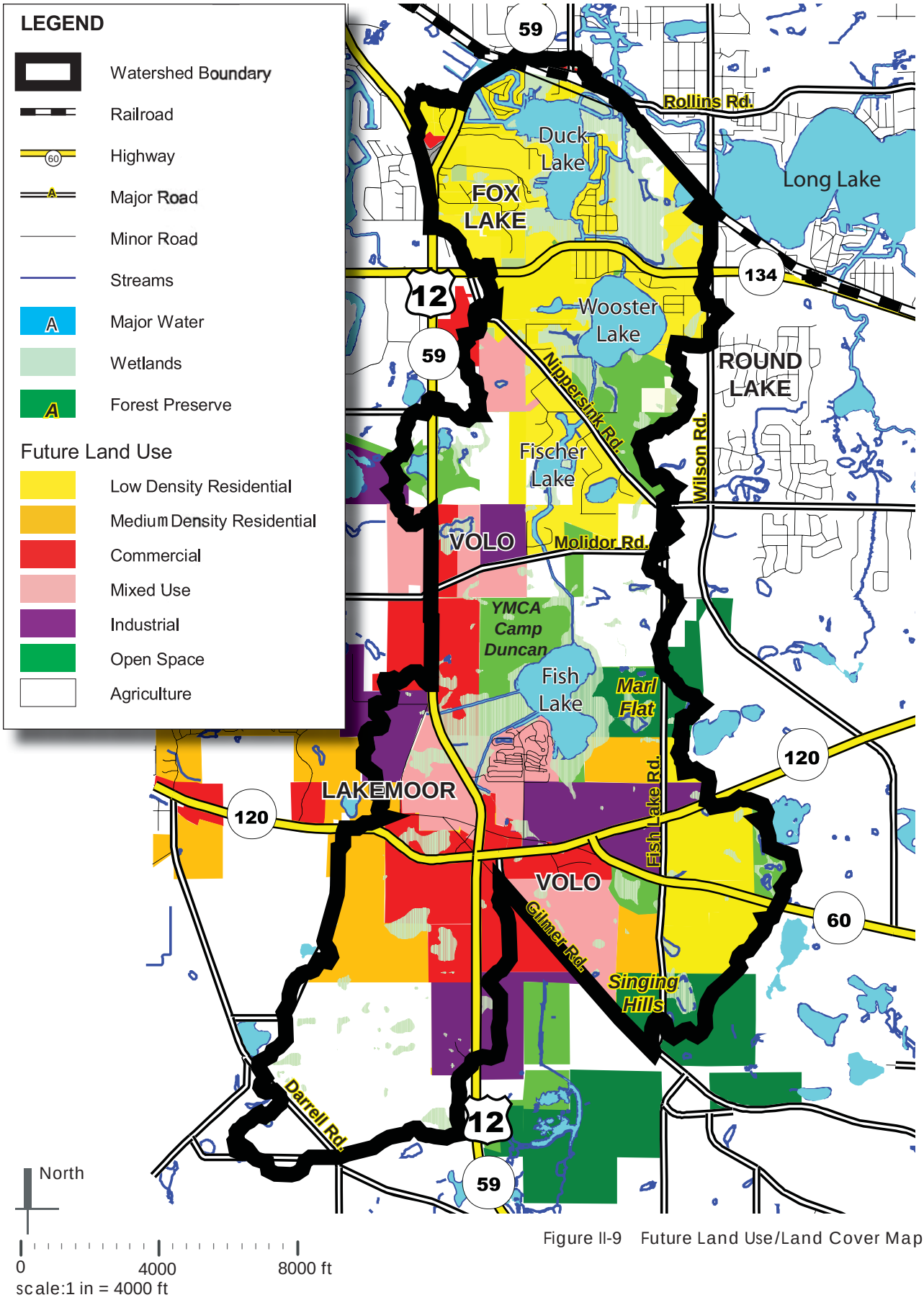


Figure II-9 Future Land Use/Land Cover Map

Reach 1B Stream Corridor Condition

Reach 3 Stream Corridor Condition

Reach 4C Stream Corridor Condition

Reach 5A Stream Corridor Condition

B. Major Waterbody Inventory

This section describes in detail the stream corridor and wetland inventories performed by CDF staff during the summer of 2002 and summarizes the lake assessments performed by the LCHD Lakes Management Unit.

Stream Corridor Inventory

Based on general characteristics and current conditions, the Fish Lake Drain corridor, from Fish Lake to the rail line south of Rollins Road, was divided into 5 reaches and a number of "sub-reaches" (marked as A, B, or C) for field inventory and data analysis purposes. From downstream to upstream, the stream reaches were divided at the following geographical locations:

- Reach 1: Metra railroad culvert to Duck Lake
- Reach 2: Duck Lake to Wooster Lake
- Reach 3: Wooster Lake to Fischer Lake
- Reach 4: Fischer Lake to Molidor Road
- Reach 5: Molidor Road to Fish Lake

Representative photographs are included on the left. Fish Lake Drain, at the time of this survey performed in July and August of 2002, was flowing at a rate of about 7.5-15 cubic feet per second (cfs). These flow rates are believed to be fairly typical of mid to late summer conditions. As mentioned earlier, this Drain is not a natural waterway channel but was excavated between lakes to increase drainage. A detailed inventory of instream conditions for each sub-reach along the drain is provided in Appendix 2. This section summarizes the findings of the inventory in terms of the degree of substrate stability, stream bank erosion, algae growth, and aquatic habitat. A previous inventory performed by LCSMC interns, is provided in Appendix 7 that is only included on the CD of this report.

- Substrate Stability

Substrate stability is generally high in natural streams but will vary from high stability in riffle areas to lower stability in slower moving pools between riffles. Areas of high substrate stability, characterized by gravelly substrates, are necessary to support diverse macroinvertebrate and fish communities.

Substrate stability was generally low to moderate throughout the Drain (see Figure II-10). The substrates consisted largely of unstable silt covering somewhat more stable sand and fine gravel bottoms in some reaches and soft organic bottoms in other reaches. Exceptions were reaches just downstream of Fish and Wooster Lakes (shown in yellow on the map). These reaches had very stable substrates due to the combination of low silt export from these lakes and

high enough gradients to keep the gravelly substrates clean. Since the riparian corridor is fairly wide and relatively well vegetated, the source of most of the silt in the Drain is probably stream bank erosion and naturally soft organic soils. Also, many of the reaches were excavated through wetland areas with naturally low stability soils. There is no available data for sub-reach 1B (shown in green on the map). The reach was inaccessible during the inventory work.

- Stream Bank Erosion

While erosion is a natural process, it can be greatly accelerated by changes in hydrology associated with urbanization. Stream bank erosion can be a significant source of sediment that subsequently settles in slower reaches and in the watershed's lakes. Eroding banks also lead to losses of riparian habitat.

Stream bank erosion shown on the Figure II-11 reflects both the prevalence of erosion (proportion of the reach experiencing bank erosion) and the bank height. Some degree of erosion was present in all but a very small portion of the Drain. Areas of high stream bank erosion occurred downstream of Fish and Wooster Lakes and just upstream of Fischer Lake. Areas of low stream bank erosion occurred upstream of Molidor Road and near Duck Lake. Areas of low to no stream bank erosion that occur near Duck Lake are probably due to the low gradients in this area, which reduce the potential for scouring during high flows and also reflects the low stream bank height in this area. In the higher gradient, more upstream areas, the stream banks tended to be covered with less stable vegetation such as reed canary grass. This type of vegetation provides low resistance to erosion when high flows occur.

- Algae Growth

In moderate amounts, algae is a food source for fish and macroinvertebrates. However, in larger amounts, the decay of algae and other aquatic plants represents an oxygen demand.

Algae growth varied from none to high in the various reaches of the Drain (see Figure II-12). Algae growth tended to be absent or low in areas downstream of Fish and Wooster Lakes, but moderate to high both upstream and downstream of Fischer Lake and downstream of Duck Lake. The high algae may be indicative of high nutrient concentrations in these areas but may be more the result of very pond-like conditions, with very little water movement.

- Macroinvertebrate Quality

Combined, the parameters described above have a significant influence on the quality of macroinvertebrate habitat and the quality of macroinvertebrate communities. High quality

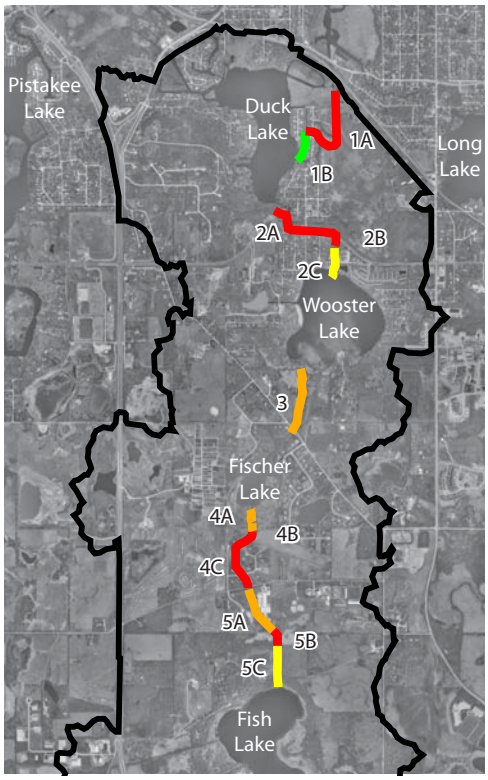


Figure II-10 Substrate Stability Map

N/A High Moderate Low

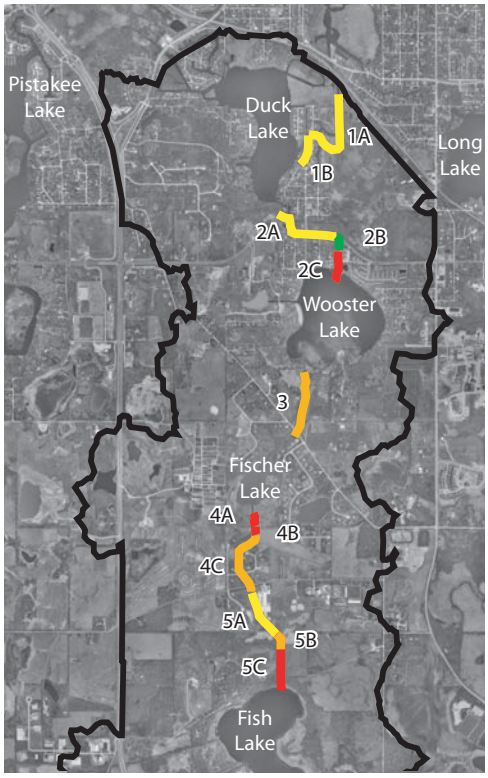


Figure II-11 Stream Bank Erosion Map

None Low Moderate High

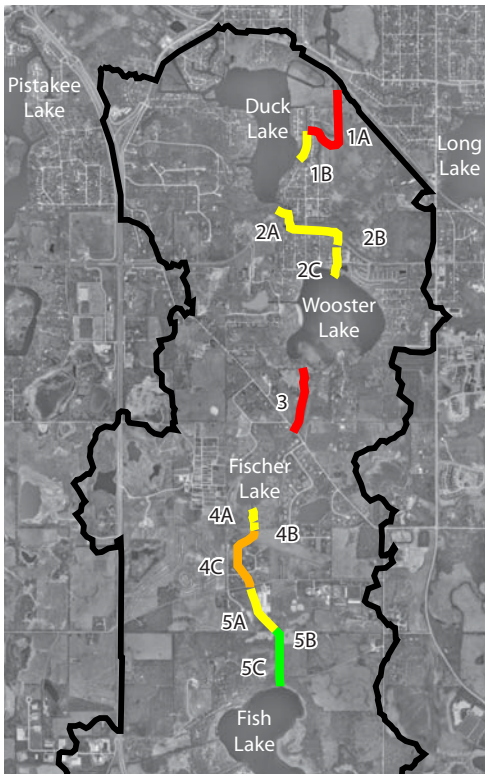


Figure II-12 Algae Growth Map

None Low Moderate High

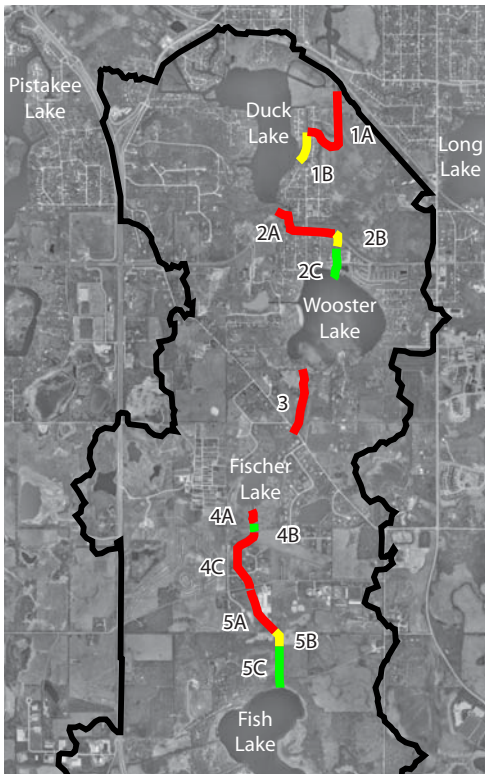


Figure II-13 Macroinvertebrate Quality Map

High Moderate Low

macroinvertebrate communities are characterized by high species diversity and a lack of pollution-tolerant species.

In-stream habitat for aquatic life was minimal throughout the Drain. As a result, the macroinvertebrate communities were generally of low quality (see Figure II-13). In the few places where gradient kept the substrates relatively free of silt, the presence of degradation-intolerant caddisflies, blackflies, and mayflies suggest that the water quality of the stream is good enough to support aquatic life use and that the stream is primarily habitat limited.

• Conclusion

Fish Lake Drain is not a natural channel, but was dredged between lakes to provide drainage for agricultural and urban development. As a result, it is difficult to evaluate, since good to excellent in-stream conditions are generally not expected from a dredged channel. There are clear variations, however, in the degree of substrate stability, bank erosion, algae growth, and aquatic habitat in different reaches of the Drain. Although the channel has a relatively natural appearance, it is generally more characteristic of a channel excavated through wetlands than a natural stream.

The low to moderate substrate stability upstream of Duck Lake is due primarily to the presence of silt and due to the naturally occurring organic soils through which portions of the channel were dredged. In many watersheds, heavy silt loads can come from agricultural areas or developed areas where construction practices that produce sediment have been used without methods for preventing sediment transport to the stream. However, most of the Fish Lake Drain riparian corridor that is still significantly wide (over 100′ in places) consists of vegetated open space and very little agriculture or development. Bank erosion and the naturally soft organic soils are the likely the primary causes of low substrate stability in the Drain.

Streambank erosion is caused by exaggerated flow fluctuations during large storm events that scour the toe of unprotected banks and wash away aquatic organisms. Scour of the toe leads to slumping of the upper banks. Streambank erosion not only leads to bank recession, it also undermines trees and culverts, and the subsequent sedimentation buries natural substrates. Erosion will tend to be worse where there is a higher gradient.

The degree to which stream banks can withstand erosive forces depends on the nature of bank vegetation. Woody vegetation (i.e., trees and shrubs) with large roots can provide support for bank soils but are often too coarse to prevent scour and provide virtually no protection against surface erosion. Deep-rooted herbaceous vegetation with its fine, dense root systems provides greater soil structure and protection

against scour and surface erosion. In general, excessive growth of woody riparian vegetation that shades deep-rooted herbaceous species will lead to increased bank erosion; however, the worst bank erosion is generally associated with shallow rooted turf grass.

There is a small water elevation control weir, apparently abandoned, just downstream of Fish Lake. Due to accretion of the channel upstream of this structure, the channel is currently more of a control than the weir. A weir is also used to maintain lake levels at Wooster Lake. At Fischer and Duck Lakes, elevation is provided by culverts. As the watershed develops and more storm water is directed to the lakes and streams from additional impervious surfaces, there may be public pressure to build and operate flow control structures. Although lake levels are not currently actively managed, manipulation of lake outflows to minimize lake level fluctuations can lead to greater erosion downstream during periods of high discharge. Conversely, manipulation of lake discharge rates to moderate downstream flow rates and provide flood control can lead to excessive lake level fluctuations which can be detrimental to shoreline vegetation and increase shoreline erosion and degrade shoreline habitat.

Excessive siltation, uniform channel structure, and lack of riffle development combine to limit the number and type of aquatic organisms present. Since this is a created channel, even if the siltation is reduced or eliminated, it is unlikely that substrates would be suitable for high-quality fish and macroinvertebrate habitat in all but a few areas. Under improved conditions, however, it is likely that a greater diversity of both fish and macroinvertebrates could be achieved than exists at present. With more stable hydrology and reduced bank erosion and other sources of sediment, pool and riffle stream morphology may begin to develop over time, particularly in the reaches where present substrate stability is at least moderate.

In many locations, the flat gradient and quiescent conditions of the channel are more characteristic of lake conditions than of stream conditions. In these areas, measures to create shoreline-like habitat may be the best approach to stream restoration. This would include creation of flat streambanks with an emergent fringe in some areas and introduction of overhanging vegetation in others.
In areas with somewhat higher gradients, it may be feasible to introduce bottom habitat such as artificial riffles that are suitable substrate for desirable macroinvertebrate and fish communities. The artificial riffles can also improve aeration and dissolved oxygen levels.

Wetlands Inventory

The purpose of the wetlands inventory was to compile existing ecological data on natural habitats and/or species within the project area, present a summary of these data in narrative form, and confirm or determine the quality (both hydrologically and biologically) or existence of those wetlands previously identified.

A summary of the available data (mostly from the ADID studies) for the higher quality wetland areas is addressed below. Two ADID wetlands that are adjacent to, but outside of, the watershed are also discussed in this section. A list of wetlands and their associated functions is contained in Table II-1. Locations of those wetlands can be found in Figure II-14. A more detailed inventory of wetlands in the Fish Lake Drain Watershed is included in Appendix 3.

- High Quality Wetlands

  Map Location 9: ADID Wetland 101 - Singing Hills Forest Preserve/Monahan Lake
  This approximately 16.93-acre wetland is primarily comprised of two plant community types: shallow marsh (dominated by cattails, common bur reed, and common arrowhead) and sedge meadow (dominated by common tussock sedge and bottlebrush sedge). There is also a floating mat component to this area (dominated by steeple bush, marsh shield fern, and common water plantain). The wetland is surrounded by an overgrown oak/hickory savanna community. In general, this wetland exhibits high biological values for the presence of a high-quality plant community. It also exhibits high qualities for stormwater storage volume and sediment/toxicant retention. In addition, this site has been identified as a rookery. Management problems include low water levels and areas dominated by reed canary grass.

  Map Location 10-12: ADID Wetland 73– Fish Lake
  This approximately 230-acre wetland complex is primarily comprised of three plant community

Wetland Inventory Map Location No. 19

Wetland Inventory Map Location No. 4

Wetland Inventory Map Location No. 5

Wetland Inventory Map Location No. 3

types: a degraded aquatic bed/open water habitat (dominated by coontail) in the center of the wetland; a high-quality sedge meadow/calcareous wet prairie (dominated by sedges, prairie cord grass, little bluestem grass, and indian grass) to the east; and an oak/hickory savanna amongst the campground infrastructure to the west. In general, this wetland exhibits high biological values for the presence of a high-quality plant community and wildlife habitat. It also exhibits significant stormwater storage, shoreline/bank stabilization, sediment/toxicant retention, and nutrient removal/transformation qualities. Management problems include shrub invasion and expansion of exotic plant species. The vicinity of wetlands 11 and 12 has recently been added to the Illinois Natural Areas Inventory (INAI) due to the presence of several threatened and endangered bird and plant species.

Map Location 20: ADID Wetland 189 – Wooster Lake
This approximately 117-acre wetland is primarily comprised of an open-water community with very little natural shoreline. In general, this wetland exhibits high biological values for the presence of some fish species. It also exhibits characteristics that provide for sediment/toxicant retention and nutrient removal/transformation. Management problems include turf shorelines associated with residential development on the east and west shoreline edges, siltation from the campground and residential development, and shoreline erosion.

Map Location 25: ADID Wetland 81
This wetland is primarily comprised of an open-water community dominated by cattails. In general, this wetland exhibits high stormwater storage, sediment/toxicant retention, and nutrient removal/transformation characteristics. Management problems include low water levels, dominance of reed canary grass, and salt run-off from US-12/IL-59. This wetland is connected to the Fish Lake complex.

Map Location 26: ADID Wetland 72 – Molidor Road Marsh
This approximately 18-acre wetland is primarily comprised of an open water deep marsh community dominated by cattails. The wetland is a cycling/hemi-marsh (open water with interspersed vegetation), which provides good waterfowl habitat. In general, this wetland exhibits high biological values for the presence of high quality wildlife habitat. It also provides high values for stormwater storage and sediment/toxicant retention. Management problems include salt run-off from US 12, agricultural runoff, and sedimentation.

- Adjacent High Quality Wetlands

ADID Wetland 66 – Stanley Road Bog
This approximately 17-acre wetland is primarily comprised of

Table II-1 Wetlands Inventory Summary

ADID #	Map Location	Community Type	Notes/Comments:	Wildlife Habitat	Plant Community	Stormwater Storage	Shoreline/Bank Stabilization	Sediment Toxicant Retention	Nutrient Removal Transfer
	1	Wetland	Lurvey's Landscape, large detention/ponded area, lots of birds (seagulls and geese); appears farmed.	X		X			
	2	Wetland	Isolated storage lined with trees. Forested area appears to be silver maple, cottonwood, willow.	X		X			
	3	Wetland	Shrub/scrub wetland dogwood, willow, and reed canary grass.	X		X			
	4	Wetland	Cattails, wetland mitigation site. Geese and ducks.	X		X			
	5	Wetland	Cattails, wet meadow with rolling topography, some low lying, appears mostly dry. Willows and reed canary grass.		X	X			
	6	Upland Savanna	Remnant oak / hickory savanna. Some degradation from buckthorn invasion.		X				
	7	Wetland	Wetland/Farmed Wetland			X			
	8	Wetland/Farmed Wetland	Parcel listed for development; reed canary grass, some shrubs and trees, open water, birds. Farmed to edge.	X		X			
101	9	Wetland	Singing Hills Forest Preserve. 16.93-acre shallow cattail marsh lined with oak/hickory savanna and black walnut trees. Marsh dominated by burreed, arrowhead, Carex stricta & bottlebrush sedge. Reed canary grass is beginning to dominate areas. Sedge meadow/floating mat community. Red-winged Blackbird, Common Yellow-throat. This area has been identified as a T&E site based on its use as a rookery.		X	X		X	
73	10	Upland Savanna	Fish Lake complex. Oak savanna.		X				
73	11	Wetland	Fish Lake. 230 Acres. Degraded plant community dominated by coontail. Large areas of cattails around lake. Shrub invasion and non-native herbaceous species. T&E bird species have been identified on this site by the Forest Preserve.	X		X		X	X
73	12	Wetland/Wet Prairie	Fish Lake complex. High quality calcareous wet prairie dominated by little bluestem, sedges, prairie cordgrass and indian grass. T&E plants have been identified on this site by the Forest Preserve.	X	X		X		
	13	Upland Savanna	Campground facilities mixed with oaks and hickory.		X				
	14	Wetland	Open cattail marsh near Wilson Nursery. Very rolling topography with contour cropping and several low lying pocket wetlands. Egrets and wood duck box. T&E species identified.	X		X			

"X" indicates applicable wetland functions

Table II-1 Wetlands Inventory Summary (continued)

ADID #	Map Location	Community Type	Notes/Comments:	Wildlife Habitat	Plant Community	Stormwater Storage	Shoreline/Bank Stabilization	Sediment Toxicant Retention	Nutrient Removal Transfer
	15	Wetland	Fischer Lake. Some erosion; banks mostly seawall or rip rap in residential areas. Lawn to shore but plenty of space for riparian buffer in yards. Undeveloped island & south portion of lake mostly natural shoreline.			X			
	16	Wetland/Pond	Artificial pond in Fischer Estates subdivision; note double aerators. Armored banks, no natural shore. Large oaks, hickory, silver maple in yards.			X			
	17	Upland Savanna	Oak savanna.		X				
	18	Wetland	Wooded wetland (elms and silver maple); appears dried up (vernal pond).	X	X				
	19	Wetland/ Detention Basin	Holiday Park subdivision under construction; detention basin; much regrading and large storm sewer pipes. Open space/disturbance on Wooster Lake.						
189	20	Wetland	Wooster Lake. 117 Acres. Many houses right to shore, including new construction. Siltation from campground and shoreline erosion. Very little natural shoreline, but some cattails. Presence of State Threatened & Endangered fish.	X				X	X
	21	Wetland	Cattail marsh.	X		X			
	22	Wetland	North part of Duck Lake wetland complex. Ingleside at RR tracks, a few native plants: spiderwort, little bluestem, allium, smartweed, prairie cordgrass. Mostly invasives/cattail marsh.	X		X			
	23	Upland Savanna	Oak Savanna.	X	X				
	24	Wetland	Wooded wetland with much water.			X			
81	25	Wetland	Provides significant stormwater storage. Site connected to Fish Lake complex.			X		X	X
72	26	Wetland	Molidor Road Marsh. 18 acres. Deep marsh dominated by cattails. Good waterfowl habitat, Red-winged Blackbird, Common Yellowthroat. Salt runoff from US-12, agricultural runoff, sedimentation.	X		X		X	

"X" indicates applicable wetland functions

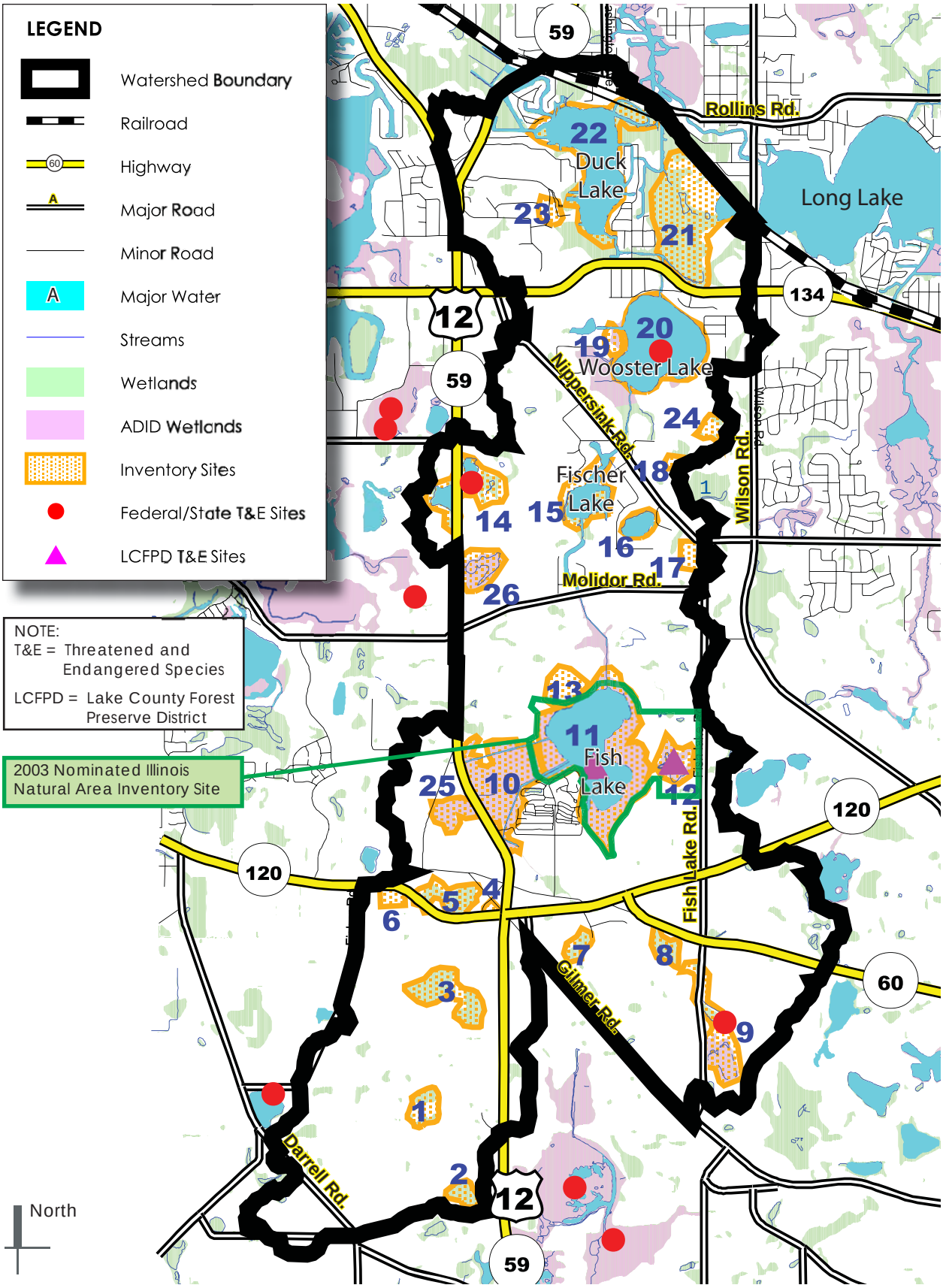


Figure II-14 Wetland Inventory Location Map

a low shrub bog (location not shown on the map). In general, this wetland exhibits high biological values for the presence of rare plant and animal species. It also exhibits high value for stormwater storage and sediment/toxicant retention. Management problems include presence of invasive species (purple loosestrife, reed canary grass, common buckthorn, and glossy buckthorn) due to the alteration of water levels.

ADID Wetland 85-Sargent Marsh
This approximately 43-acre wetland is primarily comprised of an emergent marsh. This marsh has been described as a cycling marsh, which provides good hemi-marsh (open water with interspersed vegetation) habitat conditions. In general, this wetland exhibits high biological values for the presence of high-quality plants and animals. It also exhibits high values for stormwater storage and sediment/toxicant retention. Management problems include the presence of invasive species, such as purple loosestrife.

- Conclusion

As would be expected from the large amount of hydric soils found in the watershed, many wetland habitats of varying qualities occur within the watershed. These wetlands vary from high-quality, remnant habitats such as wet prairie and sedge meadow to degraded areas such as farmed wetlands. Few remnant oak savanna areas were also identified within the watershed. All of these areas provide significant wildlife habitat due to the relatively high level of connectedness of many of the stream and wetland areas.

Inappropriate development that does not consider environmental impacts often causes habitat fragmentation; subsequently, small habitat would degrade and diminish and result in a loss of plant and animal species. Primary areas of habitat fragmentation within the watershed can be found between Molidor Road and Fischer Lake, and US-12/IL-59 and IL-120.

The substantial amount of water and wetland area (19% of the watershed) provides significant stormwater storage and water quality benefits that tend to mitigate the impacts of urban and agricultural development. However, many of the wetlands have already suffered from the impacts of runoff from existing development and will continue to degrade if their use for this purpose continues or increases.

Most of the higher quality wetland and natural areas identified within the watershed consist of the designated ADID wetlands. These sites provide significant wildlife habitat, plant communities, stormwater storage, sediment and toxicant retention, shoreline and bank stabilization, and nutrient removal, among other functions.

The watershed wetlands are threatened and degraded by urban and agricultural runoff as well as lack of management and stewardship. As a result, many of the wetlands have been invaded by non-native species (e.g. purple loosestrife, reed canary grass, common buckthorn, and glossy buckthorn) that are tolerant of degraded runoff conditions and thrive under conditions of fire-suppression. Many of these areas are under private ownership. Thus, education will be critical to the health and longevity of these natural areas even as runoff-related issues are addressed.

Significant efforts should be made to preserve and maintain the identified ADID wetlands as well as the additional wetlands and natural areas. Fire is the most critical stewardship activity to maintain these native landscapes that evolved under a regimen of burn management. Ongoing stewardship of the native landscape will improve floristic and habitat quality; reduce runoff and surface erosion through improved soil health; enhance water quality through reduced surface and shoreline erosion; and increase the aesthetic quality of the area. When properly restored, the existing habitat diversity contained throughout these areas will afford a marvelous resource that offers a setting of rare, natural beauty, as well as cultural significance.

Ecological monitoring of the wetland areas should be implemented to assess landscape response to watershed management and stewardship activities and to guide management plan revisions.

Lakes Inventory

The following characterizations are based on the LCHD studies.

- Fish Lake

The 96 acre, 19-foot deep Fish Lake is the most upstream of the lakes in the Fish Lake Drain Watershed. The area immediately surrounding Fish Lake remains mostly undeveloped, giving the lakeshore a pleasant, natural character.

Fish Lake is somewhat nutrient enriched. Nutrient enrichment results in excessive aquatic plant growth, particularly algae, that float in the water column. Algae, along with sediments resuspended from the bottom or contributed from the watershed, can result in decreased water clarity. Water clarity in Fish Lake is better than that in Fischer and Duck Lakes but not as high as Wooster Lake. Nutrient enrichment of the lake, including that which settles out into the bottom sediments, is most likely due to contributions from agricultural and residential areas farther to the southeast and southwest. Much of this area most likely did not historically drain to the lake, and probably had more extensive wetlands than exist today.

Fish Lake has not been rated by the Illinois EPA. However, based on conditions reported by the LCHD, Fish Lake is potentially fully supporting the aquatic life use but appears to be only partially supporting its other uses. As discussed above, causes of impairment include nutrients, suspended solids, exotic species (Eurasian water milfoil), and periods of low dissolved oxygen. Sources of impairment are believed to include agricultural runoff and perhaps on-site wastewater systems (septic systems). As the watershed develops, these problems could play a greater role in impairing lake quality.

- Fischer Lake

Fischer Lake is a shallow (11-foot maximum depth), 23 acre man-made lake. It was constructed in the late 1970s and early 1980s, as part of development of Fischer Estates within which it is located. Water clarity is poor, most likely due to suspended sediments and algae in the water column. Aquatic plants are not abundant in this lake, probably because of the poor water clarity. Low oxygen levels, shallow depths, and a lack of plants result in poor habitat for fish within the lake.

Approximately 30% of the developed shoreline of the lake consists of lawns. Lawn grasses are very shallow rooted and function poorly for holding soil. As a result, a significant portion of the shoreline is experiencing some degree of erosion. In addition to poor erosion control characteristics, lawns at the water's edge can be a significant source of

Fish Lake

Fischer Lake

Wooster Lake

Duck Lake

nutrient runoff due to lawn fertilizers and grass clippings. However, it is reported that many residents within Fischer Estates use low phosphorous fertilizer, consistent with LCHD recommendations. Finally, lawns at the water's edge can attract nuisance numbers of Canada geese. When present in large numbers, these geese can be another significant source of nutrients, as well as bacteria loading to the lake. Other potential but unverified nutrient sources include septic systems and nursery operations within the sub-watershed.

A few residents have provided buffers along their shoreline and those areas appear to be eroding less than the adjacent lawn areas. Also, the island and much of the southern, undeveloped shoreline are in a more natural state. However, some of the more natural shoreline areas are overgrown with woody shrubs and are experiencing significant erosion. This lake would benefit from enhancement of its riparian zone to include native shoreline vegetation to help control erosion, filter runoff, and decrease its attractiveness to geese.

Fischer Lake has not been rated by the Illinois EPA but is likely only partially supporting its designated uses. Based on the conditions reported by LCHD, the likely causes of impairment include nutrients, suspended solids, shoreline alterations, and limited habitat. Sources of impairment are believed to include agricultural runoff, urban and construction site runoff, and streambank and shoreline erosion.

- Wooster Lake

Wooster Lake is a 98-acre natural glacial pothole lake that has a maximum depth of 29 feet and has the highest water clarity of the lakes in this watershed. It supports a diverse aquatic plant community, as well as a fish community and three state-listed endangered fish species.

Most of the shoreline along the residential northern portion of the lake consists of lawns. As discussed under Fischer Lake, lawns along the shoreline can lead to shoreline erosion and degraded water quality due to runoff of nutrients and bacteria from lawn fertilizers and Canada geese. Like Fischer Lake, Wooster Lake would benefit from enhancement of its riparian zone to include native shoreline vegetation to help control erosion, filter runoff, and decrease its attractiveness to geese.

While some of the shoreline is residential property, there are also campground holdings and undeveloped areas. The shoreline is more naturalized in these areas.

There is a large area consisting of a new subdivision with significant stormwater infrastructure being constructed on the west side of the lake. There is significant potential that this development will increase negative impacts on water quality and wildlife habitats around the lake due to the greater volume and higher temperatures typically associated with urban runoff.

Wooster Lake is a high-quality lake, but it may be on the verge of becoming much more nutrient enriched, with the potential to increase algae levels and decrease aquatic plant growth; the results of which will compromise the fish population.

Wooster Lake has been rated by the Illinois EPA as fully supporting its designated uses overall. This is generally consistent with findings of the LCHD. Future threats to Wooster Lake include: increased nutrient and sediment levels from urban and construction site runoff and upstream lake discharges.

- Duck Lake

Duck Lake is the most downstream of the lakes in the watershed. It is a shallow (9-foot maximum depth), 110-acre natural lake. Most likely, prior to the dredging of the Drain and other modifications, most of the area around Duck Lake would have been little more than large, shallow, open-water marshes. Even now, much of its lakeshore and surrounding areas remain as wetlands, along with some residential development. A significant number of residences that surround the lake are within the 100-year floodplain based on the Fish Lake Drain Floodplain Study (Draft 2003). Overbank flooding is also reported to be a problem for many properties according to the LCSMC Flood Problem Areas Inventory.

Duck Lake has been rated by the Illinois EPA as fully supporting the aquatic life use but it is only partially supporting its designated uses overall. Causes of impairment are listed as habitat alteration, excessive algal growth, and exotic aquatic plant species. These are consistent with conditions reported by the LCHD. Based on LCHD information, additional causes include nutrients, suspended solids, and excessive aquatic plants. Based on the Illinois EPA and LCHD information, sources of impairment include urban runoff, on-site wastewater systems, and shoreline modification (turf-lined edges).

C. Water Quality

Water quality measurements in the lakes indicate that the greatest water quality-related issues are high nutrient levels. To varying degrees, all of the lakes within the watershed suffer from nutrient enrichment and reduced water clarity. Because these lakes are connected via the Drain, poor water quality in one of the lakes represents a threat to the water quality of the lakes downstream. There is also some degree of erosion and reduction in the natural riparian corridors around Fischer, Wooster, and Duck Lakes. Despite these problems, Fischer and Wooster Lakes retain some quality features such as riparian habitat and diverse aquatic plant and fish communities, respectively.

High nutrient levels do not directly impact aquatic organisms, although these nutrients contribute to the growth of filamentous algae in the drain, as was noted along several sub-reaches. This excessive algae growth and decay of algae represent an oxygen demand and contribute to the degradation of aquatic habitat. Nutrient levels much lower than those measured in Fish, Fischer, and Duck Lakes are required to maintain more desirable aquatic plant communities as evidenced by the ability of Wooster Lake to continue to support such communities. In addition to the typical urban and agricultural runoff sources of nutrients, several nursery operations within the watershed may be contributing significant loads.

As evidenced by higher quality macroinvertebrate communities in reaches with good substrate habitat, water quality in Fish Lake Drain itself appears to be adequate to support aquatic life that is less tolerant of poor water quality conditions such as elevated temperature, low oxygen levels, high suspended and dissolved solids, and/or toxic chemicals.

Warmer water holds less oxygen, and low oxygen levels can inhibit fish reproduction and reduce food organism populations. Wind movement across the lakes tends to oxygenate surface water, although the large surface area of the lakes contributes to elevated water temperatures and a reduced ability to hold oxygen. Increasing levels of surface runoff as the watershed urbanizes can also lead to increases in water temperatures. The low gradient and relatively quiescent conditions within the Drain also contribute to low oxygen conditions.

The main effect of high suspended solids concentrations in streams occurs when these solids are transported to depositional areas of the Drain or the lakes, where the particles settle out to the bottom of the waterbody and cover the more desirable gravel substrates (where they exist).

Streambank erosion

Wood debris/beaver dam

Point discharge

Eutrophic condition

Excessive levels of particulate material also create difficult conditions for gill-breathing fish and some of their food sources, including macroinvertebrate organisms. High suspended solids levels in Fish, Fischer, and Duck Lakes suggest that suspended solids levels are also high in the Drain, although observed turbidity levels were low to moderate. The major sources of suspended solids in the Drain appear to be streambank erosion with contributions from urban and agricultural runoff (row crops and landscape nursery operations). High suspended sediment and turbidity levels in the lakes result from high nutrient levels (leading to high algae levels), wind action, carp activity, and shoreline erosion. Suspended solids can be transported to the streams and lakes, even from remote areas of the watershed, via tile drainage, storm sewers, roadside ditches and swales. As the watershed develops, construction site runoff will be a potential growing source of sediment if soil erosion and sediment control practices are not properly designed, installed, and maintained.

Dissolved solids include substances such as salts. One of the most problematic dissolved solids in urban watersheds is sodium chloride, used as road deicing material. Road salt can occur at toxic levels in the water column at intermittent times when the weather conditions demand its use. This salt does not settle out or degrade, and can build up to high levels in the lower waters of small lakes. In addition, being soluble, the salt eventually ends up in the soils and groundwater, if not surface water. Levels of dissolved solids are most likely low in the Drain itself in the spring, summer, and fall. The road network in the watershed is not extensive, with only three major road crossings (Molidor Road, Nippersink Road, and IL-134) and five minor subdivision road crossings, so this pollutant is not of great concern at this time. As the road network increases in response to additional development, this may become another potential source of water quality impairment, particularly as more efficient storm sewer drainage systems are installed.

Potential sources of toxic chemical pollutants to Fish Lake Drain include commercial, industrial, and residential discharges (incidental or accidental), and pesticide contributions from agricultural and lawn management practices. Heavy metals, organics, and other pollutants exist in stormwater runoff and therefore “dumping” or “spills” are not necessary for these to be present. Educational campaigns, such as "Dump no waste, drains to stream" stenciling, can help reduce incidental toxic pollution due to occasional uninformed dumping of materials such as used motor oil. Also, the Solid Waste Agency of Lake County (SWALCO) has household hazardous waste collections a couple of times per month at various locations around the County.

Industrial and commercial activities near Fish Lake Drain are minimal, but increased development may bring such facilities into closer proximity. Appropriate design of new facilities should include practices such as appropriate stormwater management for potentially contaminated water and retrofitting of old buildings might include rerouting of old waste drains or stormwater to treatment facilities. Communities should also be aware that increasing development will most likely increase the chances of accidental pollutant releases into local waterways, and they should be able to coordinate with appropriate agencies for response to such an emergency. In all likelihood, agricultural practices probably represent the greatest current contribution of toxic materials to Fish Lake Drain, although actually measuring pesticide levels in ambient waters is difficult. Modern methods of precise pesticide delivery that aim to target application rates to the most efficient levels, leaving the least amount of waste that may be washed away to the Drain, are desirable both from a business and an environmental perspective.

While water quality in Fish Lake Drain and its chain of lakes appears to be generally good, the challenge for the future will be to reduce inputs from traditional sources, such as agriculture, while also preventing further degradation due to increases from developed areas. Incorporating good soil erosion and sediment control and advanced stormwater management practices as outlined in the BMP Toolbox of Chapter III and Appendix 4 will be essential to minimize water quality impacts as the watershed develops.

D. Drainage System Analysis

The drainage system analysis consisted of three parts: identification of the drainage network (including stream channels, storm sewers, and field tiles), delineation of regionally significant water storage locations, and delineation of potential wetland restoration sites.

Drainage Network

Figure II-17 details the drainage networks identified within the Fish Lake Drain watershed. The drainage network in the developed north area of the watershed is different from that in the farmed south area. In the developed north area, the drainage system is primarily composed of open drainage swales along the roads and a few storm sewers and culverts connecting remote areas to the Drain and the lakes. Newer development in the watershed has been constructed with storm sewers rather than open drainage swales. If this trend continues, the character of drainage in the watershed may change significantly and the number of direct discharges to the stream and lakes could increase.

The watershed south of Fish Lake is not as developed, and is still primarily farm land. There is an extensive field tile network in this part of the watershed. The presence of these tiles and the extensive hydric soils in the southern watershed indicate that a much greater proportion of the southern watershed was covered by wetlands prior to drainage and farming activity. Without the field tiles, it is likely that much of the area would revert back to wetland. Consequently, there is significant wetland restoration potential in this area. Alternatively, if this area becomes more developed, it is likely that these field tile networks will be replaced with storm sewers, which could potentially convey much larger amounts of stormwater to Fish Lake and the other downstream portions of the watershed.

LCSMC conducted a detention basin inventory in 2002. All the 22 basins inventoried were wet detention basins and most had turf side slopes. Two had rip rap at the shoreline and over a third had at least some native vegetation. Most of the basins exhibited little to no shoreline erosion. However, a couple had moderate erosion. Improved long term shoreline stability and water quality benefits could be achieved by establishing native vegetation within the turf-lined basins.

Regionally Significant Water Storage Locations

Nine regionally significant depressional water storage locations were identified in the watershed; the criteria used to identify these locations were:

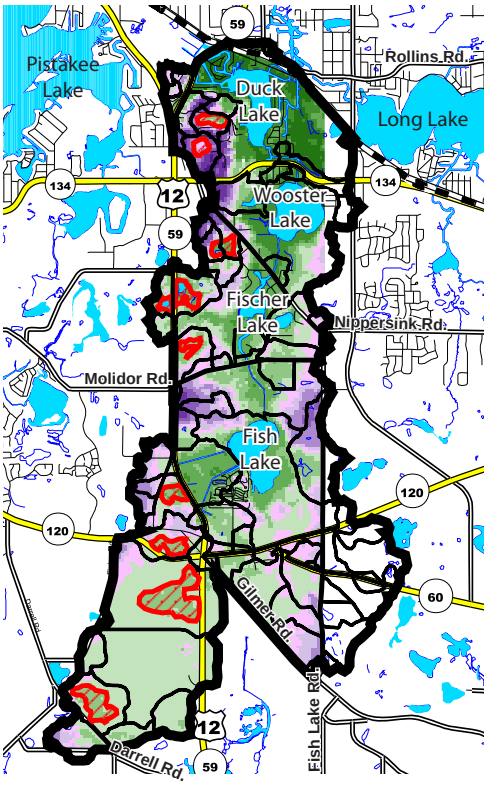


Figure II-15 Regional Significant Depressional Areas Map

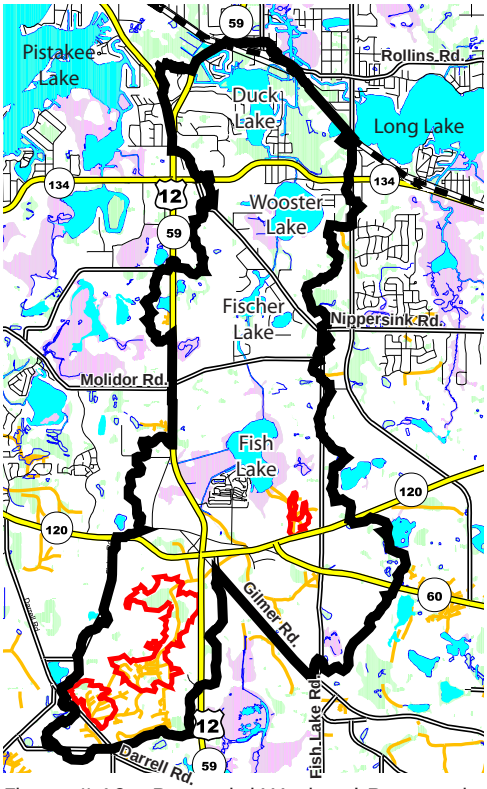


Figure II-16 Potential Wetland Restoration Sites Map

- ✓ Topographic depression greater than five acres
- ✓ Hydraulically disconnected from remainder of the watershed - no or weak surface water connection

The locations of those areas are shown on the Figure II-15.

The large number and size of depressional storage areas in the Fish Lake Drain Watershed is unique relative to other watersheds in Lake County. During the LCSMC floodplain management study (draft), many of the identified depressions were found to have sufficient storage to prevent overflow during even a 100-year event. While a number of the depressions were determined or estimated to have weak hydraulic connections via farm tiles, a number were believed to have no hydraulic connection. Wetlands and hydric soils are associated with each of these depressions.

Each of the depressions has been mapped as floodplain in the draft study and thus the storage associated with them will be protected by the Lake County Watershed Development Ordinance. With development, however, there will be pressure to better drain these areas and provide greater hydraulic connection to the remainder of the watershed. Improving the drainage of these areas could have a significant impact on the hydrology and water quality of the receiving water body (lake or Drain) if the volume of groundwater recharge is decreased and surface water discharge increased.

Four of the depressional locations occur in the southwestern corner of the watershed, where they are separated from the rest of the watershed by US-12/IL-59. One of these locations is identified as an ADID wetland associated with Fish Lake. The other three are non-ADID wetlands currently drained by field tiles, and one of these is an open water wetland.

Three additional locations occur to the west of Fischer Lake, between Molidor and Nippersink Roads. The southernmost location is identified as an ADID wetland. The largest location is bisected by US-12/IL-59 and consists of a degraded open water wetland with a small amount of tile drainage leading to it. The third location, near Nippersink Road, consists of small areas of wetland with larger areas of hydric soils nearby.

The eighth and ninth locations are low-lying areas within existing development west of Duck Lake. A portion of the northern depression and most of the southern depression is wetland.

Potential Wetland Restoration Sites

Based on drainage system analysis, three large potential wetland restoration/creation sites were identified (see Figure II-16) based on the following criteria:

- ✓ Sites are associated with hydric soils but not currently classified as wetland
- ✓ Sites adjacent to existing wetlands
- ✓ Sites affiliated with drainage tiles and therefore hydrology that likely could be restored
- ✓ Sites greater than 5 acres in size
- ✓ Sites not developed

The purpose of this exercise was to identify locations where significant wetlands could be created to mitigate for wetland losses in other areas of the watershed and/or for establishment of wetland banks.

Two significant candidates are located in the southwest lobe of the watershed, where an extensive drain tile network exists within large hydric soil areas. These two sites also include existing wetlands, and therefore restoration of these areas could significantly enhance environmental quality for wildlife habitat and natural open space. A portion of the northern site is currently identified for commercial development in Lakemoor's Comprehensive Plan.

The other potential wetland restoration site is located southeast of Fish Lake. This site is associated with hydric soils and drainage tiles that drain to Fish Lake. Implementation of restoration at this site would not only create a relatively large wetland but would also reduce direct drainage to Fish Lake, thus providing a water quality benefit to the lake.

Although only three restoration sites were identified, most if not all the wetlands in the watershed could benefit from some level of restoration management. In many cases, annual prescribed burns would be the most significant component of the restoration. In some other cases, regrading channels through some of the wetlands to reduce flow could significantly improve hydrology. Management recommendations for selected wetland areas are included in Chapter IV.

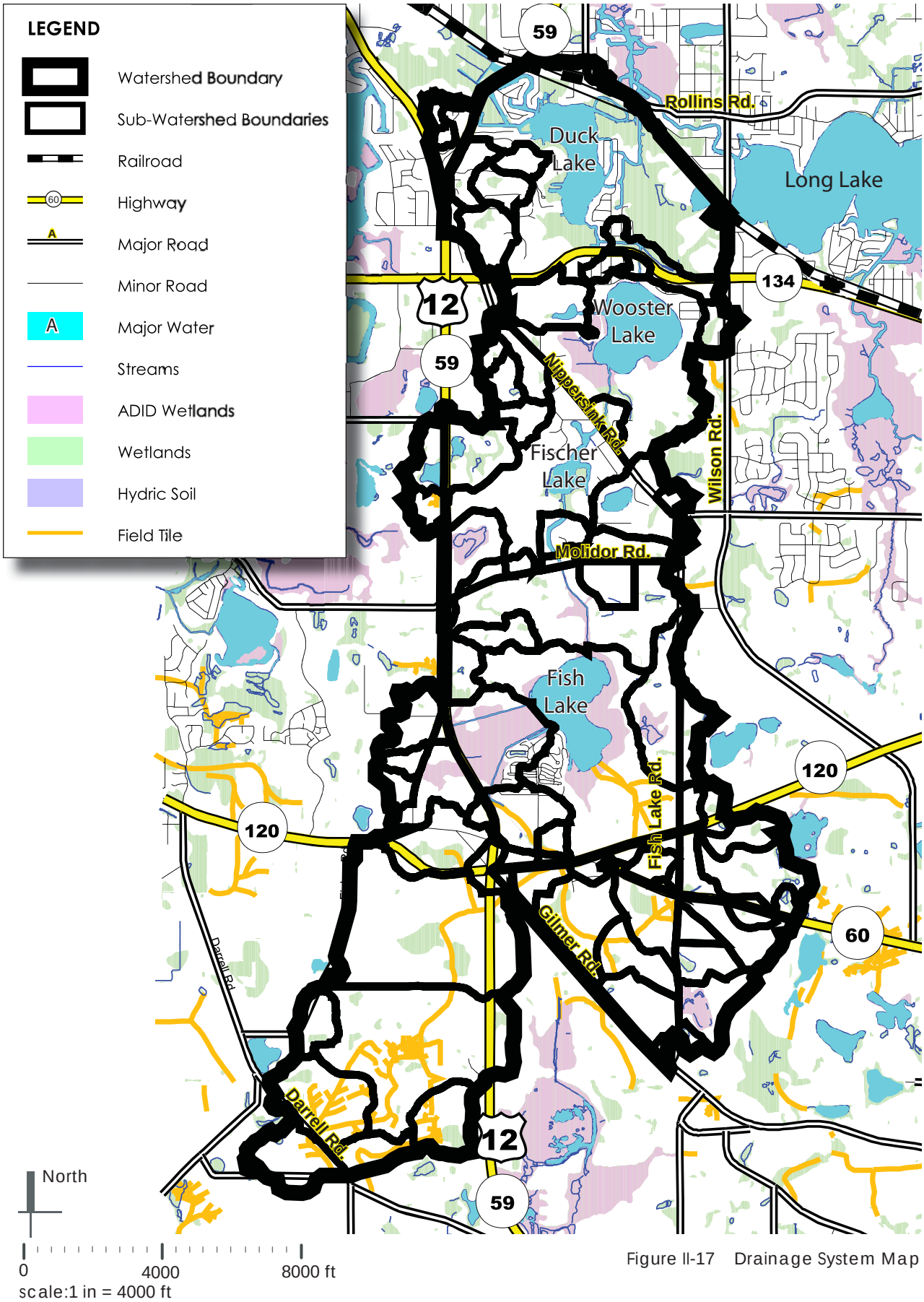


Figure II-17 Drainage System Map

E. Flooding Assessment

A floodplain analysis was performed in 2005 for LCSMC to update the FEMA floodplain mapping. As part of that analysis, 2-year and 100-year flow rates were determined, 10-year through 500-year flood profiles were developed, and the 100-year floodplain amd floodway were mapped. The flow rates, flood profiles, and boundaries are currently under formal review. The floodplain analysis showed that the 2-year and 100-year discharge rates at the watershed outlet are 43 cfs and 253 cfs, respectively. Relative to the watershed drainage area, the flow rates are equivalent to 0.008 cfs/acre and 0.046 cfs/acre for the two events. These unit area flow rates are quite low as a result of the large amount of depressional storage and the broad floodplains.

The flooding assessment performed for this management plan consisted of three parts: identification and mapping of structures within the draft 100-year floodplain; updates of the Flood Problem Areas Inventory (FPAI) based on input from local residents; and evaluation of flood remediation alternatives.

Floodplain Structures

To identify structures in the floodplain, the 100-year floodplain from the 2005 floodplain study prepared for LCSMC was compared to aerial photographs. This comparison indicated that there are 60 structures that appear to be located in the floodplain. These are mapped in Figure II-18. The majority of these occur in the vicinity of Duck Lake, particularly homes in the subdivisions on the northwest side of the lake. A few additional structures, also homes, are within the floodplain along the Drain between Duck Lake and Wooster Lake. Although no structures are highlighted on the map, a portion of the mobile home/campground facility on the southwest corner of Fish Lake is in the floodplain.

In addition to these structures located in the 100-year floodplain, structures built on hydric soils were identified since areas associated with hydric soils often have poor drainage and can be subject to localized flooding. There are 77 structures built on hydric soils outside the floodplain. Most of these are also in the vicinity of Duck Lake and Fischer Lake, with a few additional structures scattered throughout the watershed.

Flood Problem Areas Inventory

Given that many homes surrounding Duck Lake are located in the floodplain, it is not surprising that there are significant areas surrounding Duck Lake that are listed in the FPAI as being prone to overbank flooding. Some of the homes along Fish Lake Drain near Wooster Lake have identified erosion problems, which is consistent with the findings in the Stream Corridor Inventory.

A few areas outside of the floodplain have identified flood problems. These are in localized areas near Wooster Lake and near Gilmer Road and US-12/IL-59. The Wooster Lake area where these problems were reported is in the vicinity of a small depressional wetland area. The Gilmer Road area is near the point where the field tile drain system carries drainage from nearly the entire southwestern lobe of the watershed across Gilmer Road, suggesting that the system is periodically overloaded at this pinch point. The multiple roads in this area would restrict the floodwaters from spreading out into a wider floodplain. One of the structures on hydric soils occurs near this flood problem area.

Flood Remediation Alternatives

- Duck Lake Area

Of the 60 structures located in the floodplain, 58 are located in the area surrounding Duck Lake and downstream from Wooster Lake. As described in the 2005 floodplain study, flood stages for the 10-year through 100-year events, north of IL-134, are controlled by Fox Lake rather than by flood flows from the Fish Lake Drain watershed. Without flooding from Fox Lake, the flood stage surrounding Duck Lake would be 0.9 feet lower for the 10-year event and 1.1 feet lower for the 100-year event. With this lower elevation, the number of houses potentially flooded would be fewer. However, a large number would continue to be flooded by the Fish Lake Drain 100-year flood elevations. For the 10-year event, it appears that four to five homes would be flooded based on the Fox Lake flood stages and none would be flooded based on Fish Lake Drain flood stages. Therefore, the frequency

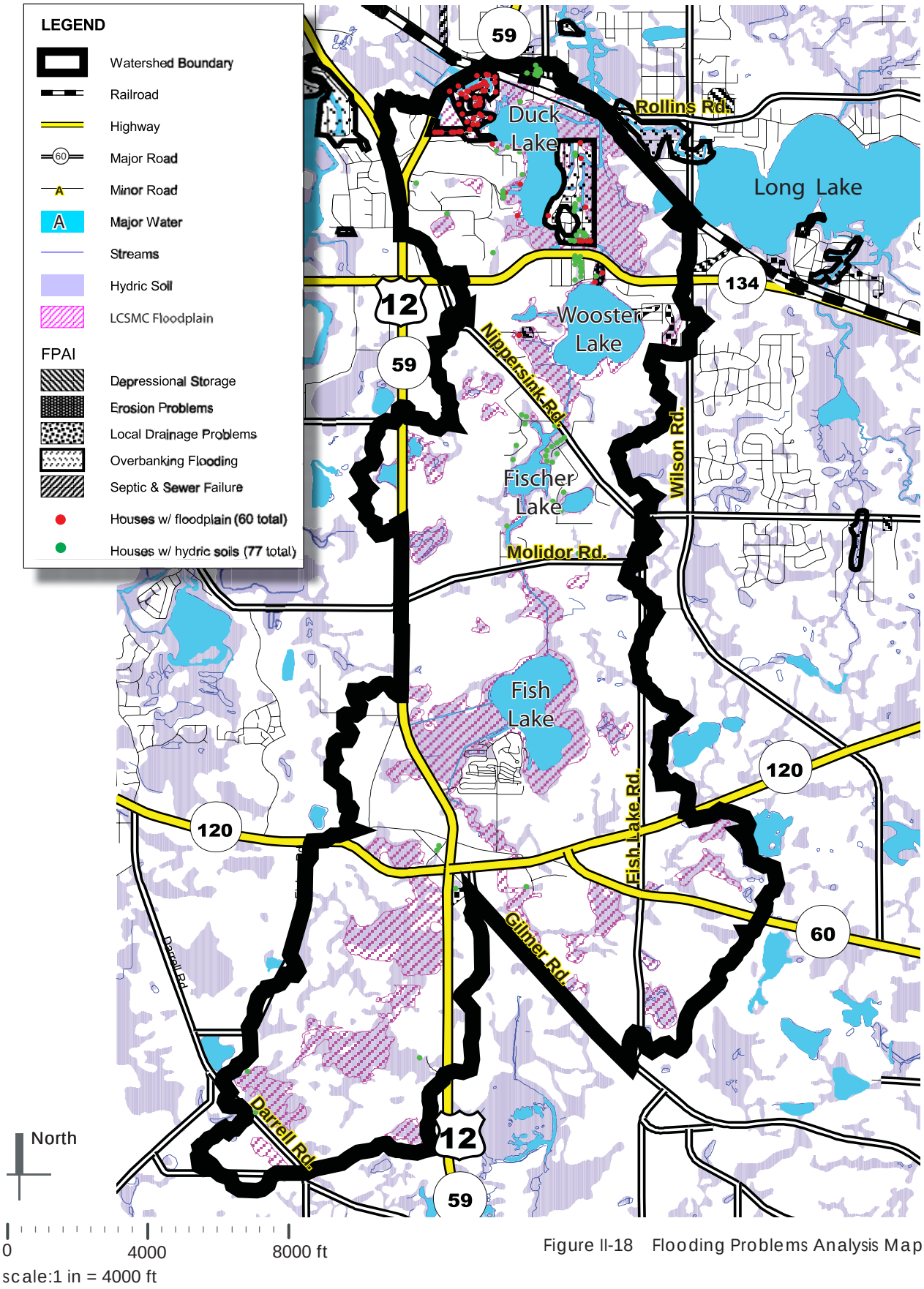


Figure II-18 Flooding Problems Analysis Map

of flooding of these houses could potentially be reduced by decreasing flows to the Duck Lake area or by increasing the capacity of the culverts at Rollins Road and the railroad.

Increasing the size of the culverts at Rollins Road and the railroad would increase downstream flow rates and therefore could increase flooding surrounding Fox Lake. Further, increasing conveyance to reduce flooding is inconsistent with the Lake County Watershed Development Ordinance (WDO); thus, this option was not considered any further.

Flow rates to Duck Lake could be reduced by restricting the culvert at Wooster Lake Road. However, this would increase flood heights surrounding Wooster Lake and increase the number and frequency of structures flooded in the vicinity of Wooster Lake. Further, since the floodplain area in the Duck Lake "pool" (the level floodplain pool surrounding Duck Lake) is nearly twice the area in the Wooster Lake pool, flood heights on Wooster Lake would need to be increased nearly two feet to decrease the flood height on Duck Lake one foot. Increasing flooding on Wooster Lake to decrease flooding on Duck Lake was not considered an acceptable trade-off and therefore not considered further.

Another option to reduce flood heights on Duck Lake would be to increase the flood storage in areas not inhabited by structures. For example, the wetland area east of Forest Avenue could be increased to provide greater floodplain storage in that area. Based on the computer modeling for the 2003 floodplain study, approximately 450 acre-feet of storage would be required to reduce flood stages from the Fish Lake Drain watershed down to an elevation that would cause no damage. Although this would be feasible, the expense would be high, pumps would likely be required to evacuate the storage facility, and it is likely the large wetland would need to be eliminated (excavated). However the wetland could potentially be replaced in the bottom of the facility. Although increasing floodplain storage east of Duck Lake could potentially reduce flood heights during periods when Fox Lake <u>is not</u> flooding, it would have no influence on flood stages when Fox Lake <u>is</u> flooding. For these reasons, it does not appear that there are any financially feasible options for significantly reducing flooding around Duck Lake.

The final and most feasible option is to reduce the damage associated with flooding using floodproofing measures. Floodproofing measures include elevating the structures above flood stage, constructing small landscape berms or walls surrounding individual homes or groups of homes, and water-proofing to prevent water from entering the homes.

- Wooster Lake Area

There are two structures in the area surrounding Wooster Lake that appear to be in the floodplain based on aerial photographs. The outlet culvert controlling the Wooster Lake stage causes significant backwater and Wooster Lake Road overtops during 50- and 100-year events. The 100-year lake level rise for Wooster Lake is approximately five feet and the 50-year rise is more than four feet. Although increasing the size of this culvert could reduce flood stages on Wooster Lake, it would increase flood potential for the already floodprone Duck Lake area. Thus, this is not an acceptable option. Restricting the discharge from Fischer Lake is also not an option as there are several structures surrounding Fischer Lake that are only slightly above 100-year flood stage.

For the reasons described above, floodproofing is recommended for the floodprone structures surrounding Wooster Lake.

Although modification of the Wooster Lake outlet structure is not recommended as a means to reduce flooding, modification of the structure to reduce water level fluctuations for 2-year and smaller events should be evaluated to reduce shoreline erosion. Currently, the weir controlling the lake level is only as long as the culvert and the short weir length causes the lake level to be quite sensitive to flow rates through the lake. Based on the modeling in the 2005 floodplain study, the 2-year stage is nearly two feet greater than the normal water level. If the existing weir was detached from the culvert and a new, longer weir constructed upstream from the culvert, the water level increase during 2-year events could be reduced. However, this potential project needs to be evaluated further to ensure that the modification would not increase downstream flow rates for 10-year and larger events that have the potential to cause flood damages.

F. Pollutant Loading Analysis

The pollutant loading analysis for Fish Lake Drain is based on typical loading rates calculated for each pollutant by land use, as provided by LCSMC. These loading rates were adjusted based on additional information from the Northeastern Illinois Planning Commission (NIPC), and were combined with the land use areas from the existing land use/land cover data shown on Figure II-8 to determine the total loading rates for the watershed.

Pollution Loading Rates

Table II-2 and Table II-3 list land uses for which pollutant loading rates were available, along with the adjustments proposed for the Fish Lake Drain watershed based on the additional information from NIPC for total phosphorus (TP) and total suspended solids (TSS). In general, residential lands are unsewered in the Fish Lake Drain watershed except high density residential areas around Duck Lake. A summary of the pollutant loads from each land use and for the watershed as a whole is provided in Table II-4.

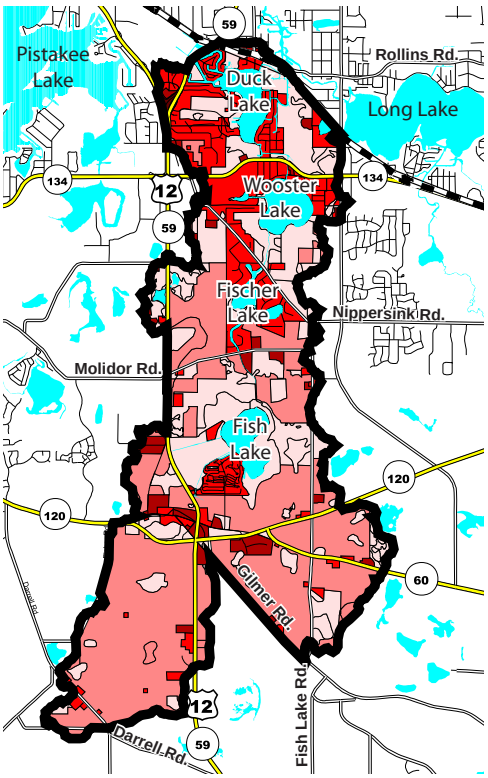


Figure II-19 Total Phosphorous Loading Map

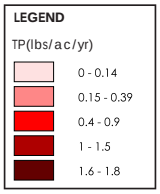


Table II-2 Total Phosphorous Loading Rate

Land Use	NIPC Load (lbs/ac/yr) Sewered	NIPC Load (lbs/ac/yr) Unsewered	Lake County Load (lbs/ac/yr)	Proposed Fish Lake Drain Load (lbs/ac/yr)
Commercial	1.30	1.20	1.30	1.30
Industrial	1.50	1.30	1.50	1.50
Institutional	1.40	0.80	1.40	1.40
Transportation	1.80	1.10	1.80	1.80
Residential	0.81	0.40	0.81	0.81(sewered) 0.40(unsewered)
Agriculture	-	0.36	0.18	0.36
Vacant	0.22	0.088	0.22	0.088
Open Space	0.39	0.13	0.39	0.13

Pollutant Loading Analysis Summary

Although the more intensive commerical/industrial/ transportaion land uses have the greatest unit area loading rates, the proportion of the watershed devoted to these uses is relatively small. Most of the total load for TP, therefore, is from agricultural and unsewered residential land uses. For TSS, both transportation and commercial land uses produce greater watershed loads than residential despite their relatively smaller area. Because agriculture covers almost as much watershed area (44%) as all other uses combined, it produces the greatest TSS load.

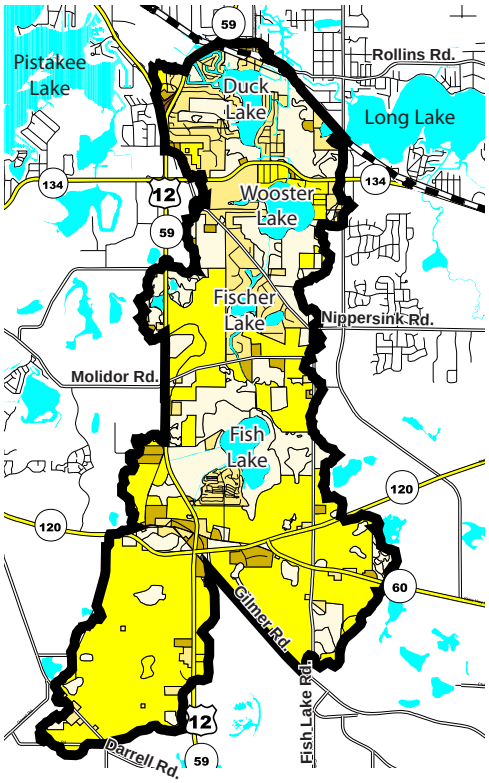
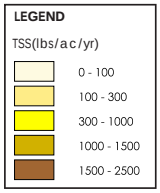


Figure II-20
Total Suspended Solids Loading Map



TP and TSS are the primary pollutants of concern for this relatively rural, lake-oriented, and flat gradient watershed. Nutrients are of greatest concern for the water quality of the lakes, and also indirectly for the streams, due to the impact of nutrient enrichment on increasing algae growth. TSS is also a concern due to the impact of sedimentation on habitat quality in the streams, lakes, and wetlands.

Because of the relatively small proportion of commercial and industrial land uses in the watershed, the load analysis was limited to TP and TSS. (See Figures II-19 and II-20).

It should be noted that the analysis above is based strictly on loading rates that are typical for the given land uses and not on any watershed-specific data. The analysis also does not reflect the influence that watershed depressional storage and lakes have on delivery of pollutants to the watershed outlet. Thus, the watershed totals in Table II-4 are likely higher than what is actually leaving the watershed. Instead the values should be viewed as the total load to various water resource areas both inside and outside the watershed.

It should be noted that there was no water quality sampling performed as part of this watershed planning effort. A comprehensive water quality sampling program is quite

Table II-3 Total Suspended Solids Loading Rate

Land Use	NIPC Load (lbs/ac/yr) Sewered	NIPC Load (lbs/ac/yr) Unsewered	Lake County Load (lbs/ac/yr)	Proposed Fish Lake Drain Load (lbs/ac/yr)
Commercial	1180	1040	1180	1180
Industrial	1240	1080	1240	1240
Institutional	1320	790	1320	1320
Transportation	2260	1330	2260	2260
Residential	309	154	309	309 (sewered) 154 (unsewered)
Agriculture	-	307	153	307
Vacant	100	40	100	40
Open Space	61	20	61	20

Table II-4 Pollution Loads Summary

Landuse	TSS	TP	Acres
Commercial	163602	180.24	138.65
Industrial	73345	88.72	59.15
Institutional	26830	28.46	20.33
Transportation (TCU)	157637	125.55	69.75
Residential (sewered)	4296	11.26	13.90
Residential (unsewered)	145175	377.08	942.69
Agriculture	737921	865.31	2403.65
Vacant	26916	59.21	672.90
Open Space	3230	21.00	161.52
Total	**1338952**	**1756.84**	**4482.54**

expensive and was beyond the scope of this effort. Instead, observed conditions with the Drain and the generalized loadings presented here were used to assess the causes and sources of watershed impairment as previously discussed.

Tables II-2 and II-3 indicate that it is particularly important to address runoff from intense land uses such as commercial, industrial, and transportation as these uses produce proportionately much greater pollutant loadings than other land uses. However, because these land uses currently (and in the future) occupy a relatively small proportion of the watershed, it will continue to be important to address residential and agricultural runoff as well (see total loads of Table II-4). The maps indicate that a significant portion of the potential load is from areas south of IL-120 and surrounding Fish Lake. Because of the relatively low level of hydraulic connection of the areas south of IL-120 to the remainder of the watershed, it is likely that much of the potential load does not actually reach Fish Lake. However, as the watershed urbanizes, there will likely be pressure to increase the hydraulic connection of areas south of IL-120, which could disproportionately increase the load to Fish Lake. Although to a lesser degree, similar statements could be made relative to Fischer, Wooster, and Duck Lakes as they all have internally drained areas within their sub-watersheds that currently contribute little surface runoff.

G. Summary of Impairments, Causes and Sources

Causes and sources of impairment (Table II-5) for Fish Lake Drain are derived primarily from the Illinois Environmental Protection Agency Illinois Water Quality Reports (305(b)) and are based on the professional opinion of watershed planners and engineers, observed conditions, and conditions typical of urbanizing watersheds in the region. This table summarizes the findings of the watershed inventory and assessment in previous sections of this chapter. Impairments include water quality, habitat degradation and alteration, increased flood flows, and flood damages. Aquatic life toxicity, primarily chlorides, was identified as potential future water quality impairment within the watershed plan assuming future conventional watershed development. Causes and sources of impairment are identified for the stream channel of Fish Lake Drain in its entirety; lake impairments are addressed within Lake County Health Department reports.

Table II-5 Summary of Impairments, Causes and Sources

Impairment	Causes	Sources
Water Quality	Total suspended solids / turbidity (may also include sedimentation and siltation)	Urban runoff
		Bank modification and destabilization
		Agricultural activity / nursery operations
		Development / Land use conversion
		Inappropriate land management
		Online lakes / impoundment / dams
Water Quality	Nutrients (phosphorous, algal growth, low DO)	Urban runoff
		Agricultural activity / nursery operations
		Animal waste
		Unsewered residential (septic) [modeled]
Water Quality*	Aquatic life toxicity (chlorides)	Urban runoff (heavy metals, organics)
		Agricultural activity / nursery operations (pesticides)
		Road salt and storage/ highway maintenance and runoff
Habitat degradation and alteration	Lack of habitat characteristics (pools, riffles, substrate, meandering, cover, streambanks)	Channelization
		Bank modification and destabilization
		Online lakes / impoundment / dams
Habitat degradation and alteration	Hydrologic disturbance / flow alterations (increase or decrease of streamflow)	Urban runoff
		Development / Land use conversion
		Loss / drainage of depressional storage
Habitat degradation and alteration	Draining, filling, and degradation of wetlands	Agricultural activity
		Development / Land use conversion
Habitat degradation and alteration	Exotic and invasive species (wetlands)	Spread from existing infestations
Habitat degradation and alteration	Loss/reduction/degradation of natural buffer	Development / Land use conversion
		Inappropriate management
		Agricultural activity
Habitat degradation and alteration	Loss of natural management mechanisms**	Lack of natural management mechanisms**
Increased flood flows	Increased rate and volume of runoff	Urban development / runoff / loss of infiltration capacity
Increased flood flows	Loss / drainage of depressional storage	Agricultural activity
		Development / Land use conversion
Flood damages	Past encroachments on floodplain	Past floodplain development
Flood damages	Creek obstruction	Bridges, culverts, debris

* Water quality impairment due to aquatic life toxicity is considered a *potential* impairment that may result from future conventional watershed development.

** Natural management mechanisms include fire, natural predation, etc. that have been removed from by human intervention

III Watershed Management Toolbox

This chapter consists of two sections that are designed to provide the building blocks, or tools, for watershed and stormwater management in the Fish Lake Drain Watershed. Each of these tools are referenced in the actions and recommendations of Chapter IV. Section A of this chapter identifies a Green Infrastructure Plan that serves as a blueprint for water resources protection for the watershed. It is designed as a watershed-scale water resources overlay to the comprehensive plans of the municipalities and the County. Section B of this chapter illustrates best management practices (BMPs) that may be applied at various scales and to various land uses. The BMPs include policy/regulation, planning/zoning, and stormwater management tools. Integrating these tools, and applying them accordingly, in the Fish Lake Drain Watershed area will help to promote the most effective watershed management plan and achieve the goals and objectives of the project.

A. Green Infrastructure Plan

The purpose of a Green Infrastructure Plan is to indicate the most appropriate locations for the preservation of open space that will protect and enhance natural hydrologic functions and natural features of the watershed with a focus on the aquatic environment. The intent is to allow movement of runoff through the watershed in a manner that enhances the aquatic ecology of the watershed, and at the same time provides natural conveyance, floodwater storage, and water quality benefits. Natural features include streams, wetlands, lakes, forest preserves, and other significant open space. As water is the essential element in the watershed, water resources and hydrologic functions are emphasized in the Fish Lake Drain Watershed Green Infrastructure Plan. Forest preserves, parks, and other open space considered during the process are critical large patches of natural resources that are important to provide a sound and healthy environment to protect natural features, wildlife habitat, flood mitigation, and an open space network. In short, a well-developed Green Infrastructure Plan delineates a critical open space network to protect hydrologic and ecologic natural resources in the watershed.

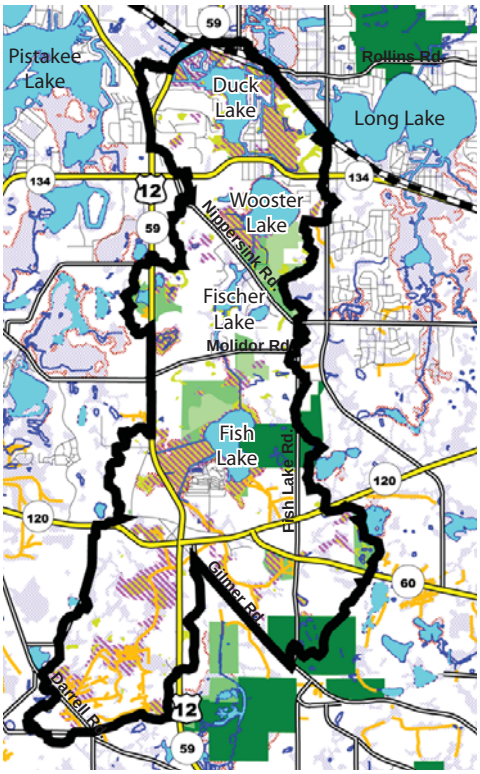
The Criteria

The following features and criteria were used to delineate the Green Infrastructure Plan in the Fish Lake Drain watershed:

- Floodplains, lakes, and wetlands
- Minimum 100-foot buffers around ADID wetlands and 50-foot buffers around other wetlands, streams, and lakes
- Use hydric soils as connectors between isolated wetlands to create larger complexes
- Consider drainage tile routes and other wet or depressional areas as other potential connectors
- Connect significant open space, such as forest preserves
- Exclude from the Green Infrastructure Plan boundary areas that are already developed

The Process

The following steps were employed in the development of the Green Infrastructure Plan, using the criteria outlined above:



Step 1: Identify water resources, natural features, and open space

Step 1: Identify water resources, natural features, and open space.

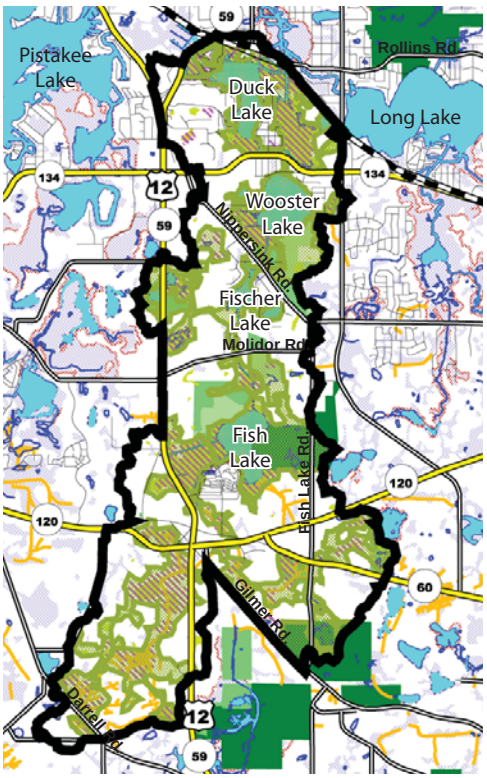
The purpose of this step is to identify all the ingredients that will be used to define the Green Infrastructure Plan. These ingredients include: water resources such as floodplains, streams, lakes, wetlands, ADID wetlands, hydric soils, and drainage tiles; and open space such as forest preserves, recreation center, camp grounds, and existing parks.

Step 2: Outline Preliminary Green Infrastructure Plan.

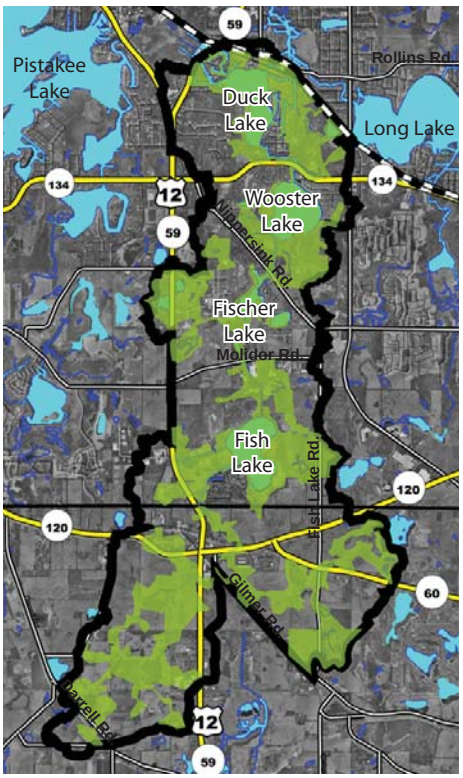
After identifying the components in Step 1, the next step is to outline a draft Green Infrastructure Plan based on the criteria described earlier. Essentially, the Plan includes floodplains, streams, lakes, and wetlands, and their buffers, and existing protected open space. Then hydric soils are used to connect isolated patches to the larger network.

Step 3: Refine Green Infrastructure Plan by removing existing developed areas from the boundary of the Plan.

After developing the preliminary Green Infrastructure Plan, the last step is to refine the Plan to exclude existing developed areas from the Plan boundary using aerial photos and existing land use plans.



Step 2: Outline the Plan based on natural resources



Step 3: Refine the Plan by excluding developed areas

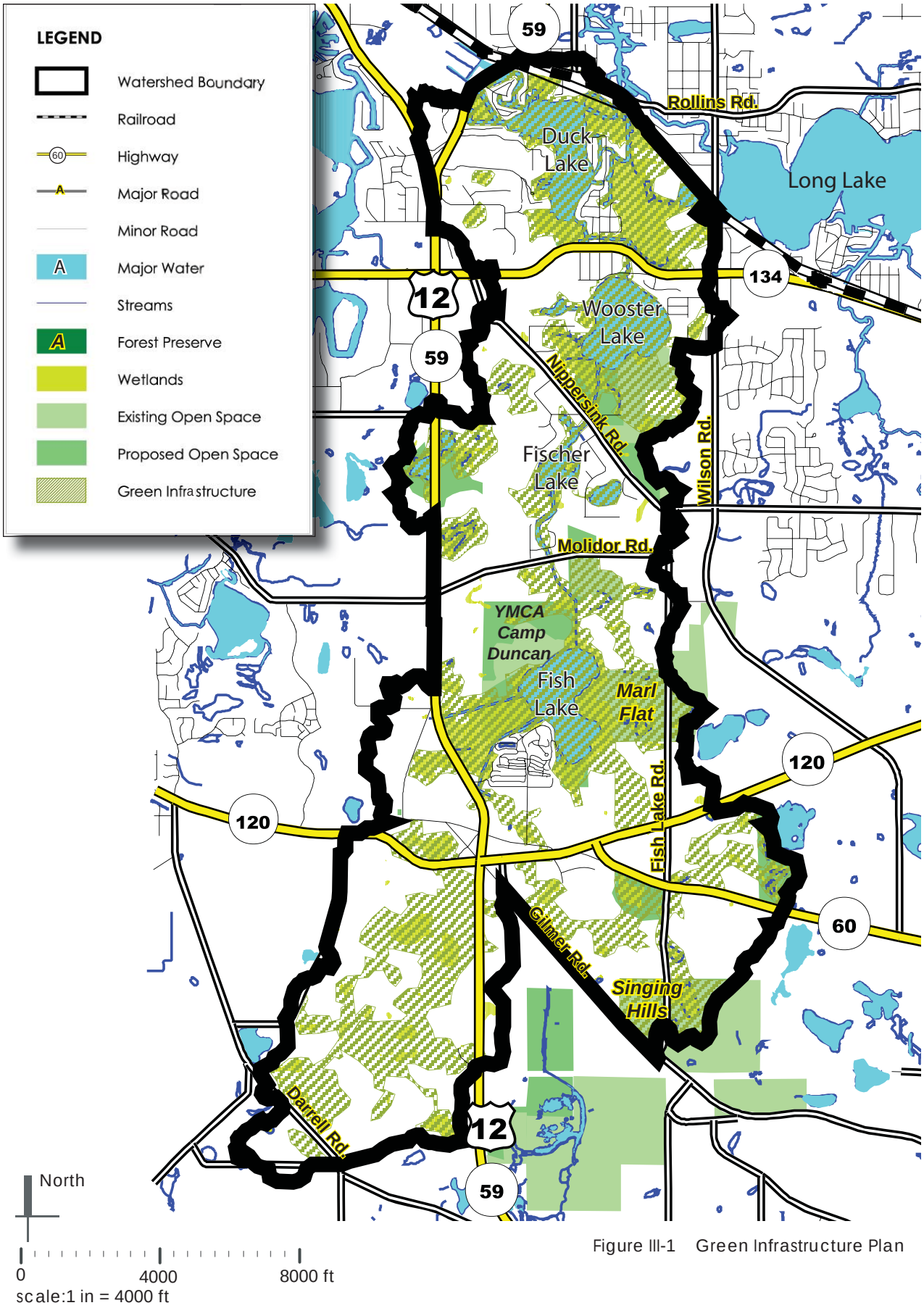


Figure III-1 Green Infrastructure Plan

The Green Infrastructure Plan helps to preserve natural resources and wildlife habitat in the watershed.

The Results and Conclusions

The Green Infrastructure Plan (see Figure III-1) for the Fish Lake Drain watershed was based on watershed inventory and drainage system analysis data that were discussed in Chapter II.

The Plan consists of undeveloped floodplain, all ADID and most other wetlands, and some non-wetland hydric soil areas that are critical elements of watershed protection and preservation. In addition to the expected areas north of IL-120, significant areas south of IL-120 were also included in the Plan. Although the actual wetland area south of IL-120 is somewhat limited, this area has the greatest concentration of hydric soils and those soils are extensively drained. Thus, with strategic tile removal, this area could revert to a large wetland complex that could rival the Duck Lake wetland complex in size. Finally, the Plan includes regionally significant depressional areas (see Chapter II, Section D).

Implementation of the Green Infrastructure Plan would include the following actions:

- Delineate the open space network on existing and future land use plans;
- Modify zoning and development codes to facilitate implementation of the Plan;
- Pursue protection of key resource areas and areas not readily protected through stream, wetland, floodplain, and buffer standards using purchase of development rights or conservation easements; and
- Develop management plans for areas within the open space network.

B. Stormwater Best Management Practices Tools

This section presents a brief, illustrated overview of a variety of policy/regulation, site planning, and stormwater/ landscaping best management practices (BMPs.) Each of the BMPs was integrated into the Fish Lake Drain watershed management action items and recommendations presented in Chapter IV. Policy/regulations BMPs provide the legal framework for conservation development, while planning process BMPs are on-site strategies that protect natural features and facilitate conservation stormwater BMPs. Stormwater BMPs are individual practices that achieve on-site stormwater management objectives. Common to many of the techniques is the use of native plants that function not only as a part of an effective stormwater management system but also as native landscapes. Following the brief descriptions, more detailed information is provided including guidance on applicable scale and land use, benefits and effectiveness, and design considerations.

Apply stormwater BMPs to improve water quality (Duck Lake)

Policy/Regulations BMPs

Policies and regulations serve as the first step to establish and then enforce minimum standards for natural resource protection and stormwater management. Policies express goals for natural resource, water quality, habitat, and open space protection. Regulations (along with zoning described below) are the tools used to implement the policies. Policy actions or regulations include: acquisition of Conservation Easements, Wetland/Stream Management and Restoration, and adoption of Watershed Development Ordinances.

Conservation Easement: Legal mechanism for landowner to place voluntary restrictions on the future use of their land. Generally requires landowner to sell, permanently relinquish, or donate the rights of development.

Watershed Development Ordinance: Ordinance to regulate development and minimizes on-site and off-site impacts to flooding and water quality.

Wetland/Stream Management and Restoration: Practices that restore and/or create healthy aquatic ecosystems. Activities include stream corridor restoration, hydrologic restoration, and vegetative management. In some cases, creation of wetland banks and fee-in-lieu of wetland mitigation can be used as funding mechanisms for wetland creation and enhancement.

Conservation Development Site Plan Example (CDF)

Bioswales along streets (Seattle, WA)

Filter Strips/ Level Spreaders (Chesterton,IN)

Green Roof (Portland, OR)

Naturalized Detention (Bolingbrook, IL)

Planning Process BMPs

Planning/Zoning-related practices are also used to implement policy goals of maintaining high environmental quality as a watershed develops. Significant natural features and other areas to be protected are identified using environmental planning processes. Many of these areas can then be protected through open space and other protective zoning. Open Space/Natural Greenway delineation, Riparian Buffers, and Floodplain Zoning are tools used to protect natural resource areas from development. Conservation Development and Impervious Area Reduction are critical site-level planning and design strategies to create environmentally sensitive developments to achieve stormwater management and watershed goals.

Open Space/Natural Greenway: Designation of linear open spaces and/or natural areas as greenways, to preserve and to connect significant natural features and accommodate aesthetic, recreational, and/or alternative transportation uses.

Riparian Buffer: A buffer of native vegetation along lakes, streams, and wetlands that provides water quality and habitat benefits.

Floodplain Zoning: Zoning regulations established to protect stream corridors and floodplains from urban development and other encroachments.

Conservation Development: Site planning and design approach that preserves existing natural areas and utilizes naturalized drainage and detention measures for stormwater management, energy consumption, transportation efficiency, and habitat enhancement.

Impervious Area Reduction: Impervious area reduction can be achieved in a number of ways, such as: narrower streets; shorter streets in lower density residential neighborhoods; creative driveway design; shared parking facilities; and designing roads, walkways, and trails for multiple uses as an integrated system.

On-Site Stormwater BMPs

On-site stormwater BMPs are site-specific practices that can minimize on-site and off-site hydrologic and water quality impacts derived from stormwater runoff via methods of incorporating and re-establishing natural hydrologic processes into an urbanized environment. These measures can be designed and implemented into new development as well as retrofitted into existing development in cost effective ways.

Bioswale: Filtration and infiltration systems planted with grasses and forbs, and designed to filter, retain and evapotranspirate stormwater. Vegetation enhances filtration, cooling, and cleansing of water to improve water quality and prevent sealing of subsoils. The bioswales typically include an infiltration trench below the vegetated swale to provide temporary storage to increase the volume of runoff water infiltrated.

Filter Strip/Level Spreader: Filter strips are an area of dense, preferably native, vegetative cover used to filter and absorb runoff. Level spreaders, often used in conjunction with filter strips, are laid on the contour to distribute runoff over filter strip areas. Filter strips/level spreaders are can be used within stream and wetland buffers to de-concentrate stormwater prior to discharge to streams and wetlands.

Green Roofs: Vegetated roof system designed to capture, temporarily store, and evapotranspirate rainwater on the top of roofs. Typically, green roofs are planted with drought and wind tolerant vegetation. Green roofs can be designed as simple, lightweight systems that provide stormwater benefits, or as more elaborate rooftop gardens that also provide outdoor space.

Naturalized Detention: Naturalized detention basins are used to temporarily store runoff and release it at a rate allowed by ordinances. Native wetland and prairie vegetation improves water quality and habitat benefits. Naturalized detention basins can be designed as either shallow marsh systems with little or no open water or as open water ponds with a wetland fringe and prairie side slopes.

Porous Pavement: Permeable or perforated paving materials with spaces that allow for the infiltration of rainwater and the transmission of water to aggregate base and subsoils. Runoff is temporarily stored in the base for infiltration into the subsoils and/or slow release to a bioswale or stormwater system.

Rain Barrel/Cistern: A vessel used to capture and temporarily store rainwater for various uses, including landscape irrigation, reuse for graywater purposes, etc.

Rain Garden: A landscaped garden designed to retain, detain, infiltrate, and evapotranspirate stormwater runoff from individual lots and roofs.

Vegetated Swale: Vegetated stormwater feature that conveys, retains, infiltrates and cleanses stormwater. Native vegetation enhances filtration and retention of stormwater.

Porous Pavement (Elmhurst, IL)

Rain Barrel (Chicago, IL)

Rain Garden (Maplewood, MN)

Vegetated Swales (Madison, WI)

Native Landscaping (Geneva, IL)

Landscaping BMPs

Landscaping, as a BMP, stands alone in its own category due to the importance of vegetation in biodiversity, aesthetics, habitat, cooling of ambient air, and stormwater management. Native landscapes, including native prairies and wetlands, can improve water quality through infiltration and cleansing of stormwater runoff. Properly designed landscapes that incorporate native plants and hydrologically and ecologically appropriate vegetation cannot only facilitate effectiveness of stormwater management but also provide wildlife habitat and quality open space.

Native Landscaping: Native vegetation in either large restoration or smaller garden projects. Native vegetation uses plants that are endemic to a specific geographic region prior to European settlement. Native landscapes can serve a variety of purposes, including habitat, infiltration, filtering, and evapotranspiration of stormwater, and wildlife habitat.

Wetlands/Stream Management and Restoration: Landscape restoration practices that maintain existing remnant landscapes and/or restore them to their natural state.

Flood Reduction BMPs

Structural Flood Control: Structural measures control or contain water and are generally designed to prevent floodwaters from reaching buildings. Structural alternatives generally include: reservoirs, levees and floodwalls, diversions, stream channel conveyance improvements and drainage and storm sewer improvements. Because of their size and cost, structural projects are often implemented with help from state or federal flood control agencies such as the Illinois Department of Natural Resources - Office of Water Resources, or the U.S. Army Corps of Engineers.

Non-Structural Flood Control: In addition to structural controls for flood remediation, flooding problems can also be addressed using non-structural means. Some of the non-structural flood control techniques include floodproofing, acquisition of floodplain buildings, building elevation, and building relocation. More communities and county-wide agencies could get involved in non-structural programs such as acquisition by helping to identify repetitively flooded properties.

Each of the BMPs vignette begins with its definition and continues with its range of applicability, associated benefits, and finally some potential design considerations. A more detailed description of these specific discussion categories follows:

Definition - A brief description of the BMP relative to stormwater management.

Applicability - Where and how each BMP is the most applicable is addressed in three aspects: scale, applicable applications, and effectiveness:

Scale
- Watershed/County: Applied at a regional scale in watershed or county-wide.
- Town/Village: Applied at municipal or other scale with common zoning authority.
- Neighborhood: Applied at development or other sub-municipal scale.
- Lot: Applied within individual residential lot or commercial parcel.

Applications
- Retrofit: Applied to existing developed areas, infill, and redevelopment.
- New: Applied to new development.
- Roofs: Applied on roofs or used to treat roof runoff.
- Streets: Applied on or used to treat runoff from public/private streets and roads.
- Driveways: Applied on or used to treat runoff from driveways.
- Parking Lots: Applied on or used to treat runoff from parking lots.
- Lawns: Applied on or used to treat runoff from existing open lawns that are generally planted with turfs, such as parks, campuses, individual yards, etc.
- Sensitive Areas: Applied on ecologically sensitive areas such as remnant habitats, floodplains, wetlands, steep slopes, and highly erodible soils.

Effectiveness
- Runoff Rate Control: Practices that can control or reduce runoff rates.
- Runoff Volume Control: Practices that can control or reduce runoff volumes.
- Physical Habitat Preservation/Creation: Practices that can preserve, introduce, or provide wildlife habitats.
- Sediment Pollution Control: Practices that can remove suspended solids from runoff.
- Nutrient Control: Practices that have the ability to reduce or remove nutrients such as nitrogen and phosphorus from runoff.
- BOD Control: Practices that can remove constituents that exert a Biological Oxygen Demand (BOD) in runoff.
- Other Pollutant Control: Practices that can reduce and remove other pollutants such as heavy metals and petroleum-based hydrocarbons.

Benefits - Other positive effects that the individual or system of practices performs. Benefits can be specific to stormwater management or be more general to various functions and values for the quality of life.

Design Considerations - Design recommendations and suggestions that should be considered when implementing the specific BMP. Drawings are not illustrated for construction, but rather as a general guidance on the components of the practice. (See Tables III-1 and III-2 BMP Tool Applicability and Effectivenes)

Table III-1

Fish Lake Drain Watershed Stormwater Management Tool Applicability

Tools	Scale				Applications							
	Watershed/ County	Town/ Village	Neighbor-hood	Lot	Retrofit	New	Roofs	Streets	Drive-ways	Parking Lots	Lawns	Sensitive Areas
Policy/Regulations												
Conservation Easement	X	X	X	X	X	X						X
Wetland/Stream Management and Restoration	X	X	X	X	X	X						X
Watershed Development Ordinance	X	X			X	X	X	X	X	X	X	X
Planning/Zoning												
Conservation Development	X	X	X			X		X	X	X	X	X
Floodplain Zoning	X	X			X	X						X
Impervious Area Reduction		X	X	X		X	X	X	X	X		
Open Space/Natural Greenway	X	X	X		X	X						X
Riparian Buffer	X	X	X	X	X	X					X	X
Site Stormwater BMPs												
Bioswale			X	X	X	X		X		X		
Filter Strip/Level Spreader			X	X	X	X			X	X	X	X
Green Roof				X	X	X	X					
Naturalized Detention	X	X	X		X	X	X	X	X	X	X	X
Porous Pavement			X	X	X	X		X	X	X		
Rain Barrel/Cistern				X	X	X	X					
Rainwater Garden				X	X	X	X		X		X	
Vegetated Swale			X	X	X	X	X	X	X	X	X	
Landscaping												
Native Landscaping			X	X	X	X	X	X	X	X	X	X

"X" = practices that are applicable to corresponding scale and applications

Table III-2

Fish Lake Drain Watershed Stormwater Management Tool Effectiveness

Tools	Effectiveness						
	Runoff Rate Control	Runoff Volume Control	Physical Habitat Preservation/ Creation	Sediment Pollution Control	Nutrient Control	BOD Control	Other Pollutant Control
Policy/Regulations							
Conservation Easement	-	-	H	-	-	-	-
Wetland/Stream Management and Restoration	-	-	H	H	M	-	-
Watershed Development Ordinance	H	H	H	H	H	H	H
Planning Process							
Conservation Development	H	H	H	H	H	H	H
Floodplain Zoning	H[1]	-	H	-	-	-	-
Impervious Area Reduction	H	H	-	H	H	H	H
Open Space/Natural Greenway	-	-	H	-	-	-	-
Riparian Buffer	M	-	H	M	M	M	M
Site Stormwater BMPs							
Bioswale	H	H	-	H	H	H	H
Filter Strip / Level Spreader	M	M	-	H	H	H	H
Green Roof	H	H	-	-	-	-	-
Naturalized Detention	H	-	M	H	H	H	H
Porous Pavement	H	H	-	H	M	M	H
Rain Barrel / Cistern	-	M	-	-	-	-	-
Rainwater Garden	M	M	-	-	-	-	-
Vegetated Swale	M	M	-	M	M	M	M
Landscaping							
Native Landscaping	-	M	M	M	M	M	M

1 Prevents flood damage as a result of high flow rates

"H" = High effectiveness; "M" = Moderate effectiveness; " –" = Not Applicable

Policy/Regulations

Conservation Easement

conservation easements provide mechanism for long term protection of morphologically-based corridors

Definition

- Legal mechanism for landowner to place voluntary restrictions on the future use of their land. Generally requires landowner to sell, permanently relinquish, or donate the rights of development.

Applicability

Scale	☒ Watershed/ County	☒ Town/Village	☒ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☐ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☐ Lawn	☒ Sensitive Areas	
Effectiveness	☐ Runoff Rate Control	☐ Runoff Volume Control	☒ Physical Habitat Preservation/ Creation	☐ Sediment Pollution Control
	☐ Nutrient Control	☐ BOD Control	☐ Other Pollutant Control	

Benefits

- Preserves significant natural features and open space.
- Protects created/restored natural areas from development and other disturbances.
- Provides opportunity to protect morphologically and ecologically-based corridors that may be more difficult to protect with fixed width buffers in many stormwater ordinances.
- Can be used as a tool to create interconnected network of open space to improve ecological functioning of overall system.

Design Considerations

- Conservation easements, along with floodplain/open space zoning, ordinance buffer requirements, and conservation design should be used to preserve and create natural resource networks.
- Conservation easements are best suited to areas not subject to land use change and therefore cannot readily be protected through the development process.
- Conservation easements may also be used to protect high quality uplands and other areas not readily protected through zoning and/or stormwater ordinances.

one's backyard may be wildlife's treasure habitat

Wetland / Stream Management & Restoration

Coffee Creek streambank restoration (Chesterton, IN)
(Conservation Design Forum)

Definition

- Practices that maintain a healthy ecosystem and/or restore a deteriorated ecosystem to its natural state.

Applicability

Scale	☒ Watershed/ County	☒ Town/Village	☒ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☐ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☐ Lawn	☒ Sensitive Areas	
Effectiveness	☐ Runoff Rate Control	☐ Runoff Volume Control	☒ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control
	☒ Nutrient Control	☐ BOD Control	☐ Other Pollutant Control	

Benefits

- Preserves significant natural features and their habitat, runoff moderation, and water quality benefits.
- Reduces the impact to natural systems by floods and other natural perturbations and improves recovery from these disturbances by preserving natural processes and functions.

Design Considerations

- Conduct a thorough analysis of existing and historic conditions of the restoration site, surrounding area, and watershed to understand system processes and functions.
- Establish stewardship program with local governments, stakeholders, interest groups, and communities to ensure sustained management and monitoring efforts on managed/restored ecosystems.
- Management and stewardship activities should be recognized as ongoing activities. Intensiveness of stewardship activities will decrease as system health and processes are restored.

a successful wetland restoration ensures the healthiness of ecosystems and improves quality of life for both human and wildlife

Policy/Regulations

Watershed Development Ordinance

watershed development ordinances are designed to preserve and enhance natural site features and protect downstream areas from stormwater impacts

Definition

- Ordinance to regulate development for the purpose of minimizing on-site and off-site impacts to flooding and water quality.

Applicability

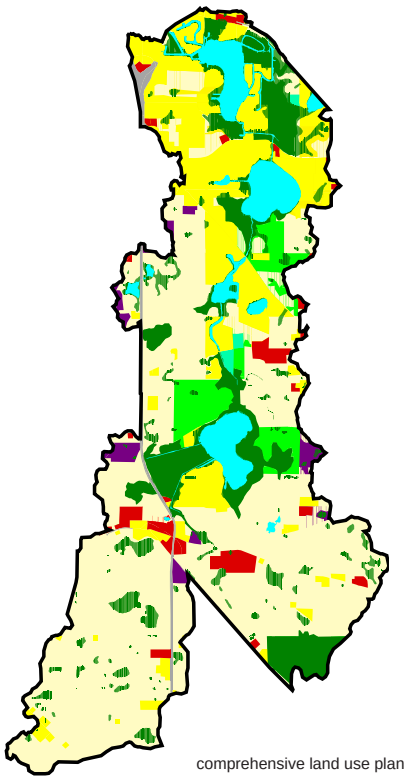
Scale	☒ Watershed/ County	☒ Town/Village	☐ Neighborhood	☐ Lot
Applications	☒ Retrofit	☒ New		
	☒ Roofs	☒ Streets	☒ Driveways	
	☒ Parking Lots	☒ Lawn	☒ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☒ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control	

Benefits

- Provides consistent level of protection throughout watershed.
- Prevents/minimizes degradation of watershed resources.
- Establishes orderly rules and procedures for development activities.

Design Considerations

- Ordinances should comprehensively address stormwater management, floodplain management, stream and wetland protection, and soil erosion and sediment control.
- Ordinances should include standards to address runoff volumes, runoff rates, and water quality.
- Ordinances should provide flexibility in methods of meeting standards.
- Ordinances should facilitate watershed resources restoration activities.



comprehensive land use plan

the watershed development ordinance is a critical element of the Fish Lake Drain watershed management plan (Conservation Design Forum)

Planning / Zoning

Conservation Development

residential conservation development
(Grayslake, IL)

Definition

- Site planning and design approach that preserves existing natural areas and utilizes naturalized drainage and detention measures for stormwater management, energy consumption, transportation efficiency, and habitat enhancement.

Applicability

- Scale: ☒ Watershed/County ☒ Town/Village ☒ Neighborhood ☐ Lot
- Applications: ☐ Retrofit ☒ New
  - ☐ Roofs ☒ Streets ☒ Driveways
  - ☒ Parking Lots ☒ Lawn ☒ Sensitive Areas
- Effectiveness: ☒ Runoff Rate Control ☒ Runoff Volume Control ☒ Physical Habitat Preservation/Creation ☒ Sediment Pollution Control
  - ☒ Nutrient Control ☒ BOD Control ☒ Other Pollutant Control

Benefits

- Preserves significant natural features and open space.
- Minimizes changes in runoff volumes, rates, and water quality typically associated with urban development.
- Improves views and site aesthetics, while at the same time providing site drainage and water quality functions.

Design Considerations

- On-site natural areas should be identified and preserved.
- Existing natural drainageways should be incorporated into site plan.
- Roadway should generally follow ridge lines.
- Impervious runoff should be routed through naturalized drainage systems integrated into the site plan.
- Use of native vegetation adapted to expected hydrologic conditions will improve runoff reduction and water quality benefits.
- Naturalized drainage systems should be protected from construction site runoff during establishment.

conservation moderate density residential site plan
(Conservation Design Forum)

Planning / Zoning

Floodplain Zoning

floodplain zoning prevents development from occurring in floodprone areas

Definition

- Zoning regulations established to protect stream corridors and floodplains from urban development and other encroachments.

Applicability

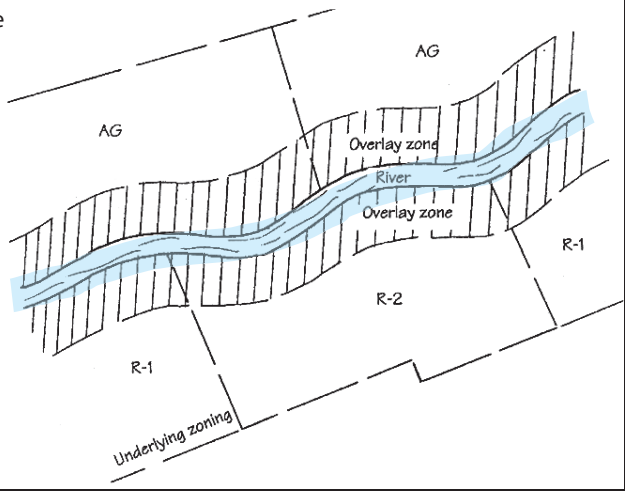
Scale	☒ Watershed/ County	☒ Town/Village	☐ Neighborhood	☐ Lot
Applications	☒ Retrofit	☒ New		
	☐ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☐ Lawn	☒ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☐ Runoff Volume Control	☒ Physical Habitat Preservation/ Creation	☐ Sediment Pollution Control
	☐ Nutrient Control	☐ BOD Control	☐ Other Pollutant Control	

Benefits

- Preserves stream corridors and riparian wetlands and provides natural buffer.
- Enhances safety and quality of life.
- Protects properties from flood damages.
- Protects natural floodplain functions.

Design Considerations

- Zoning regulations should allow for and encourage riparian corridor restoration.



floodplain zoning overlays underlying zoning (source: SEMCOG)

Planning / Zoning

Impervious Area Reduction

reduce impervious areas by reducing street width (Seattle, WA)

Definition

- Impervious area reduction can be achieved by reducing street widths and building setbacks, examining parking lot requirements, and through building design alternatives.

Applicability

Scale	☐ Watershed/ County	☒ Town/Village	☒ Neighborhood	☒ Lot
Applications	☐ Retrofit	☒ New		
	☒ Roofs	☒ Streets	☒ Driveways	
	☒ Parking Lots	☐ Lawn	☐ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☐ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control	

Benefits

- Reduces runoff volumes and rates and associated pollutants.
- Reduces urban heat island effect and thermal impacts to waterbodies.
- Reduces development and maintenance costs.

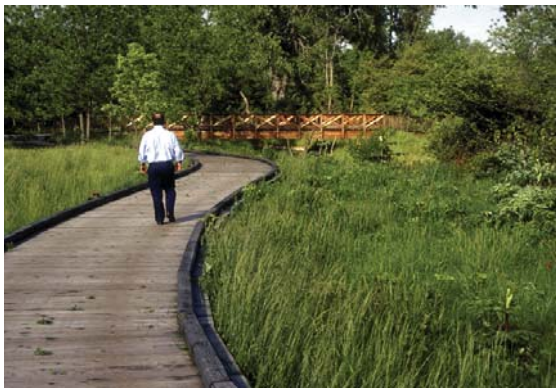
Design Considerations

- Impervious area reductions can be achieved through reduced road widths, shared parking, reduced setbacks, and other measures. These reductions will often require changes in subdivision code.
- Street length can often be reduced by clustering development onto portions of the site.
- Benefits of impervious area reduction are enhanced when combined with methods to "disconnect" impervious surfaces, e.g. vegetated swales, bioswales, filter strips/level spreaders, etc.

impervious areas reduced by lessening road length through clustering of development (Plano, IL) (Conservation Design Forum)

Planning / Zoning

Open Space / Natural Greenway



open space greenways can provide recreational as well as habitat and water quality benefits

Definition

- Designation of linear open space and/or natural areas as greenways to preserve and connect significant natural features and to accommodate aesthetic, recreational, and/or transportation uses.

Applicability

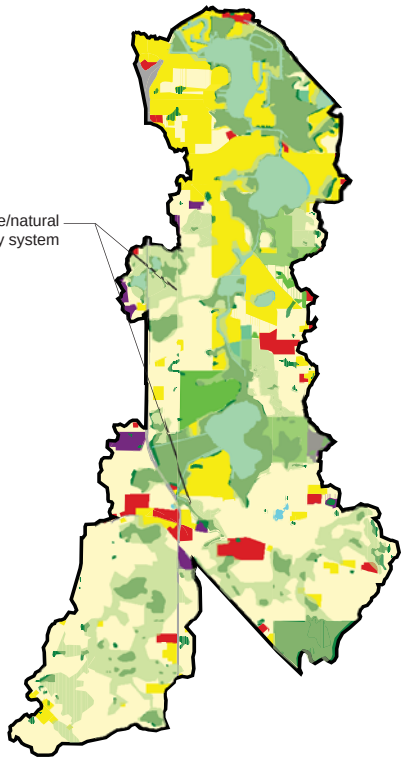
Scale	☒ Watershed/ County	☒ Town/Village	☒ Neighborhood	☐ Lot
Applications	☒ Retrofit	☒ New		
	☐ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☐ Lawn	☒ Sensitive Areas	
Effectiveness	☐ Runoff Rate Control	☐ Runoff Volume Control	☒ Physical Habitat Preservation/ Creation	☐ Sediment Pollution Control
	☐ Nutrient Control	☐ BOD Control	☐ Other Pollutant Control	

Benefits

- Preserves large contiguous natural areas and resources.
- Provides opportunity for wildlife movement and habitat within an ecological network.
- Provides alternative and connected passive recreation and transportation opportunities.

Design Considerations

- A natural resources inventory should be completed to identify significant natural features and functioning ecological networks.
- Significant cultural features should also be integrated into the network.
- Buffer requirements, open space/floodplain zoning, conservation easements, and conservation design should be used together to implement greenway networks.



an open space/natural greenway system is designated to protect key natural resources in the Fish Lake Drain Watershed area (Conservation Design Forum)

Riparian Buffer

buffers of native vegetation along streams and wetlands provide natural stabilization and pollutant filtering

Definition

- A buffer of native vegetation along lakes, streams, and wetlands that provides water quality and habitat benefits.

Applicability

Scale	☒ Watershed/ County	☒ Town/Village	☒ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☐ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☒ Lawn	☒ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☐ Runoff Volume Control	☒ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control	

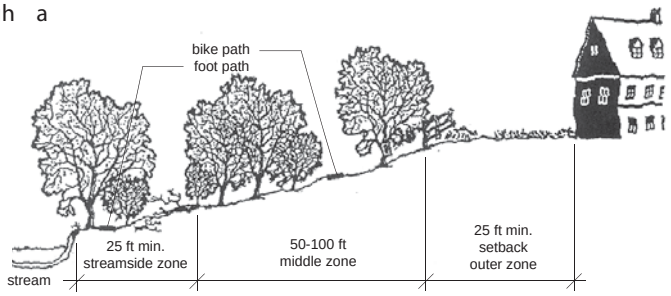
Benefits

- Preserves and protects natural functions of lakes, streams, and wetlands.
- Naturally attenuates flow rates.
- Provides filtering of lateral surface and groundwater inflows.
- Helps stabilize streambanks and shorelines against erosion.

riparian buffers preserve and protect riparian habitat

Design Considerations

- Riparian buffer width should be dependent on lake, stream, or wetland quality, ground slope, and size of feature.
- Buffer should be planted with native riparian vegetation.
- Buffers are often established/protected through a watershed development ordinance.



the three-zone urban stream buffer system (source: Center for Watershed Protection)

Site Stormwater BMPs

Bioswale

bioswale in a parking lot (Tellabs, Napeville, IL) (Conservation Design Forum)

Definition

- Vegetated swale system with an infiltration trench designed to retain and temporarily store stormwater. Bioswales are planted with native grasses and forbs that enhance filtration, cooling, and cleansing of water in order to improve water quality and prevent sealing of subsoils.

Applicability

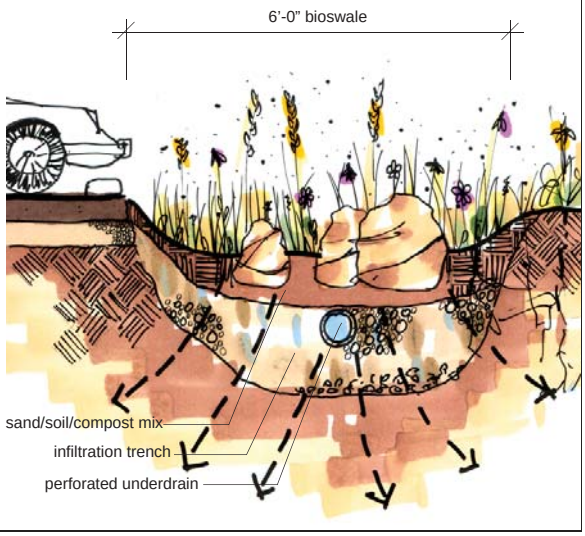
- Scale: ☐ Watershed/County ☐ Town/Village ☒ Neighborhood ☒ Lot
- Applications: ☒ Retrofit ☒ New
  - ☐ Roofs ☒ Streets ☐ Driveways
  - ☒ Parking Lots ☐ Lawn ☐ Sensitive Areas
- Effectiveness: ☒ Runoff Rate Control ☒ Runoff Volume Control ☐ Physical Habitat Preservation/Creation ☒ Sediment Pollution Control
  - ☒ Nutrient Control ☒ BOD Control ☒ Other Pollutant Control

Benefits

- Reduces impervious runoff volumes and rates.
- Recharges groundwater and sustains base flows.
- Reduces sediment and nutrient runoff.
- Can reduce detention needs.

Design Considerations

- Bioswales must be sized and designed to account for drainage area and soils.
- Filtration benefits can be improved by planting native deep-rooted vegetation.
- Infiltration storage should be designed to drain in 24 hours to prevent sealing of subsoils.
- Topsoil should be amended with compost and/or sand to improve organic content for filtering and to achieve adequate infiltration rates.
- Bioswales should be protected from construction site runoff to prevent sealing of topsoil and/or subsoils.
- Direct entry of stormwater runoff into infiltration trench should be prevented to protect groundwater quality and to prevent sealing of subsoils.
- Underdrain should be sufficiently low in the trench to provide adequate drainage of aggregate base of adjacent paved areas but sufficiently high to provide infiltration storage.



cross section of bioswale (Conservation Design Forum)

Filter Strip/ Level Spreader

Coffee Creek Center level spreader installation (Chesterton, IN) (Conservation Design Forum)

Definition

- A filter strip is an area with dense, preferably native, vegetative cover used to filter and absorb runoff from impervious areas. A level spreader is a trench laid on the contour to distribute runoff over filter strip areas.

Applicability

Scale	☐ Watershed/ County	☐ Town/Village	☒ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☐ Roofs	☐ Streets	☒ Driveways	
	☒ Parking Lots	☒ Lawn	☒ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☐ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control	

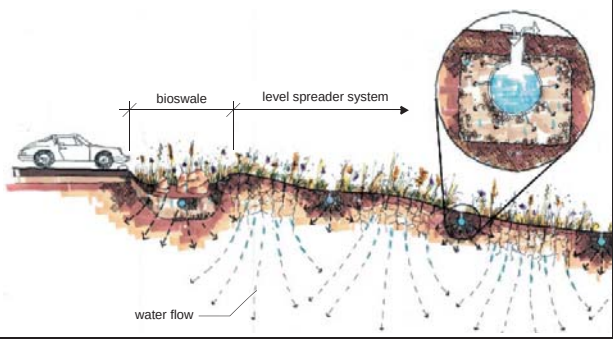
Benefits

- Reduces runoff volumes and rates by allowing runoff to infiltrate over a large area.
- Recharges groundwater and sustains base flows.
- Reduces sediment and nutrient runoff.
- Deconcentrates storm sewer and detention basin discharges to dissipate energy, reduce scour, and better mimic historic runoff patterns to receiving waterbody.
- Can reduce detention needs.

filter strip/level spreader

Design Considerations

- Filter strips/level spreaders must be sized and designed to account for drainage area, slope, and soils. Chronic hydraulic overloading of filter strips may cause erosion.
- Filtration benefits can be improved by planting native deep-rooted vegetation and by minimizing the slope.
- Infiltration storage within the level spreader trench should be designed to drain in 24 hours to prevent sealing of subsoils.
- Compaction of filter strips should be avoided and/or topsoil should be amended with leaf compost and coarse sand to improve filtration, infiltration, and plant establishment.
- Runoff should be diverted away from filter strips during construction until vegetation is established.



cross section of level spreader (Conservation Design Forum)

Site Stormwater BMPs

Green Roof

green roof on City Hall (Chicago, IL) (Conservation Design Forum)

Definition

- Vegetated roof system designed to retain and slow rainwater runoff on the top of roofs. Green roofs are generally planted with drought and wind tolerant vegetation.

Applicability

Scale	☐ Watershed/ County	☐ Town/Village	☐ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☒ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☐ Lawn	☐ Non-Buildable	
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☐ Physical Habitat Preservation/ Creation	☐ Sediment Pollution Control
	☐ Nutrient Control	☐ BOD Control	☐ Other Pollutant Control	

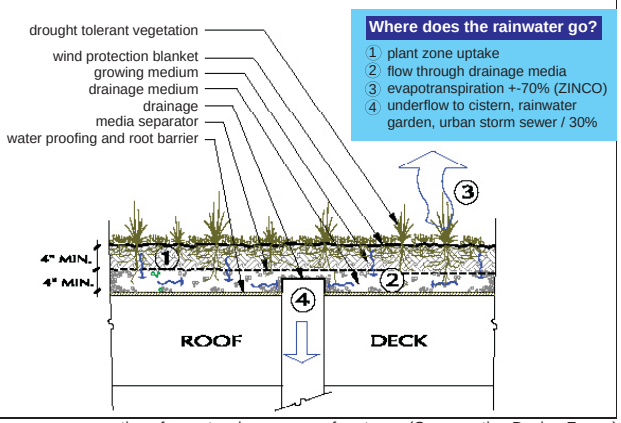
Benefits

- Significantly reduces runoff volumes and rates as well as thermal impacts (50 - 90% reduction in annual runoff).
- Can reduce detention needs.
- Contributes to reduction in urban heat island effect.
- Can reduce energy requirements associated with heating and cooling.
- Creates opportunities for outdoor space as roof top gardens.

green roof can be applied on various roofs and scales

Design Considerations

- Structural load capacity of existing roof system must be evaluated.
- Plant material, such as succulents, that are drought tolerant, should be used on lightweight "extensive" green roof systems.
- A wider range of vegetation may be used on heavier, "intensive" green roof systems with deeper growing medium.
- Use of a granule drainage layer will improve retention and detention benefits relative to drain boards.



cross section of an extensive green roof systems (Conservation Design Forum)

Naturalized Detention

naturalized wetland detention on Tellabs industrial campus (Bolingbrook, IL) (Conservation Design Forum)

Definition

- Naturalized detention basins are used to temporarily store runoff and release it at a rate allowed by ordinances. Native wetland and prairie vegetation improves water quality and habitat benefits. Naturalized detention may also be used as a retrofit to achieve water quality benefits.

Applicability

Scale	☒ Watershed/ County	☒ Town/Village	☒ Neighborhood	☐ Lot
Applications	☒ Retrofit	☒ New		
	☒ Roofs	☒ Streets	☒ Driveways	
	☒ Parking Lots	☒ Lawn	☒ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☐ Runoff Volume Control	☒ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control	

Benefits

- Reduces runoff rates.
- Recognized by virtually all stormwater agencies as approved method of controlling stormwater runoff.
- Very effective at removing sediment and associated pollutants.
- Provides attractive site amenity when properly designed and not used as sole BMP on sites with high pollutant/ nutrient runoff.

Design Considerations

- Should be sized to control release to allowable rate.
- Size should reflect use of upstream BMPs.
- Water level fluctuations should be limited to 3-4 feet (during 100-year storm) to maximize plant diversity.
- Shallow water entry angles will minimize shoreline erosion, improve water quality benefits, increase aquatic habitat and plant diversity and provide safety ledge.
- May be used as retrofit along stream corridors to prevent direct discharge of stormwater runoff.

a well designed naturalized wet detention pond provides open space and passive recreation opportunities

Site Stormwater BMPs

Porous Pavement

porous pavement driveway

Definition

- Permeable or perforated paving materials or pavers with spaces that allow transmission of water to aggregate base and subsoils. Runoff is temporarily stored in the base for infiltration into the subsoils and/or slow release to storm drain system.

Applicability

Scale	☐ Watershed/ County	☐ Town/Village	☒ Neighborhood	☒ Lot	
Applications	☒ Retrofit	☒ New			
	☐ Roofs	☒ Streets	☒ Driveways		
	☒ Parking Lots	☐ Lawn	☐ Sensitive Areas		
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☐ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control	
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control		

Benefits

- Reduces runoff volumes and rates.
- Recharges groundwater and sustains base flow.
- Filters sediments and associated pollutants from runoff.
- Can reduce detention needs.

porous pavement allows infiltration through the paving material

Design Considerations

- Base and subbase materials should be coarse aggregate with no fines to allow adequate drainage and to prevent frost heave.
- Subgrade should be graded at minimum 1% slope to allow drainage when water entry rate exceeds infiltration capacity of subsoils.
- Subsoils should be compacted to the minimum level necessary to achieve structural stability.
- Geotextiles should be used between base and subgrade to improve structural stability and separate base from subgrade.
- Underdrains should be placed at edge of pavement to provide drainage as necessary to prevent ponding in the base for periods greater than 24 hours.

porous pavement in parking lot

Rain Barrel/ Cistern

rain barrels in back yard (Conservation Design Forum)

Definition

- A vessel used to capture and temporarily store rainwater for various uses, including graywater reuse and irrigation.

Applicability

Scale	☐ Watershed/ County	☐ Town/Village	☐ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☒ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☐ Lawn	☐ Sensitive Areas	
Effectiveness	☐ Runoff Rate Control	☒ Runoff Volume Control	☐ Physical Habitat Preservation/ Creation	☐ Sediment Pollution Control
	☐ Nutrient Control	☐ BOD Control	☐ Other Pollutant Control	

Benefits

- Reduces runoff volumes.
- Conserves water for reuse.
- Provides irrigation water during watering restrictions.

Design Considerations

- At the residential scales, rain barrels located at downspouts will typically be used.
- One inch of rainfall over 1,000 square feet of roof area is equivalent to 625 gallons of rainwater.
- Rain barrels can be used in combination with rainwater gardens, green roofs, and other stormwater BMPs to increase stormwater benefits.
- Larger cisterns in some settings may be used to provide graywater for use in toilet flushing and other non-potable uses.

a cistern system collects rainwater from Chicago Center for Green Technology (Chicago, IL) (Photo: Conservation Design Forum)

Site Stormwater BMPs

Rainwater Garden

rainwater garden planted with vegetation that attracts butterflies

Definition

- A landscaped garden designed to retain and detain stormwater runoff from individual lots and roofs.

Applicability

Scale	☐ Watershed/ County	☐ Town/Village	☐ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☒ Roofs	☐ Streets	☒ Driveways	
	☐ Parking Lots	☒ Lawn	☐ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☐ Physical Habitat Preservation/ Creation	☐ Sediment Pollution Control
	☐ Nutrient Control	☐ BOD Control	☐ Other Pollutant Control	

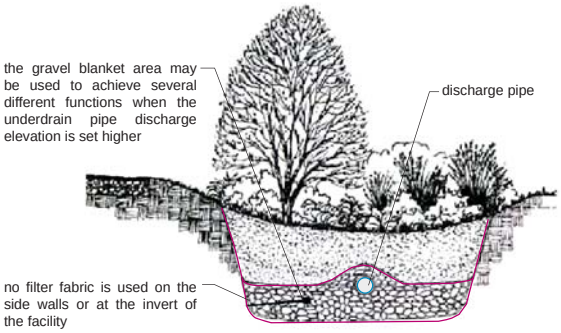
Benefits

- Reduces runoff volumes and rates from lawns, roofs, and driveways.
- Recharges groundwater and sustains base flows.
- Reduces sediment and nutrient runoff.
- Can reduce detention needs.
- Can increase aesthetic value for the properties.
- Can provide wildlife habitat.

roof downspout connects to rainwater garden (Glen Ellyn, IL)

Design Considerations

- Rainwater gardens must be sized and designed based on drainage area, soils, and desired runoff volume reduction.
- Filtration and nutrient control benefits can be improved by planting native vegetation.
- The soils in the top 18″ to 24″ should be amended with leaf compost and coarse sand to enhance organic content and improve permeability.
- Where subsoil infiltration rates are low (less than 0.5 to 1.0 in/hr), a gravel trench with underdrains should be used to encourage drainage between events.
- Maximum ponding depths should generally be limited to 6″ to 12″ unless underdrains are used.



rainwater garden cross section (Low Impact Development Center)

Vegetated Swales

vegetated swales planted with native grasses and forbs along the street

Definition

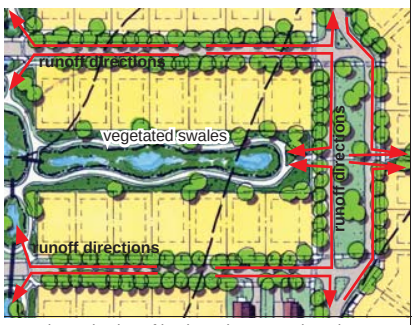
- Vegetated swales are planted stormwater features that convey, retain, infiltrate, and cleanse stormwater.

Applicability

Scale	☐ Watershed/ County	☐ Town/Village	☒ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☒ Roofs	☒ Streets	☒ Driveways	
	☒ Parking Lots	☒ Lawn	☐ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☐ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control	

Benefits

- Reduces runoff volumes and rates.
- Provides conveyance and water quality benefits in one stormwater feature.
- Reduces sediment and nutrient runoff.
- With proper design, can reduce detention needs.



schematic plan of back yard vegetated swale system (Conservation Design Forum)

Design Considerations

- Vegetated swales must be sized to convey design runoff rate (typically 10-year storm).
- Filtration benefits can be substantially improved by planting native deep-rooted grasses and forbs and by minimizing the slope.
- Topsoil may be amended with compost and/or coarse sand to improve organic content for filtering and to improve infiltration and retention of runoff.
- Vegetated swales should be protected from construction site runoff to prevent sealing of topsoil and/or subsoils.

back yard vegetated swales

Landscaping

Native Landscaping

prairie planted in residential development area (Mill Creek, IL)

Definition

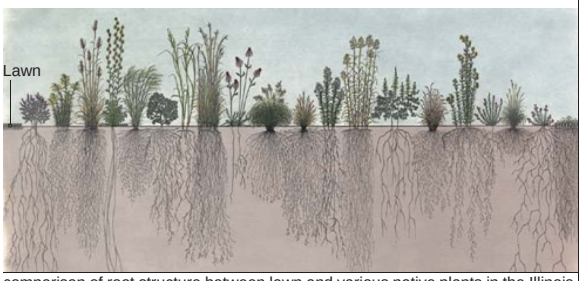
- Establishment of native vegetation in either large restoration projects or smaller gardening projects. Native landscaping is often a component of other BMPs such as detention, filter strips, bioswales, and rainwater gardens.

Applicability

Scale	☐ Watershed/ County	☐ Town/Village	☒ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☒ Roofs	☒ Streets	☒ Driveways	
	☒ Parking Lots	☒ Lawn	☒ Sensitive Areas	
Effectiveness	☐ Runoff Rate Control	☒ Runoff Volume Control	☒ Physical Habitat Preservation/ Creation	☒ Sediment Pollution Control
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control	

Benefits

- Reduces runoff volumes.
- Increases infiltration rates.
- Increases ability to remove nutrients.
- Increases organic content of soils.
- Increases permeability of compacted soils.
- Reduces irrigation and fertilization requirements.
- Reduces use of fossil fuels and air pollution relative to turf landscapes that require regular mowing and maintenance.
- Provides wildlife habitat.



comparison of root structure between lawn and various native plants in the Illinois and Mid West Region (Conservation Research Institute)

Design Considerations

- Some local "weed" ordinances may need to be amended to allow native and taller vegetation.
- Plant diversity and health is maximized by annual burning. Plots may be mowed and then burned to prevent spread of fire on small sites. Fall burning will select for prairie wildflowers.
- On compacted soils, amendment may be necessary to increase organic content, improving success of establishment.

Blackwell Prairie (IL)

IV Watershed Management Recommendations

While Chapter III identifies generalized tools or best management practices that can be used in the Fish Lake Drain Watershed, this chapter presents specific recommended action items that were developed jointly by the watershed stakeholders, the LCSMC, and the consultant team. In this chapter, recommended action items are presented in two sections according to two different methods of organization. In Section A, the recommendations are organized by the watershed goals and objectives. In Section B, the recommendations are organized by watershed location.

A. Watershed Action Items

This section provides a list of specific action items for each of the goals and objectives identified in Chapter I. Many of these actions are not specific to a particular location and should be generally applied throughout the watershed.

Goal 1: Improve Water Quality and Stream, Lake, and Wetland Resources

Objective 1: Perform in-lake management measures to improve water quality and aquatic habitat of the watershed lakes.

Action Items

1. Enlist additional volunteer lake monitoring program participants

Trained volunteers provide a dedicated and efficient resource for monitoring the progress of water quality improvements. Volunteer networks provide a mechanism for education of interested residents and build stewardship for protection of watershed resources.

2. Continue LCHD's monitoring program

Water quality in the lakes is an important concern of watershed stakeholders. The existing program has provided valuable information to the Watershed Management Plan for determining existing lake conditions. Continued monitoring and analysis is critical for providing feedback on the progress of implementation of the Watershed-based Plan.

3. Create and restore natural shorelines

Natural shorelines, those which are not armored with rip rap or sea wall but instead consist of native vegetation and riparian wetlands, provide many benefits to lakes. These benefits include erosion protection, water quality improvement, aesthetic value, and wildlife habitat. Further, naturalized shorelines discourage geese from inhabiting the shorelines, lakes, and ponds. The References and Resources section at the end of this Plan identifies a number of resources that may be used as guidance for creating and managing shorelines. In particular, Lakescaping for Wildlife and Water Quality is an excellent reference.

4. Implement recommendations in LCHD lake management reports

The LCHD lake management reports provide specific and detailed recommendations for several of the lakes. These recommendations are summarized in Section B of this chapter.

5. Reduce powerboat and personal watercraft traffic impacts on lake quality

Powerboats and personal watercraft (e.g. "Jet Skis") can cause shoreline erosion by wave action due to excessive speed and also churn up bottom sediments in shallow areas. Prevention or minimization of these impacts can be accomplished through lake ordinances that create or enlarge "no wake" zones or exclusion zones.

Objective 2: Restore and enhance water quality and habitat of existing drainage corridors.

Action Items

6. Perform stream corridor restoration and management activities

Stream corridor restoration and management activities include streambank stabilization, repair of engineered structures, and riparian corridor vegetation management to improve water quality and ecological health. Site-specific recommendations are provided in Section B.

Objective 3: Restore and enhance water quality, habitat, and floristic quality of existing and former watershed wetlands.

Action Items

7. Develop site-specific restoration and management plans for highest quality ADID wetlands

The presence of invasive exotic vegetation and impacts from historic and ongoing disturbances can degrade the vegetation and habitat quality of areas not under active management. Most all of the ADID wetlands are more or less affected by these factors. Site-specific restoration and management plans would enable the efficient use, allocation, and prioritization of resources in alleviating these problems and promoting higher quality in existing wetland areas. These plans can also be used to seek funding for projects and serve to direct volunteer work.

8. Perform vegetative management activities for all wetlands

Most of the watershed's wetlands will respond well to burn management, which is a relatively low-cost management strategy, particularly for large wetlands (low cost per acre). Burn management tends to select for native vegetation that is adapted to fire and exclude exotic vegetation, such as reed canary grass, that is not adapted to fire. However, it should be recognized that in highly disturbed wetlands that are subject to large water level fluctuations and/or significant sediment loads, more intense measures may be needed. In some cases, it may be very difficult to eliminate or even significantly reduce the population of invasive species.

9. Identify and restore former wetlands

There are many areas that are currently drained via field tiles located in hydric soils throughout the watershed, particularly south of Fish Lake. Many of these areas may be suitable for restoration to an undrained state in order to provide additional wetland habitat and water quality benefits. This can be accomplished through the strategic removal and/or blockage of field tiles. Restoration of these areas should include native vegetation restoration and management.

Objective 4: Address the quality and quantity of runoff from existing development.

Action Items

10. Develop source control programs for existing pollutant sources

Many sources of pollutants in stormwater runoff, such as atmospheric deposition, are difficult to control. However, in other cases, such as yard waste, the source can readily be controlled. Source control programs should be developed to address those sources of pollutant loadings that can be controlled. These programs should address the following:

- Management of landscape, household, and pet waste to prevent their introdution into stormwater runoff as well as out of lakes, streams, and wetlands
- Storage of materials in floodplains and riparian zones, particularly floatable materials
- Application of fertilizers and pesticides
- Protection of storage yards, loading docks, etc., from rainfall and runoff to prevent washoff of materials.

11. Retrofit site-scale stormwater BMPs through incentive and other measures

In relation to this goal and objective, this action item is focused on reducing the water quality and hydrologic impacts of existing development on the ecological health of streams, lakes, and wetlands. There are many areas of the watershed that were built prior to current stormwater standards. The site-scale stormwater BMPs in the toolbox of Chapter III should be retrofitted into existing development; wherever feasible, to improve water quality and enhance groundwater recharge. This activity could occur at the individual property scale as well as neighborhood and sub-watershed scale. These BMPs include green roofs, rainwater gardens, rain barrels or cisterns, filter strips with level spreaders, vegetated swales, bioswales, porous pavement, and naturalized detention. Guidance and potential cost-share programs should be developed to encourage property owners to implement these measures. Demonstration projects can provide examples to increase understanding of the benefits, appearance, and costs associated with these measures.

In addition, there are numerous existing detention basins within the watershed that could benefit from retrofitting such as stabilization and naturalization of side slopes to improve water quality and repair or prevent shoreline erosion. An inventory of existing

detention basins and potential retrofit opportunities is included in Chapter V (Table V-3). Care should be taken when implementing BMPs to minimize the risk of surface and groundwater contamination. In particular, source control measures should first be used on industrial and other sites where there is potential for contamination of stormwater runoff with toxic pollutants.

Objective 5: Address the quality and quantity of runoff from agricultural land uses.

Action Items

12. Install agricultural BMPs

Although the watershed is quickly urbanizing, there is significant agricultural land that remains. Implementation of practices such as nutrient management, filter strips, grassed waterways, stream buffer zones, contour plowing, crop residue cover, and no-till seeding will reduce sediment and nutrient transport to the watershed stream corridors, wetlands, and lakes. These practices should be implemented with the assistance of the Natural Resources Conservation Service and the Lake County Soil and Water Conservation District.

13. Evaluate nursery runoff and install BMPs

A number of landscape nurseries operate in the watershed. A multi-faceted approach is necessary to reduce the amount of fertilizers that are applied, improve storage and handling of materials, and evaluate the level of drainage that is required. Surface and tile runoff should be treated before discharge to the drainageway. A number of treatment mechanisms may be used, including flow-through constructed wetlands and prairie filters prior to discharge to the stream corridor, wetlands, or lakes.

Objective 6: Implement a Green Infrastructure Plan to guide preservation, restoration, and management activities.

Action Items

14. Protect areas identified in the Green Infrastructure Plan from development

Strategies to protect the Plan area include:

- Incorporate the Green Infrastructure Plan network into County and municipal land use plans.
- Modify zoning and development code to facilitate implementation of the Plan. This should include regulatory standards, as well as density bonuses and other incentives, for preserving open space. Within new developments, easements should be placed on lands within the Plan area.
- Pursue protection of key resource areas and areas not readily protected through stream, wetland, floodplain, and buffer standards using purchase of development rights or conservation easements.
- Encourage homeowner and lake associations to adopt the Plan and manage natural areas and buffers within the Plan area.

15. Develop management plans for natural areas within the Green Infrastructure Plan

The open space areas within the Green Infrastructure Plan should be managed to maintain their flood storage and vegetative characteristics. All areas should have management plans prepared that address ongoing vegetation and hydrologic management. Restoration of wetlands and preparation of management plans was also discussed under Goal 1, Objective 2.

Objective 7: Develop and maintain a database of water quality assessment information and collect additional data.

Action Items

16. Biological stream sampling - IDNR, residents

Biological communities, including both fish and invertebrates, can provide indicators of the quality of stream conditions. Generally, more numerous and more diverse communities indicate better overall water quality. The Illinois Department of Natural Resources (IDNR) should be requested to sample Fish Lake Drain to determine a baseline biological community quality for future comparisons. Professional monitoring of the lakes was discussed under Goal 1, Objective 1. Development of a comprehensive watershed monitoring program is discussed under Goal 5, Objective 2.

17. Enlist additional Riverwatch program participants

Riverwatch participants could monitor conditions in Fish Lake Drain to supplement IDNR work and to engage local residents and build stewardship for protection of watershed resources. Volunteer monitoring of lakes was discussed under Goal 1, Objective 1.

18. Improve the IEPA permit renewal process for point source discharges
Designated watershed stakeholders should be made aware when IEPA permits are up for renewal to ensure that all relevant information is considered during the renewal process.

Goal 2: Identify and Mitigate Existing Watershed Flooding Problems

Objective 1: Identify existing overbank flooding sources, properties that flood, and damages associated with flooding.

Action Items
19. Perform flood audits for structures known to flood
LCSMC's FPAI should continue to be updated as additional problem areas are identified and existing problems are addressed. Flood audits should be prepared for each of the flood problem areas to determine the cause of flooding and potential solutions. Structures in the floodplain are mapped in Figure II-18.

Objective 2: Identify existing local drainage flooding sources, properties that flood, and damages associated with flooding.

Action Items
20. Perform flood audits for structures known to flood
LCSMC's FPAI should continue to be updated as additional problem areas are identified and existing problems are addressed. Structures built upon hydric soils were mapped in Chapter II (Figure II-18). These structures may be subject to localized drainage problems.

21. Perform site-specific drainage studies for flood problem areas not covered by the 2005 floodplain study.
Drainage studies should be performed for problems areas identified in the FPAI.

Objective 3: Reduce existing flooding through the implementation of flood damage reduction projects that lower flood water levels.

Action Items
22. Implement watershed runoff reduction program using incentives and other measures
The BMPs described in the Toolbox of Chapter III should be used to reduce runoff volumes and rates and ultimately reduce flooding. Guidance and cost share incentives should be provided. Demonstration projects can provide examples to increase understanding of benefits, appearance, and costs associated with these measures. This is also discussed under Action Item 11 of Goal 1, Objective 4.

23. Identify and implement structural flood control projects
Potential flood remediation alternatives were described in Chapter II and recommendations are provided in Section B of this chapter. No flood control alternatives were identified that could be recommended for implementation.

24. Survey stream channels annually for debris
Inspections should occur annually (in spring) and after large flood events. Where necessary, remove debris that may be causing erosion and perform repairs to damaged areas.

Objective 4: Reduce existing flood damage potential by floodproofing structures.

Action Items
25. Identify and implement non-structural flood damage reduction projects
The majority of identified properties located in the floodplain or identified in the Flood Problem Areas Inventory are concentrated around Duck Lake. As discussed in Chapter II, no economically feasible flood control alternatives were identified. Thus, floodproofing to protect individual or groups of buildings is recommended. Potential floodproofing measures include construction of low berms and elevation of structures.

26. Provide educational information on flood proofing
Workshops on floodproofing should be conducted and information about methods of floodproofing should be provided. Also, people could be invited to bring photos of their house along with a property survey and local experts could suggest measures that could be taken for their specific property.

27. Adopt a local cost-share program for residents
Many municipalities and counties around the Chicago region cost-share with local residents on floodproofing projects.

Goal 3: Prevent Negative Impacts of New Development on Flooding and Watershed Resources

Objective 1: Discourage development in flood-prone areas.

Action Items

28. Discourage development in floodplains through regulatory mechanisms

After completion of formal reviews, the floodplain in the LCSMC "Fish Lake Drain Floodplain Study Final Draft" should be adopted as the regulatory floodplain map. Existing ordinance standards that discourage development within the floodplain should continue to be enforced. Prior to agency adoption of the updated floodplain mapping, the updated maps should be used as "Best Available Information". The Green Infrastructure Plan described in Chapter III (Figure III-1) should be adopted to preserve the undeveloped portions of the floodplain and prevent significant floodplain fill.

29. Prepare floodplain mapping based on future landuse conditions

Provided that the recommendations of this Plan are implemented, there should be no increase in flood heights as the watershed develops, and the flood stages identified in the final LCSMC Fish Lake Drain Floodplain Study should accurately represent both existing and future floodplain conditions.

30. Identify and avoid potential local drainage flooding sources, properties, and damages

Areas outside the floodplain but with hydric soils or drain tiles are areas that historically have been subject to wet conditions but not protected by floodplain rules. Hydric soils and known drain tiles have been mapped in Chapter II (Figure II-17) and caution should be used when developing in these areas. When draining hydric soils to prevent local drainage problems, analyses should be performed and steps taken to ensure that the drainage will not impact adjacent wetlands or cause increased flooding problems off-site.

Objective 2: Protect existing floodplain and depressional storage.

Action Items

31. Prevent changes to drainage characteristics of significant depressional storage areas

While true depressional storage often does not discharge off-site until its capacity is exceeded, depressional storage incorporated into detention basins results in discharge during most storm events. To better mimic natural hydrologic conditions, depressional storage should be preserved in its natural state or designed to mimic natural conditions. This is particularly true of the larger depressional storage areas in the Fish Lake Drain Watershed depicted in Figure II-15. This is discussed further Section B of this chapter.

Smaller depressional storage that is not practical to preserve in place should be integrated throughout the site using rain gardens, bioswales, and other measures that retain runoff rather than releasing it offsite.

32. Pursue conservation easements for properties with significant floodplain or depressional storage characteristics

Conservation easements provide landowners with economic incentives to voluntarily restrict development of property where development would be undesirable due to flooding potential, poor soil conditions, or ecological sensitivity. Tax abatements are provided in return for development restrictions in perpetuity. Areas with significant floodplain or depressional storage characteristics are unbuildable from a practical standpoint, as structures in these areas would be prone to flood damage. Additionally, construction of detention structures or other modifications often changes the drainage characteristics of these areas, increasing the frequency or rate of discharge, particularly for smaller flood events.

33. Consider regional detention in large depressional storage areas

There are a number of large regional depressional areas that: provide hydrologic stabilization; are part of the Green Infrastructure Plan; and are recommended for wetland creation/restoration (non-wetland, hydric soil areas). Regional detention may provide a funding mechanism for acquisition and restoration and facilitate protection of these large areas. To maximize restoration potential of these areas, it is recommended that 2-year detention and water quality measures continue to be implemented on-site and that the regional detention only be used to attenuate larger floods.

Objective 3: Protect stream and wetland resources from unnecessary modifications and mitigate all necessary modifications and impacts.

Action Items

34. Continue to implement and enforce stream and wetland protection standards in WDO

The existing Lake County WDO includes significant standards for stream and wetland protection. The ordinance should continue to be enforced, and tools and resources should be provided to ensure adequate implementation of the standards on development sites.

35. Establish greenway corridors and integrate those corridors into the Green Infrastructure Plan. Provide incentives for implementation

The Green Infrastructure Plan identified in Chapter III provides a recommended greenway designed to protect drainage and aquatic resources. The Plan could be expanded to include existing remnant forests or prairies to provide broader ecological benefits. In addition, trails and other amenities often associated with greenways should be incorporated into the Plan. Remnant areas should be identified and targeted for acquisition, trail development, and permanent protection. Incentives for expansion of the greenway system could include density bonuses, credit towards park and open space donations, etc.

Objective 4: Minimize increases in runoff rates and volumes (as conditions allow) associated with new development.

Action Items

36. Develop site-specific runoff rate and volume standards for selected areas of watershed

Site-specific runoff volume and rate standards are discussed in Section B of this chapter. Of particular note are the regionally significant storage areas identified in Chapter II (Figure II-15). Changes in the discharge characteristics of these sites could significantly affect the hydrology of the downstream lakes and stream reaches.

37. Provide guidance on the evaluation of runoff reduction BMP influence on stormwater detention volumes

Since the retention measures identified in the Toolbox of Chapter III are not required, they commonly are not used by many developers. Further, where they are used, consistent analysis methods are not used by all engineers. Analysis methods acceptable to the LCSMC should be developed and incorporated into the Lake County WDO Technical Reference Manual.

38. Develop incentives for implementing runoff reduction BMPs such as porous paving, infiltration bioswales, rain gardens, etc.

To improve implementation of runoff reduction measures, demonstrations and incentives should be developed. Incentives may include cost-share for early projects that serve as demonstrations and density bonuses for conservation development designs that incorporate these measures.

39. Add volume control standards for new development to the WDO or local ordinances

In their undeveloped state, most areas of the watershed produce very little and infrequent surface discharge. As development occurs, increases in the rate, volume, and frequency of surface discharge occur, along with increased pollutant loads and water temperatures. Lakes are a sink for stormwater pollutants and are affected by water temperature as well as runoff volumes. To prevent increases in surface runoff, the proposed NIPC "Model Ordinance for Conservation Design" suggests a volume standard of no increase in runoff volume for all events up to the 2-year storm event. The ordinance suggests methods of achieving this standard, including (also see Chapter III, Section B):

- Naturalized detention
- Filter strips/Level Spreaders
- Bioswales
- Vegetated swales
- Green roofs
- Porous pavement

Wisconsin DNR also has statewide standards for runoff volume control that may be a source of information for developing Fish Lake Drain ordinance rules. Runoff volume standards should be linked to existing runoff volumes such that the standards that must be met on any particular site will be sensitive to soils and other existing conditions that affect runoff volumes.

Objective 5: Minimize water quality impacts of new development.

Action Items

40. Protect water resources from sedimentation due to construction site erosion

The soil erosion and sediment control standards of the Lake County WDO are adequate for most

construction sites. However, the measures are often not installed and maintained appropriately. Compliance with the level of inspection and maintenance required in the ordinance should be improved to provide the necessary level of protection of the lakes and other aquatic resources of the watershed.

41. Continue to implement and enforce the Lake County WDO standards for water quality design of detention basins

42. Continue to implement and enforce stream and wetland buffer standards in the Lake County WDO

43. Implement a source control program for new developments
Programs should be developed to address the numerous sources of pollutant loadings from urban areas. These programs should address the following:

- Management of landscape, household, and pet waste
- Storage of materials in floodplains and riparian zones, particularly floatable materials
- Application of fertilizers and pesticides

New developments should provide opportunities to incorporate good source controls into the design and construction of the development. For example, floodplain and riparian areas that are not being built upon should be designed as featured amenities, and not allowed to develop into "hidden back areas" that invite improper waste disposal practices.

Objective 6: Evaluate and, where feasible, adopt win-win strategies to enhance existing natural resources in concert with new development.

Action Items
44. Provide guidance on conservation development planning and design
Conservation development is more than simply not filling wetlands. Detailed guidance on planning and designing conservation developments should be developed and provided to municipalities for further distribution to developers.

45. Establish an incentive program for developers
To facilitate a change in practices, an incentive program should be established to encourage developers to use conservation development planning and design practices and techniques. These incentives could include expedited permitting and review procedures, density bonuses, and technical assistance.

Objective 7: Identify and implement additional regulatory standards and enforcement needs.

Action Items
46. Develop a certified inspector program and an on-site requirement for developers to provide a certified inspector responsible for their site

47. Evaluate enforcement procedures and implement recommended improvements

48. Consider establishing higher standards for zones near high-quality resources
There may be exceptional resources within the watershed that would benefit from more restrictive volume control standards, wider buffer or filter strips, or other more stringent restrictions. Rather than adopting these standards over the entire watershed, areas near the exceptional resources should be targeted for the adoption of special overlay zones requiring the higher standards.

49. Develop suggestions for how local land use planning can be improved to incorporate the surrounding environment
The Green Infrastructure Plan provides a framework for protecting drainage and aqautic resources at the watershed scale. This Plan should be incorporated and enhanced as part of developing community comprehensive plans.

50. Encourage municipalities to consider fertilizer ordinances to reduce phosphorus levels to lakes and streams
A number of homeowner associations voluntarily restrict fertilizer use. Requirements, as well as technical assistance at the community level, would provide a higher level of consistency in compliance.

Goal 4: Provide Tools to Implement Watershed Protection and Enhancement Measures

Objective 1: Identify and secure resources to implement Plan recommendations and action items.

Action Items

51. Develop municipal funding sources

The municipalities, townships, and County should prepare an annual budget for the Fish Lake Drain Watershed and develop a funding formula to distribute that budget between the entities.

52. Identify grant opportunities to fund projects and actively pursue those grants

Grants should be used to supplement the municipal budget and could be targeted toward demonstration projects. A potential funding source list is provided in Chapter V (Table V-1).

53. Pursue and coordinate volunteer labor and donations

Volunteers can be a valuable resource and be used in many locations around the region for natural areas restoration, volunteer monitoring, etc. The business community may be a resource for volunteer labor, materials, and funding.

Objective 2: Continually pursue strategies for facilitating Plan implementation.

Action Items

54. Utilize existing and low cost resources to enhance local knowledge of watershed management strategies

Stakeholders should become active in watershed, stormwater, floodplain, and natural resource management organizations and take advantage of free and low cost information available from numerous sources. The References and Resources section of this Plan provides a list of organizations and resources.

55. Hire watershed manager to lead Watershed Plan implementation

A manager dedicated to the Fish Lake Drain Watershed can provide for a level of coordination, monitoring, technical assistance, granting assistance, etc., which are difficult to achieve by using LCSMC staff alone. A watershed manager could potentially be shared between two watersheds to control costs.

56. Form a Plan implementation committee

Led by the watershed manager, the implementation committee can provide the policy direction and budgeting necessary to implement this Plan.

57. Update the Plan on a defined schedule

An annual report should be prepared to document watershed activities and status of Plan implementation. At a minimum of every five years, the Plan should be updated to reflect changes in conditions, new information, and status of implementation.

58. Pursue adoption of the Plan at the local level

Every municipalitity and Lake County should formally adopt this Plan and incorporate it into their planning and project review processes. Municipal and County comprehensive plans should be updated to reflect the recommendations of the Plan and address land use conflicts between land use plans and the Green Infrastructure Plan.

Objective 3: Improve coordination between municipalities and Lake County agencies in watershed planning and protection.

Action Items

59. Establish a commitment by the decision-makers to hold and attend an annual watershed coordination meeting

60. Upon Plan completion, meet one-on-one with each applicable community leader to discuss the watershed plan

61. Pursue cooperation among stakeholders, including State and Federal agencies, through mutually agreeable ordinance provisions, intergovernmental agreements, increased communication, and cost sharing

Objective 4: Provide municipalities with sources for, and/or copies of, watershed-beneficial regulatory standards and land use planning methods.

Action Items

62. Develop suggestions for how local land use planning can be improved to incorporate the surrounding environment

63. Provide communities with sample ordinance and zoning language

The Reference and Resources section at the end of this Plan identifies a number of resources that may be used to identify ordinance language. In particular, the Blackberry Creek Watershed Zoning Code Analysis and Ordinance Language Recommendations report provides both ordinance language that may be incorporated into local code and provides a list of ordinances and resources from around the Nation.

Objective 5: Educate local officials, planners,

and engineers on the benefits and methods of conservation planning and development.

Action Items

64. Assist local officials in developing and implementing code to encourage and/or require conservation design practices

65. Provide training opportunities for planners and engineers on design and implementation of conservation design practices

66. Pursue the creation and implementation of LCSMC incentives (to municipalities) for watershed-beneficial actions (e.g., award of excellence, funding incentives, etc.)

Objective 6: Provide educational, management, and restoration opportunities for residents to foster watershed stewardship.

Action Items

67. Provide schools with resource information for curriculum - grant opportunities (e.g., LEAP), web sites, references, etc.

68. Publicize watershed improvement projects that are implemented (educational and provide list of volunteer opportunities)

69. Develop and distribute educational information about the Watershed Plan itself

70. Develop and distribute educational fliers, brochures, reference lists, sample ordinance language (for conservation design, etc.)

71. Provide volunteer opportunities

72. Develop and distribute a resource/contact list for watershed issues

Resource and "Who to Call" lists are provided at the end of this Plan.

Objective 7: Educate residents on source control and runoff reduction measures that may be used on their properties.

Action Items

73. Distribute informational fliers and provide workshops

Many residents are eager to improve management of their properties to help improve the health of their watershed and lakes. However, they often need assistance in determining appropriate actions.

Goal 5: Evaluate Success in Plan Implementation

Objective 1: Monitor implementation of recommendations.

Action Item

74. Annually review implementation status

The municipalities and other stakeholders should perform an annual assessment of implementation status and update action items to address new conditions, information, and needs. The results of the assessment should be published as part of an annual report.

Objective 2: Perform hydrologic, water quality, and biological monitoring of the watershed to evaluate success in meeting watershed goals and objectives.

Action Items

75. Develop a prioritized monitoring program to target resources and evaluate success in meeting watershed goals

The program should consider flow, water quality, and biological monitoring. Flow monitoring would aid in better understanding the complicated hydrology of this watershed that contains significant depressional storage. Water quality monitoring can be used to better define sources of sediments and nutrients within the lakes and to evaluate success in meeting watershed goals. Biological monitoring should also be used to evaluate success in meeting watershed goals.

76. Identify and provide resources for establishing volunteer monitoring network

The Reference and Resources and references section of this report provides sources for volunteer programs.

77. Utilize citizen volunteers to identify watershed problems

Citizens should notify local officials and the LCSMC of watershed problems so that they can be addressed before larger problems develop. Example problems may include significant land or streambank erosion, debris blockages, soil erosion and sediment control issues, potential illegal discharges, etc.

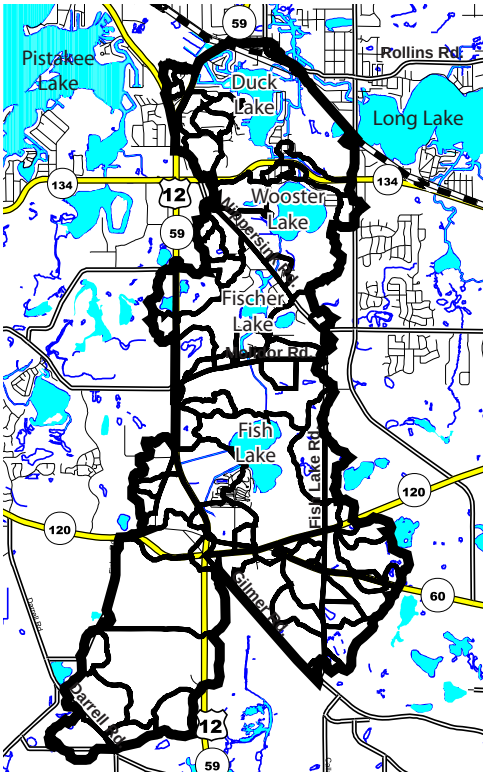


Figure IV-1 Sub-Watershed Map

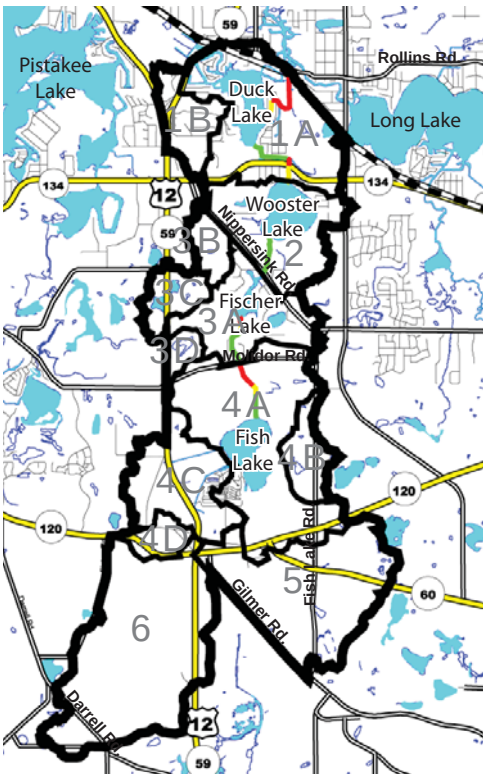


Figure IV-2 Watershed Management Unit Map

B. Watershed Management Unit Assessments and Recommendations

The watershed was divided into sub-watershed units based on topography and drainage systems. The sub-watersheds were taken from the floodplain study performed concurrently with development of this Watershed Plan. The study identified 85 sub-watersheds as shown on the Sub-Watershed Map (Figure IV-1). to the left. The sub-watersheds, indicate discrete areas that drain to a particular watershed location such as a depressional area, a highway culvert, or a particular segment of a drainageway, lake, or wetland.

The sub-watersheds were also used to divide the watershed into management units as shown in Watershed Management Unit Map (Figure IV-2) to the left. The management units generally correspond to which lake the area drains. The management units were further divided into sub-units based on drainage toward topographic depressional areas of the watershed.

This section presents location-specific recommendations by watershed management unit. For each management unit, a brief discussion of the conditions of the unit is presented followed by sub-unit, stream reach, and lake-specific recommendations. The recommendations are based on the inventory and analysis work presented in Chapter II.

Unit 1

This management unit consists of the watershed in the vicinity of Duck Lake, generally north of IL-134. It includes of a mix of residential development and scattered commercial development near the main roads. The undeveloped areas - mostly east of the lake - generally consist of low-lying depressional storage areas and wetlands that are unbuildable; therefore, this unit is nearly built out. Most of the wetland areas are classified as ADID wetlands. The western half of the residential area lies mostly within the Village of Fox Lake. This unit has the greatest number of structures located within the floodplain. Because this unit has very little remaining developable lands, the recommendations primarily focus on remedial or maintenance activities. Two sub-units have been identified based on drainage characteristics. Sub-unit 1B is internally drained.

- Sub-unit 1A

  This sub-unit is very flat and flood levels are primarily controlled by Fox Lake just downstream to the north. Nearly all of the drier areas, with the exception of the intersection of Wilson Road and IL-134, have been built out in residential use. This sub-unit also includes stream corridor Reach 1 and Reach 2.

  Duck Lake is the most downstream of the lakes in the watershed. It has slightly lower nutrient levels than Fish and Fischer Lakes, probably because of the lower nutrient contributions from Wooster Lake upstream. However, these levels are still indicative of an enriched condition. Nutrient sources to Duck Lake include fertilizer from the residential areas surrounding the lake, sediment eroded from stream banks, on-site septic systems, and internal nutrient recycling. Duck Lake has poor water clarity due to higher suspended sediment levels. This could be caused by sediment inputs from the drain or disturbance of lake sediments from boating or carp feeding.

  As discussed in Chapter II, the deepest flooding surrounding Duck Lake is caused by backwater from flooding on Fox Lake. Although the flooding due to Fox Lake cannot be addressed here, a number of alternatives were considered to potentially reduce flooding caused by Fish Lake Drain flow rates when Fox Lake is not in flood stage. The potential alternatives included restricting the discharge from Wooster Lake and increasing flood storage east of Forest Avenue. A qualitative assessment of these options indicated that neither are good solutions. Restricting the discharge from Wooster Lake would increase flooding surrounding Wooster Lake, and the required amount of excavation east of Forest Avenue to reduce the flood stage to below damage levels would likely be cost prohibitive, particularly since the excavation would do nothing to reduce flooding from Fox Lake. Thus, the most cost effective solution was determined to be floodproofing.

- Sub-unit 1B

  There are three depressional storage areas within sub-unit 1B with two being considered regionally significant (greater than five acres). Based on assumed drain tile capacity, the floodplain study indicates a maximum combined release rate from these areas of 0.01 cfs/acre up to an approximately 10-year event. The 100-year discharge was estimated to vary from 0.01 cfs/acre to 0.03 cfs/acre, depending on location. The depressional storage areas are intermixed with residential and commercial development. These discharge rates should be considered when evaluating detention release rates for this sub-unit.

Recommendations

- Floodproofing of approximately 58 homes: Floodproofing plans should be prepared and implemented for homes located in the floodplain. Technical assistance should be provided by the LCSMC and the Village of Fox Lake should consider cost-sharing with residents.

- Implement Green Infrastructure Plan: The significant floodplain and ADID wetland areas should be protected as shown in the Green Infrastructure Plan (Figure III-1). Action Item 14 under Goal 1, Objective 6 suggests methods for protection of the area within the Green Infrastructure Plan boundary.

- Protect and manage wetlands: The large wetland area east of Duck Lake should be protected from development and other negative alterations through conservation easements or other measures. Also, restoration management plans should be prepared and implemented for the wetlands.

- Repair gully erosion north of IL-134 and west of Wilson Road: There are several small ravines in this area with the southernmost ravine experiencing the greatest erosion. Management of the woodland surrounding the ravines would reduce surface runoff. Bioengineering and grade stabilization should be used to reduce down cutting.

- Preserve drainage characteristics of sub-unit 1B: Due to the high level of watershed storage, discharge from this sub-unit is small. Increasing discharge could lead to increases in surface runoff, potential decreases in groundwater flow, and increases in water level fluctuations and pollutant loads to Duck Lake. Retention BMPs such as rain gardens, bioswales, and porous pavement as outlined in Chapter III and Appendix 4 can be used to prevent increases in runoff volumes as the small amount of remaining land is developed. The Village of Fox Lake should establish standards for this area that would prohibit increases in runoff rates from this sub-unit.

- Stream Reach 1A:
  Stream corridor vegetative management: Bank erosion is relatively low in this reach and because of the low banks, even reed canary grass likely provides some level of bank stabilization. In areas subject to frequent inundation during the growing season, it will be difficult at best, or not even practical, to control reed canary grass. Those areas that are not subject to overbank flooding during the growing season may respond to management measures to control reed canary grass. Where hydrologic conditions are stable, burn management, select herbicide applications, and a native species enhancement program should provide sufficient control. However, it will take a number of years to see an impact. Initial management should be followed by annual fall burning to maintain control and allow more colorful prairie wildflowers to compete.

- Stream Reach 1B:
  Repair failing sheetpile: Since this reach is used for boat parking, replacement of failing sheetpile over this short reach may be the best shoreline treatment.

- Stream Reach 2A:
  Establish riparian corridor: The turf areas along this reach should be replaced with native riparian vegetation to stabilize bank slopes and improve water quality. Minor bank regrading may be necessary east of Forest Avenue. Annual burning is the preferred method of maintaining the corridor; however, mowing is an acceptable alternative. Burning will encourage establishment and growth of prairie wildflowers, improving the visual appearance of the corridor.

  Restore woodland: The wooded area south of the Drain, east of Forest Avenue should be restored to reduce surface erosion, improve habitat, and better stabilize streambanks. An initial clearing of non-native invasive species should be followed by a two-year program of weed control. After the initial restoration work, annual burning should be used to maintain the woodland.

- Stream Reach 2B:
  Restore riparian woodland: This area should be restored in a similar manner as described above.

- Stream Reach 2C:
  Stabilize streambanks and restore stream corridor: Streambank regrading and stabilization is required in selected areas of this reach. The woodland within approximately 25 feet on either side of the stream should be thinned by removing non-native invasives and herbaceous ground cover should be established to reduce surface erosion and improve stabilization of streambanks.

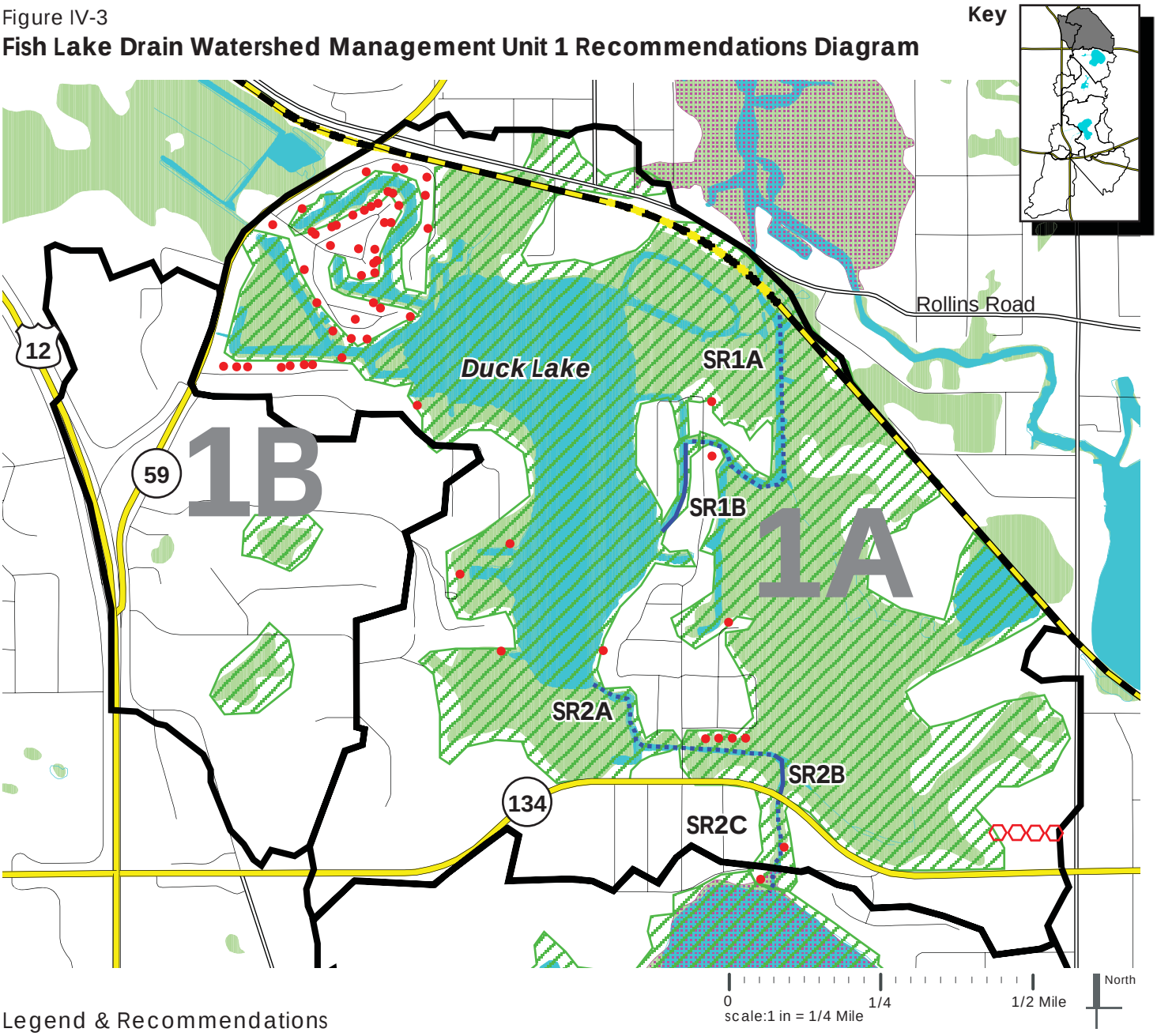
- Duck Lake:
  Source controls and lot level BMPs: Source controls include management of household landscape, pet, and solid waste and reduced use of fertilizers. Lot level BMPs include rain gardens and naturalization of existing drainage swales. These measures should be focused on those areas directly surrounding the lake and its bays.

  Shoreline stabilization: Based on the LCHD Duck Lake report, approximately 2,000 feet of shoreline is moderately to severely eroding and should be stabilized.

  Establishment of native shoreline buffer: Turf areas along this shoreline should be replaced with native riparian vegetation to stabilize shoreline slopes and improve water quality and

Figure IV-3

Fish Lake Drain Watershed Management Unit 1 Recommendations Diagram



Legend & Recommendations

- Sub-Unit Boundary
- Rail Road
- Highway
- Major Road
- Minor Road
- Stream
- Implement Green Infrastructure Plan
- Protect and Manage Wetlands
- 1B Preserve Drainage Characteristics
- Floodproofing Homes (approx. 58)
- Repair Gully Erosion
- Stream Reach
  - SR1A - Stream Corridor Vegetative Management
  - SR1B - Repair Failing Sheetpile
  - SR2A - Establish Riparian Corridor
  - SR2B - Restore Riparian Woodlands
  - SR2C - Stabilize Streambanks and Restore Stream Corridor
- A Duck Lake
  - Implement Source Controls
  - Implement Lot Level BMPs
  - Shoreline Stabilization
  - Establish Native Shoreline Buffer

aquatic habitat. Annual burning is the preferred method of maintaining a naturalized shoreline; however, mowing is an acceptable alternative. Burning encourages establishment and growth of prairie wildflowers, improving the visual appearance of the shoreline.

Unit 2

This unit consists of the watershed in the vicinity of Wooster Lake, bounded approximately by IL-134 to the north and Nippersink Road to the south. The western, more developed part of this area lies within the Village of Fox Lake, and a small amount of land to the east lies within the Village of Round Lake. Land uses are primarily residential, but an area south of the lake is designated as open space.

Stream corridor Reach 3, located in this unit, has moderate substrate stability and erosion problems along the streambanks. Algae growth was high at the time of the stream inventory. The likely causes of low substrate stability and high algae growth include the very slow moving nature of the reach as well as the relatively high nutrient concentrations of the water leaving Fischer Lake. The low strength hydric soils and the presence of shallow rooted reed canary grass, combined with frequent water level fluctuations, are the likely causes of streambank erosion.

Wooster Lake is a deep, natural pothole lake. It is deep enough to thermally stratify in the summer, which contains nutrients below the active upper levels. The reduced nutrient levels in the upper waters of the lake prevent nuisance algae from becoming dominant. As a result, this lake has better than the county-average clarity, and supports a diverse aquatic plant community, as well as a fish community that includes three state-listed endangered fish species. It is unknown how much capacity the lake has to absorb nutrient loads from the Fish Lake Drain channel and from runoff within the management unit, including the lawns surrounding the lake.

There are two open drainage swales through the ADID wetlands west of the lake. A 6-inch diameter tile drains the wetland east of the lake.

There is only a small amount of land identified for urban uses in the future land use plan that is not already developed. This is primarily within the corporate limits of the Village of Round Lake.

There are two homes surrounding Wooster Lake that are located within the draft 100-year floodplain. As discussed in Chapter II, two potential options for reducing flooding were considered. One option would be to increase the capacity of the outlet culvert to increase the discharge rate out of Wooster Lake and the other would be to decrease the capacity of the outlet from Fischer Lake to reduce inflows to Wooster Lake. Neither option was determined to be economically feasible. Increasing the discharge from Wooster Lake would likely increase the frequency of flooding in the already floodprone area of Duck Lake. Reducing the capacity of the outlet from Fischer Lake could threaten a number of homes that are only slightly above the current 100-year flood stage. Floodproofing of the two homes was identified as the preferred solution.

Recommendations

- Floodproof two homes: Depending on the frequency of flooding, floodproofing plans should be prepared and implemented for these two homes that are located in the floodplain. Technical assistance should be provided by the LCSMC and the Village of Fox Lake should consider cost- sharing with residents.

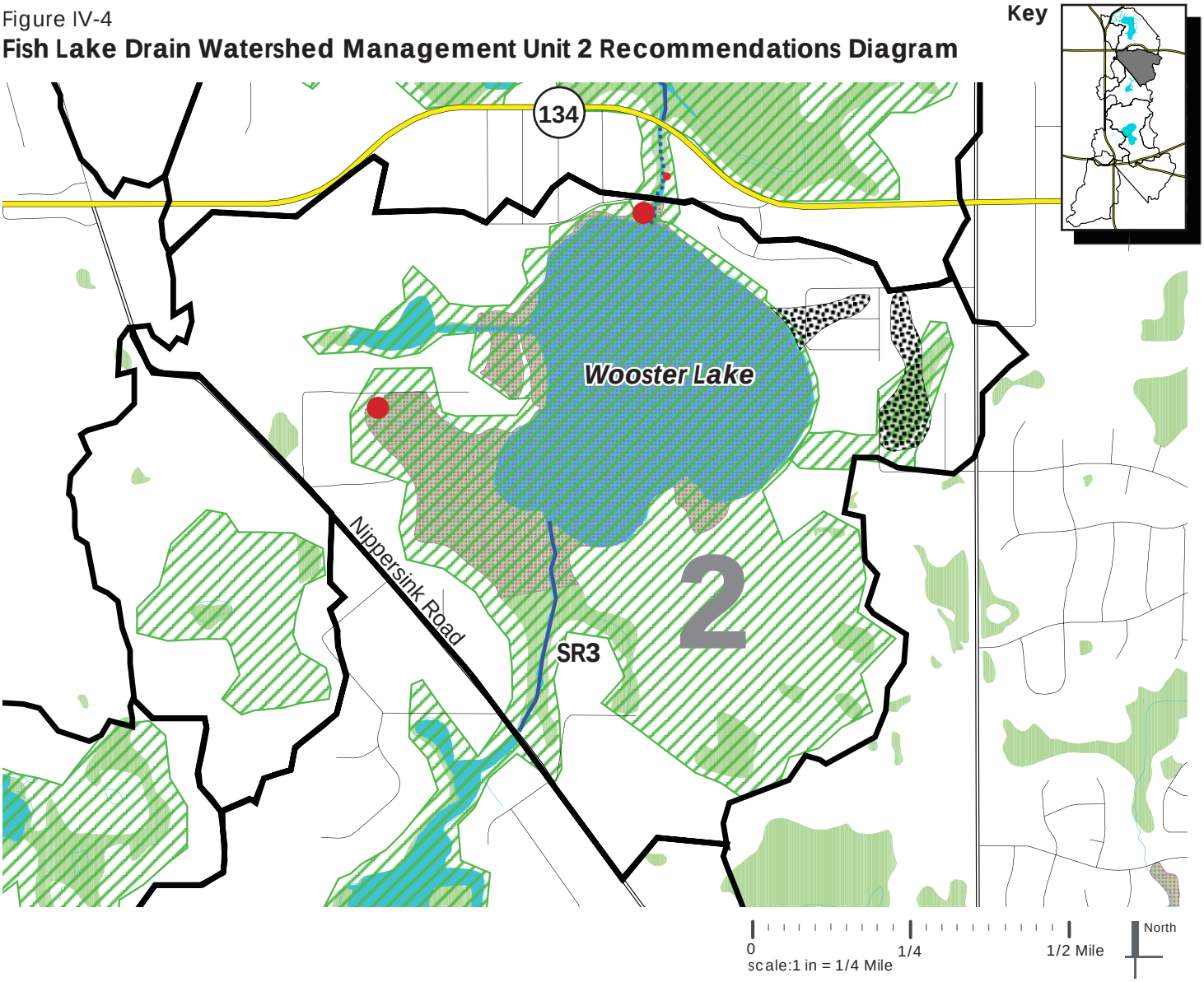
- Implement Green Infrastructure Plan: The significant floodplain and ADID wetland areas should be protected as shown in the Green Infrastructure Plan (Figure III-1). Action Item 14 under Goal 1, Objective 6 suggests methods for protection of the area within the Green Infrastructure Plan boundary.

- Protect and restore ADID wetlands: The ADID wetland areas west of Wooster Lake should be protected from development through conservation easements or other measures. Restoration management plans should also be developed and implemented for the ADID wetlands. The plan should address drainage channels through the wetlands that may be negatively affecting the hydrology of the wetlands.

- Address localized drainage problems east of Wooster Lake: An area east of the lake has been identified as a local drainage problem area that is causing some basement flooding. An outlet should be installed at an appropriate elevation to prevent basement flooding. In addition, the

Figure IV-4

Fish Lake Drain Watershed Management Unit 2 Recommendations Diagram



Legend & Recommendations

- Sub-Unit Boundary
- Rail Road
- Highway
- Major Road
- Minor Road
- Stream
- Implement Green Infrastructure Plan
- Protect and Manage ADID Wetlands
- Protect and Manage Wetlands
- Floodproofing Homes (approx. 2)
- Restore Depressional Areas and Prevent Basement Flooding
- Stream Reach 3
  - Stabilize Streambanks
  - Restore Stream Corridor
- A Wooster Lake
  - Implement Source Controls
  - Implement Lot Level BMPs
  - Retrofit Curb and Gutter Areas on North-west Side of the Lake
  - Shoreline Stabilization
  - Establish Native Shoreline Buffer
  - Implement In-lake Lake Management Strategies Recommended as per LCHD

vegetation within this area should be managed to improve biological diversity and aesthetics and reduce nuisance perceptions.

- Stream Reach 3:
  Stabilize streambanks and restore stream corridor: Bank erosion is moderate and a combination of bank regrading and vegetative management should be sufficient to reduce erosion. Reed canary grass should be addressed through a two-year program of herbiciding and burning. Initial management should be followed by annual burning to maintain control and allow more colorful prairie wildflowers to compete.

- Wooster Lake:
  Source controls and lot level BMPs: Source controls include management of household landscape, pet, and solid waste and reduced use of fertilizers. Lot level BMPs include rain gardens and naturalization of existing drainage swales. These measures should be focused on those areas directly surrounding the lake, but are appropriate throughout the watershed.

  Retrofit curb and gutter areas on northwest side of lake: The direct storm sewer discharge from this area should be eliminated to improve water quality. Options include replacement of the storm sewer outfall with a created wetland and installation of rain gardens and bioswales to filter runoff from small storm events.

  Shoreline stabilization - Reduce water level fluctuations: Modification of the weir structure at Wooster Lake Avenue to reduce water level fluctuations should be investigated. By detaching the existing weir structure from the outlet culvert and constructing a longer replacement weir, it may be possible to reduce water level fluctuations for 2-year and smaller events without increasing discharges for 10- to 100-year events that cause flooding around Duck Lake. The water level rise during a 2-year event is currently approximately 2 feet.

  Shoreline stabilization - Native plantings: Moderate regrading and establishment of native shoreline vegetation should reduce shoreline erosion. However, due to the relatively large water level fluctuations, more intense maintenance will be required to maintain the vegetation and prevent erosion unless the weir modification recommendation above is implemented.

  Establishment of native shoreline buffer: Turf areas along this shoreline should be replaced with native riparian vegetation to stabilize shoreline slopes and improve water quality and aquatic habitat. Annual burning is the preferred method of maintaining a naturalized shoreline; however, mowing is an acceptable alternative. Burning will encourage establishment and growth of prairie wildflowers, improving the visual appearance of the shoreline.

  Develop hydrologic and nutrient budgets for Wooster Lake: Hydrologic and nutrient budgets would aid in understanding the various sources and sinks of nutrients. This would provide some level of prediction of the additional nutrient load that the lake may be able to accommodate without significant degradation.

  Implement in-lake lake management strategies recommended by Lake County Health Department: The LCHD recommended control of invasive aquatic plants such as Eurasian water milfoil and Beginner's pondweed.

Unit 3

This sub-watershed area is approximately bounded by Nippersink Road to the north and Molidor Road to the south. It is hydrologically complex with a number of internally drained areas as delineated by the sub-units.

- Sub-unit 3A
  This is the main sub-watershed in the vicinity of Fischer Lake. Much of the western portion of this sub-unit, currently agricultural, has been annexed by the Village of Volo. Volo plans for this area to become commercial, industrial, and mixed-use in the future. There are a few large lot subdivisions in this area, primarily along Fish Lake Drain and within Fischer Estates around Fischer Lake. As with most of the development in the watershed, drainage is via open drainage swales.

  Fischer Lake, originally a shallow marsh, was excavated to create the lake that is present today. Like Duck and Wooster Lakes, Fischer Lake is on-line with Fish Lake Drain flowing

through it. Thus, it is subject to sedimentation and nutrient loads from the entire watershed south of the lake. There are numerous sources of nutrients to the lake from this management unit and from upstream via Fish Lake Drain. Known and potential sources include: runoff from adjacent lots and more remote urban and agricultural areas; nutrient recycling within the lake; on-site septic systems; landscape nurseries; and sediment eroded from stream banks.

All three stream reaches are located in this sub-watershed. Reach 4A is impounded and therefore very pond-like with low substrate habitat and macroinvertebrate quality. Reach 4B has a much higher gradient and has higher macroinvertebrate quality. However, there are locations of very severe streambank erosion in this reach.

- Sub-unit 3B
  This sub-unit is in the northwestern corner of Unit 3. It is currently a largely undeveloped internally drained area. The low areas within the sub-unit are composed of wetlands and hydric soils. Modeling during development of the floodplain study indicates that there is no surface water discharge from this sub-unit. The Village of Volo has annexed most of this sub-unit, and is planning to develop it as mixed use.

- Sub-unit 3C
  This sub-unit is in the western pocket of Unit 3, just west of a plant nursery. It consists primarily of a significant depressional storage area that has no surface water discharge to the rest of the watershed. This area is primarily open space and is planned to remain so in the future.

- Sub-unit 3D
  This sub-unit is south of sub-unit 3C and is characterized as depressional area with no surface water discharge to the rest of the watershed. The Village of Volo has annexed sub-unit 3D, and is planning for it to be developed as commercial, industrial, and mixed use. As a result, there may be pressure to increase discharge rates from this area.

Because management Unit 3 has both existing and future developed land uses, both remedial and preventive activities are appropriate, along with maintenance.

Recommendations

- Protect wetlands and other water resource areas as outlined in the Green Infrastructure Plan: The protection areas outlined in the Green Infrastructure Plan (Figure III-1) should be protected as open space throughout the development process. Action Item 14 under Goal 1, Objective 6 suggests methods for protection of the area within the Green Infrastructure Plan boundary.

- Implement agricultural BMPs: There is an existing farm northeast of the intersection of US-12 and Molidor Road that is already implementing many techniques such as contour plowing and vegetated buffers. BMPs should be implemented to address the landscape nursery west of the lake. Action Item 13 under Goal 1, Objective 5, discusses treatment of agricultural and nursery runoff.

- Implement sub-unit specific runoff volume and release rate standards: Discharge rates and volumes from sub-units 3B, 3C, & 3D should be limited. The floodplain study indicates that there is no discharge from these sub-units up to, and including, the 100-year event, and consideration should be given to continuing this condition.

- Develop sub-units 3B and 3D using conservation design principles: Conservation design principles should be used to prevent increases in runoff volumes and rates to protect the hydrology and water quality of the large wetlands within these sub-units. The wetland within sub-unit 3D is an ADID wetland. Conservation development should include retention BMPs such as rain gardens, bioswales, porous pavement, and naturalized detention.

- Prepare and implement restoration management plan for ADID wetland: A large ADID wetland is located in sub-unit 3D.

- Stream Reach 4A:
  Regrade banks to a more stable slope and establish native riparian and emergent vegetation: This reach should be managed as a pond with native emergent and riparian vegetation within the channel and on the shoreline. Banks are steep and slumping, and regrading should be performed to address erosion.

- Stream Reach 4B:
  Energy dissipation at culvert outfall and stream corridor restoration: A drop structure or other energy dissipation measures should be installed to address the severe erosion at the culvert outfall. Corridor restoration measures should include debris removal throughout the reach. Artificial riffles should be installed to reduce pressure at the toe of the bank and to improve habitat. Bioengineering stabilization of steep banks and toe protection should also be implemented. Visible sand seams may increase difficulty in stabilizing the slope.

- Stream Reach 4C:
  Establish shoreline buffer and perform selected stabilization: Turf areas along this reach should be replaced with native shoreline vegetation to stabilize bank slopes and improve water quality. Minor bank regrading may be necessary in a number of areas. Annual burning is the preferred method of maintaining the corridors; however, mowing is an acceptable alternative. Burning will encourage establishment and growth of prairie wildflowers, improving the visual appearance of the corridor along both sides of stream. Provide a recreational access point for each residence to allow fishing, etc.

- Fischer Lake:
  Source controls and lot level BMPs: Source controls include management of household landscape, pet, and solid waste and reduced use of fertilizers and use of zero phosphorous fertilizers. Lot level BMPs include rain gardens and naturalization of existing drainage swales. These measures should be focused on those areas directly surrounding the lake, but are appropriate throughout the watershed.

  Shoreline Stabilization: Based on the LCHD Fischer Lake report, approximately 4500 feet of shoreline (including the island) is moderately to severely eroding and should be stabilized. In most areas, there should be sufficient space to stabilize the banks through regrading and establishment of deep-rooted native vegetation.

  Establishment of native shoreline buffer: Turf areas along this shoreline should be replaced with native riparian vegetation to stabilize shoreline slopes and improve water quality and aquatic habitat. Annual burning is the preferred method of maintaining a naturalized shoreline; however, mowing is an acceptable alternative. Burning will encourage establishment and growth of prairie wildflowers, improving the visual appearance of the shoreline.

  Implement in-lake lake management strategies recommended by LCHD: LCHD's recommendations included establishment of rooted aquatic and emergent vegetation to provide fish habitat and stabilize bottom sediments, control of invasive shoreline vegetation, and control of canada geese.

Unit 4

Unit 4 is approximately bounded by Molidor Road to the north and IL-120 to the south. However, small portions of this area also occur north of Molidor Road and south of IL-120. Four sub-units were identified, one along the main drainageway and the other three associated depressional storage areas, one to the east and the other two to the west.

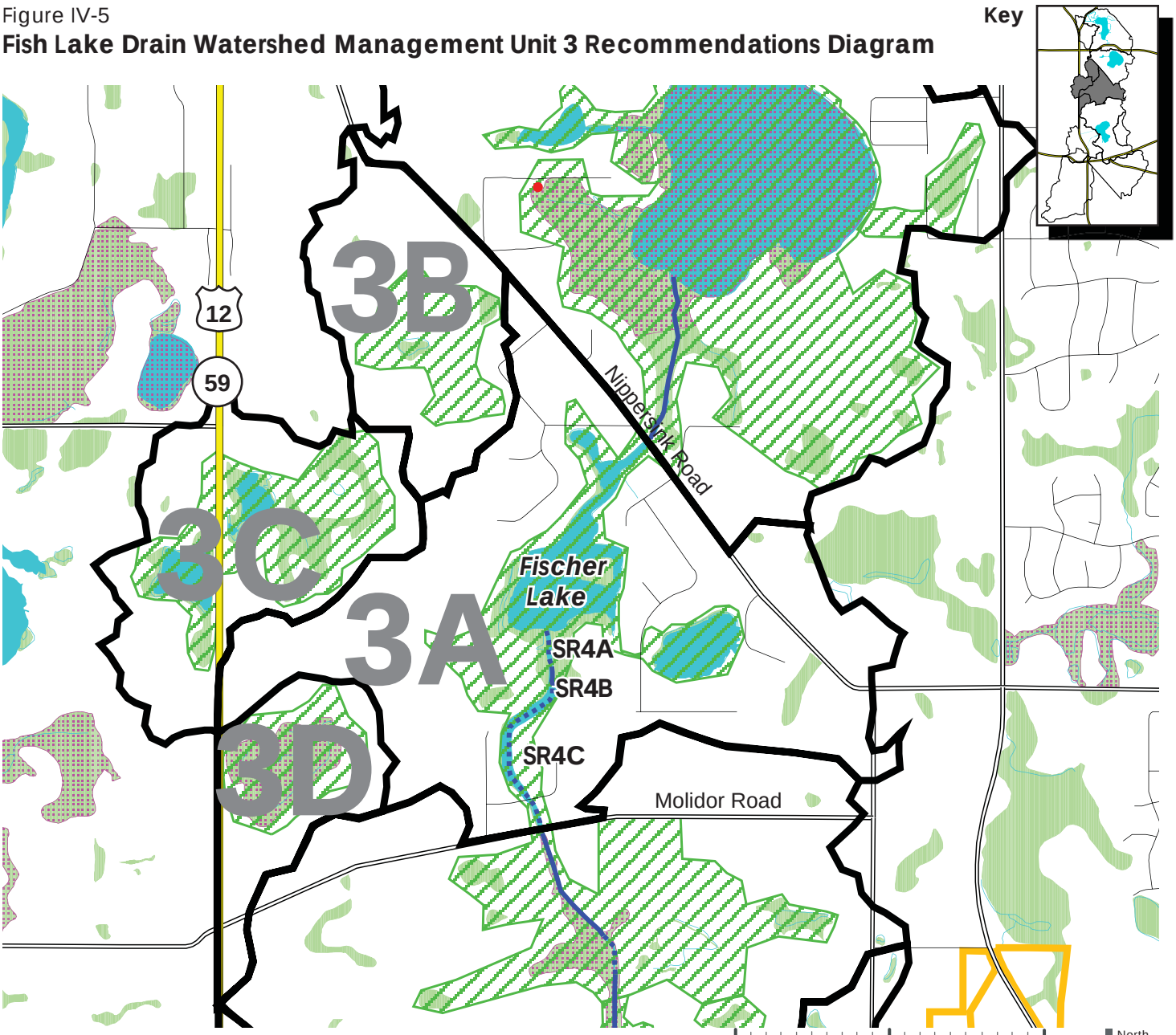
- Sub-unit 4A
  This sub-unit contains the Drain, high quality ADID wetlands, and floodplain areas surrounding Fish Lake. Fish Lake has the second highest water quality of the lakes in the watershed. Land uses are primarily agriculture or open space, with a small amount of campground development in the immediate vicinity of Fish Lake. A large hydric soil area southeast of the lake is tile drained to Fish Lake.

  This unit is relatively sparsely developed with most of the development concentrated along IL-120 and Volo Road. Grant Township facilities and a few residences exist along Molidor Road within this sub-unit. Commercial and mixed-use development is planned for the future in the northwestern portion of this sub-unit. The remainder is identified as open space.

- Sub-unit 4B
  This sub-watershed is located on the eastern edge of Unit 4, and drains to Fish Lake via an ADID wetland complex. Much of this area is already protected as part of the Marl Flat Forest

Figure IV-5

Fish Lake Drain Watershed Management Unit 3 Recommendations Diagram



Legend & Recommendations

- Sub-Unit Boundary
- Rail Road
- Highway
- Major Road
- Minor Road
- Stream

General Recommendations:
- Implement Agricultural BMPs
- Implement Sub-Unit Specific Runoff Volume and Release Rate Standards in 3B, 3C, & 3D
- Develop Sub-Unit 3B & 3D Using Conservation Design Principles

Implement Green Infrastructure Plan

Protect and Manage Wetlands

Stream Reach
SR4A - Stabilize Streambanks
- Establish Native Riparian and Emergent Vegetation

SR4B - Dissipate Energy at Culvert Outfall
- Steam Restoration

SR4C - Establish Shoreline Buffer
- Perform Selected Stabilization Stream Corridor

A Fischer Lake
- Implement Source Controls
- Implement Lot Level BMPs
- Shoreline Stabilization
- Establish Native Shoreline Buffer
- Implement In-lake Lake Management Strategies as per LCHD

Preserve.

- Sub-unit 4C
  This sub-unit is on the western edge of Unit 4. It contains a large ADID wetland complex associated with Fish Lake. Agriculture is also present, although future plans call for this area to be fully developed into mixed use, commercial, and industrial uses.

- Sub-unit 4D
  This sub-unit is south of sub-unit 4C. It consists of regionally significant depressional storage areas as well as some wetland areas that drain to the riparian wetlands of Fish Lake. Development currently includes the center of Volo Village and future land uses are planned to be commercial and mixed use.

Unit 4 is mostly undeveloped, but development pressure is coming. This presents an opportunity for integration of protection and restoration activities with development.

Recommendations

- Implement Green Infrastructure Plan: The significant floodplain and ADID wetland areas should be protected as shown in the Green Infrastructure Plan (Figure III-1). Action Item 14 under Goal 1, Objective 6 suggests methods for protection of the area within the Green Infrastructure Plan boundary.

- Protect and restore ADID wetlands: Restoration management plans should be developed and implemented for the ADID wetlands surrounding Fish Lake. The plan should address drainage channels through the ADID wetlands west of the lake that may be negatively affecting the hydrology of the wetlands.

- Restore hydric soil/wetland complex southeast of Fish Lake: A restoration management plan should be prepared and implemented for this large wetland restoration/creation site. Disruption of the drain tiles through the site should restore hydrology and begin the wetland recovery process. The site is identified for office/industrial development in Volo's comprehensive plan and this conflict should be addressed.

- Implement agricultural BMPs in sub-units 4A and 4B: BMPs should be implemented to address row crop agriculture as well as the nursery on the south side of Molidor Road and draining directly to Fish Lake Drain. Action Items 12 and 13 under Goal 1, Objective 5 discusses treatment of agricultural and nursery runoff.

- Implement sub-unit specific runoff volume and release rate standards: Discharge rates and volumes from sub-unit 4D should be limited. The floodplain study indicates that current 100-year and 2-year discharge rates are 0.04 and 0.04 cfs/acre, respectively. Consideration should be given to lowering the WDO allowable rate for the 100-year event to prevent an increase as this area builds out.

- Develop using conservation design principles: Most of the planned development is located within the internally drained areas of the watershed. Development should incorporate conservation principles, which will maintain the wetland areas and prevent additional runoff from being discharged to Fish Lake. Conservation development should include retention BMPs such as rain gardens, bioswales, porous pavement, and naturalized detention. Development plans within sub-unit 4C should be particularly sensitive to the large ADID wetland in this sub-unit.

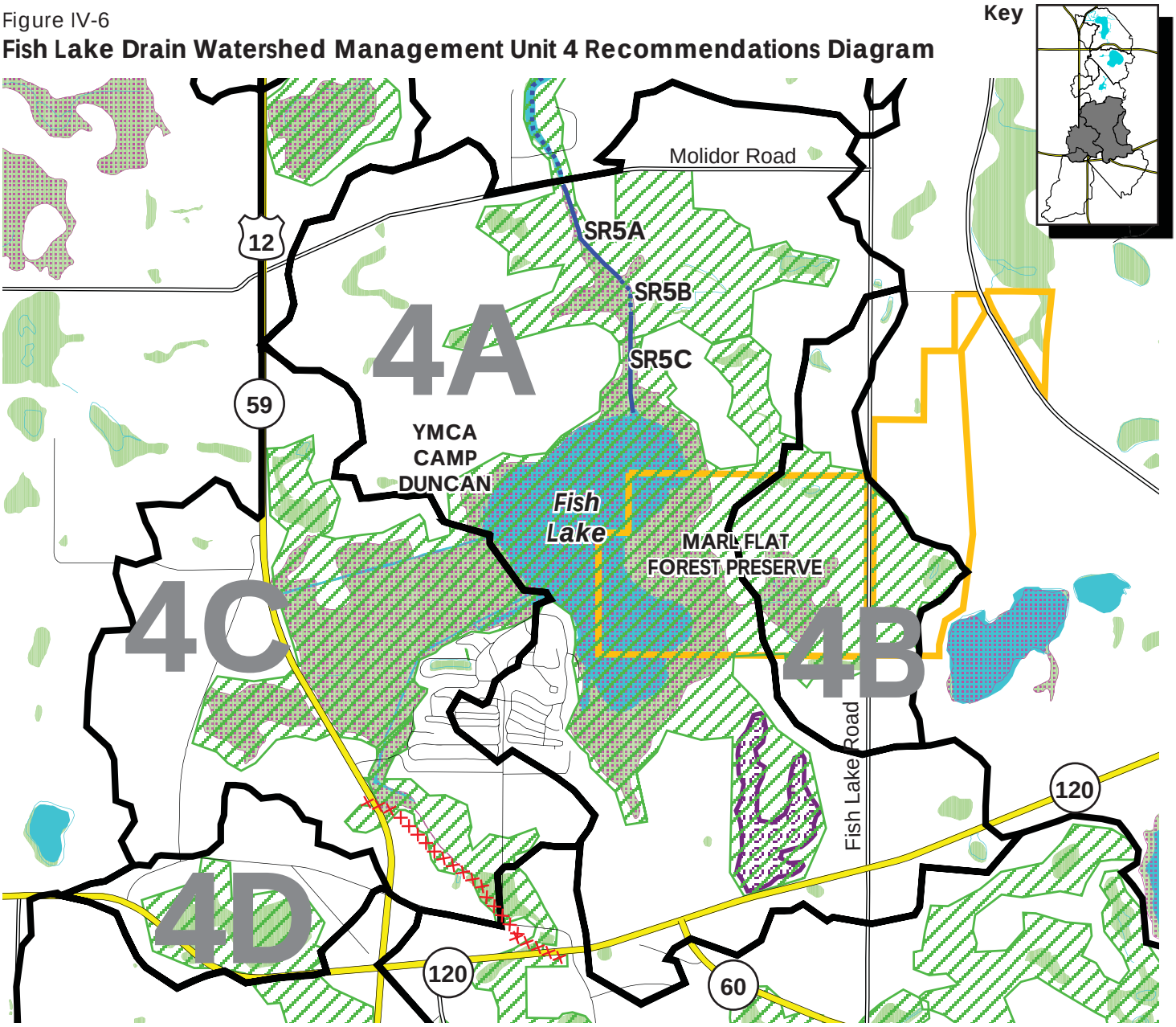
- Retrofit stormwater BMPs in the existing developed areas of sub-unit 4D: This area is relatively intensively developed. Some areas are served by existing detention with native vegetation, but other areas have no detention. Retrofit options include installation of permeable paving, bioswales or rain gardens within or at the edges of parking lots, respectively, and naturalized detention. Implementation of permeable paving or bioswales should be coordinated with parking lot maintenance and replacement projects to minimize costs.

- Retrofit regional drain tile: The regional drain tile between IL-120 and US-12/IL-59 should be removed and replaced with a naturalized wetland swale to improve water quality treatment of runoff from the significant areas of the watershed south of IL-120.

- Stream Reach 5A:
  Stabilize eroding streambanks and establish contiguous riparian buffer: Regrade steep banks to a stable slope at north end of reach. Establish

Figure IV-6

Fish Lake Drain Watershed Management Unit 4 Recommendations Diagram



Legend & Recommendations

0 1/4 1/2 Mile
scale:1 in = 1/4 Mile
North

- Sub-Unit Boundary
- Rail Road
- Highway
- Major Road
- Minor Road
- Stream
- Forest Preserve Boundary

General Recommendations:
- Implement Agricultural BMPs in Sub-Unit 4A & 4B
- Implement Sub-Unit Specific Runoff Volume and Release Rate Standards
- Develop Using Conservation Design Principles

- Implement Green Infrastructure Plan
- Protect and Restore ADID Wetlands
- Protect and Manage Wetlands
- Restore Wetland Complex

- Replace Regional Drain Tile with Open Drainage Waterway
- Stream Reach
  SR5A - Stabilize Eroding Streambanks
  - Establish Contiguous Riparian Buffer
  SR5B - Manage Riparian Corridor
  SR5C - Restore Riparian Woodlands
- A Fish Lake
  - Manage Shoreline Vegetation

riparian vegetation. Due to bank height, some areas may require bioengineering to stabilize slopes.

- Stream Reach 5B:
  Manage riparian corridor: Woodland management at south end of reach. Burn management to address reed canary grass.

- Stream Reach 5C:
  Restore riparian woodland: The wooded riparian corridor should be restored to reduce surface erosion, improve habitat, and better stabilize streambanks. An initial clearing of non-native invasive species should be followed by a two-year program of weed control. After the initial restoration work, annual burning should be used to maintain the woodland.

- Fish Lake
  Manage shoreline vegetation: The generally naturalized shoreline areas of Fish Lake should be managed through annual burning to improve shoreline stabilization, habitat, and water quality.

Unit 5

Unit 5 is the southeastern lobe of the watershed, approximately south of IL-120 and east of Gilmer Road. Nearly all of this area drains in the direction of the intersection of these two roads, with small areas to the east that rarely overflow. This unit drains to the Fish Lake ADID wetland complex.

Much of this area remains agricultural, with a small amount of existing residential along IL-60. Also, the Volo Commerce Center lies along IL-120 on the northern edge of this area. Virtually the entire unit drains through the detention pond of the Commerce Center. There are scattered pockets of wetlands in the unit that serve as locally significant depressional storage. Virtually this entire sub-unit is identified for commercial and industrial development under Volo's comprehensive plan and has the potential to contribute much greater amounts of runoff to the Fish Lake watershed than it does at present. The current discharge rate from Unit 5 is 110 cfs (0.15 cfs/acre) for the 100-year event and 10 cfs (0.015 cfs/acre) for the 2-year event. These rates are generally consistent with the Fish Lake drain allowable release rates of 0.09 cfs/acre and 0.02 cfs/acre for the 100-year and 2-year events, respectively.

Recommendations

- Implement Green Infrastructure Plan: The significant floodplain, wetlands, and depressional areas should be protected as shown in the Green Infrastructure Plan (Figure III-1). Action Item 14 under Goal 1, Objective 6 suggests methods for protection the area within the Green Infrastructure Plan boundary.

- Develop and implement restoration management plan for Singing Hills Forest Preserve wetlands.

- Develop using conservation principles: Although Fish Lake Drain allowable release rates are consistent with the existing rates, conservation design principles should be used to prevent increases in runoff volumes and improve water quality from the large amount of development slated for this area that will discharge to the Fish Lake ADID wetland complex. Conservation development should include retention BMPs such as rain gardens, bioswales, porous pavement, and naturalized detention.

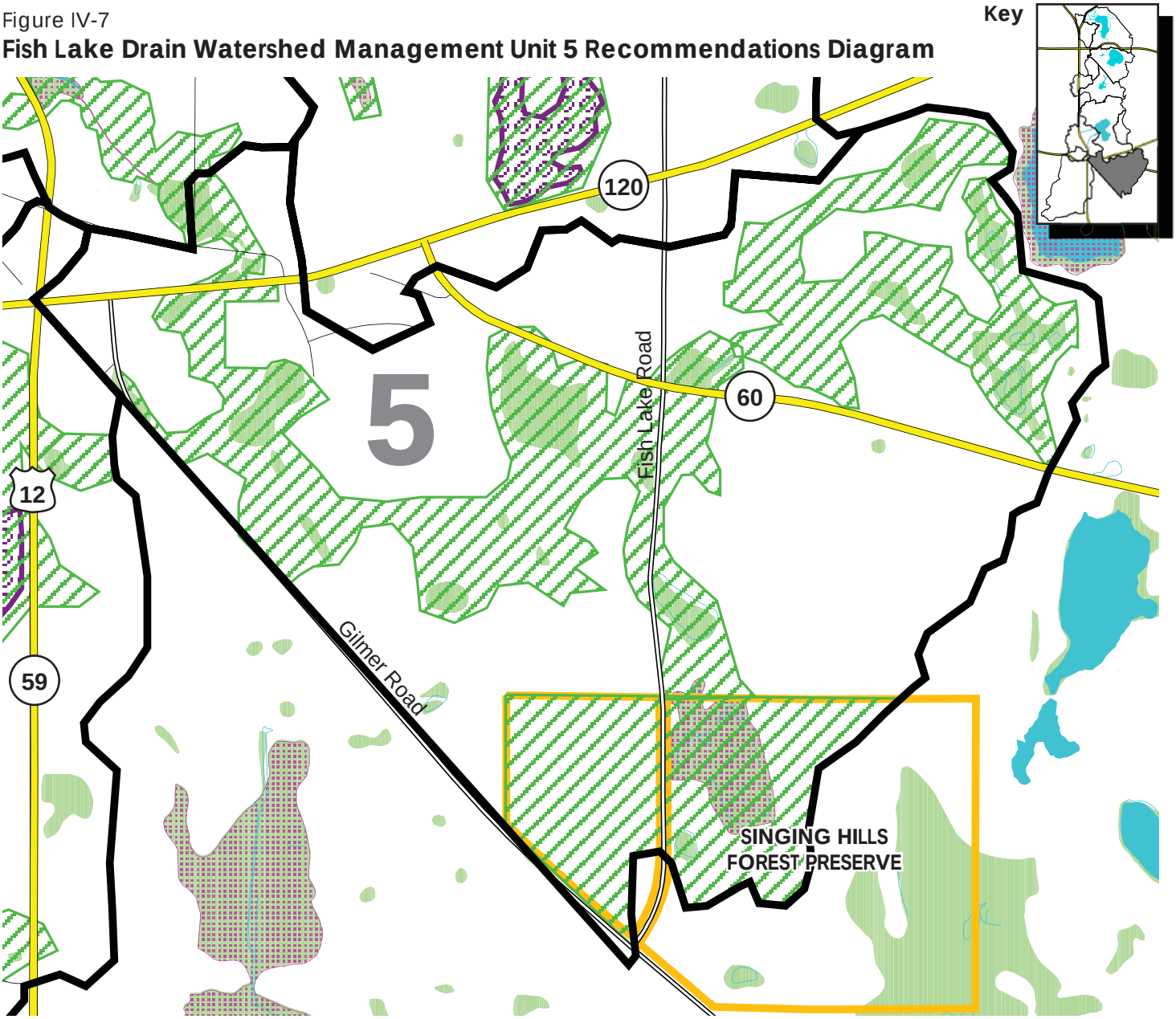
- Retrofit stormwater BMPs in the existing developed areas: The water quality and habitat benefits and shoreline stability of the existing detention basins in the Volo Commerce Center could be improved by replacing existing turf grass with native species.

  Although this area is already served by detention, at least one of the basins is an online basin and therefore may have somewhat lower water quality benefits. Thus, implementation of upstream BMPs could improve the quality of runoff discharging from Unit 4. Relatively simple retrofit opportunities include replacement of asphalt parking lots with permeable paving or installation of bioswales within and at the edge of the parking lots. These projects should be coordinated with pavement maintenance and replacement projects to minimize costs. Permeable paving and unlined bioswales should not be implemented at gas stations (i.e., at the corner of US-12 and IL-120).

- Implement agricultural BMPs.

Figure IV-7

Fish Lake Drain Watershed Management Unit 5 Recommendations Diagram



0 1/4 1/2 Mile
scale:1 in = 1/4 Mile
North

Legends & Recommendations

- Sub-Unit Boundary
- Rail Road
- Highway
- Major Road
- Minor Road
- Stream
- Forest Preserve Boundary

General Recommendations:

- Develop and Implement Restoration Management Plan for Singing Hills Forest Preserve
- Retrofit Stormwater BMPs in developed areas
- Develop Using Conservation Principles
- Implement Agricultural BMPs
- Implement Management Unit Specific Runoff Volume and Release Rate Standards

- Implement Green Infrastructure Plan
- Protect and Restore ADID Wetlands
- Protect and Manage Wetlands

Unit 6

This area encompasses the southwestern lobe of the watershed, south of IL-120 and west of the intersection with Gilmer Road. Most of this area is in agricultural use. There is also a large landscape nursery to the south along US-12/IL-59. Portions of this area along the main roads are slated for commercial and industrial development by the villages of Lakemoor and Volo, but most of the unit is expected to remain agricultural based on the municipal and county land use plans. There are two large, regionally significant depressional storage locations in this area. This unit discharges to the large Fish Lake ADID wetland complex in Unit 4.

This unit has great potential for restoration of major wetland and depressional storage complexes, due to the presence of extensive hydric soils and open wet areas. Removal of the field tiles would provide opportunities for wetland rehabilitation.

Although the amount of development planned is not as great as in some of the other areas, it will be very important to implement preventive stormwater management practices in this area to prevent increases in runoff that might increase discharge to the road intersection and the Fish Lake ADID wetland complex. The current discharge rates from this Unit are 130 cfs (0.12 cfs/acre) for the 100-year event and 4 cfs (0.004 cfs/acre) for the 2-year event. Restoration and enhancement of the depressional storage area would potentially result in a decrease in the amount of water contributed to Fish Lake from current levels.

Recommendations

- Implement Green Infrastructure Plan: The significant floodplain, wetlands, and depressional areas should be protected as shown in the Green Infrastructure Plan (Figure III-1). Action Item 14 under Goal 1, Objective 6 suggests methods for protection the area within the Green Infrastructure Plan boundary.

- Implement management unit specific runoff volume and release rate standards: Based on existing conditions, the release rate from this management unit should be limited to 0.004 cfs/acre for the 2-year event. (The allowable 100-year discharge rate of 0.09 cfs/acre is already lower than the existing.) In addition, runoff volumes should be limited to existing conditions.

- Develop using conservation principles: Conserv-ation design principals should be used to prevent increases in runoff volumes and rates to meet unit specific runoff volume and release rate standards. Conservation development should include retention BMPs such as rain gardens, bioswales, and porous pavement and naturalized detention.

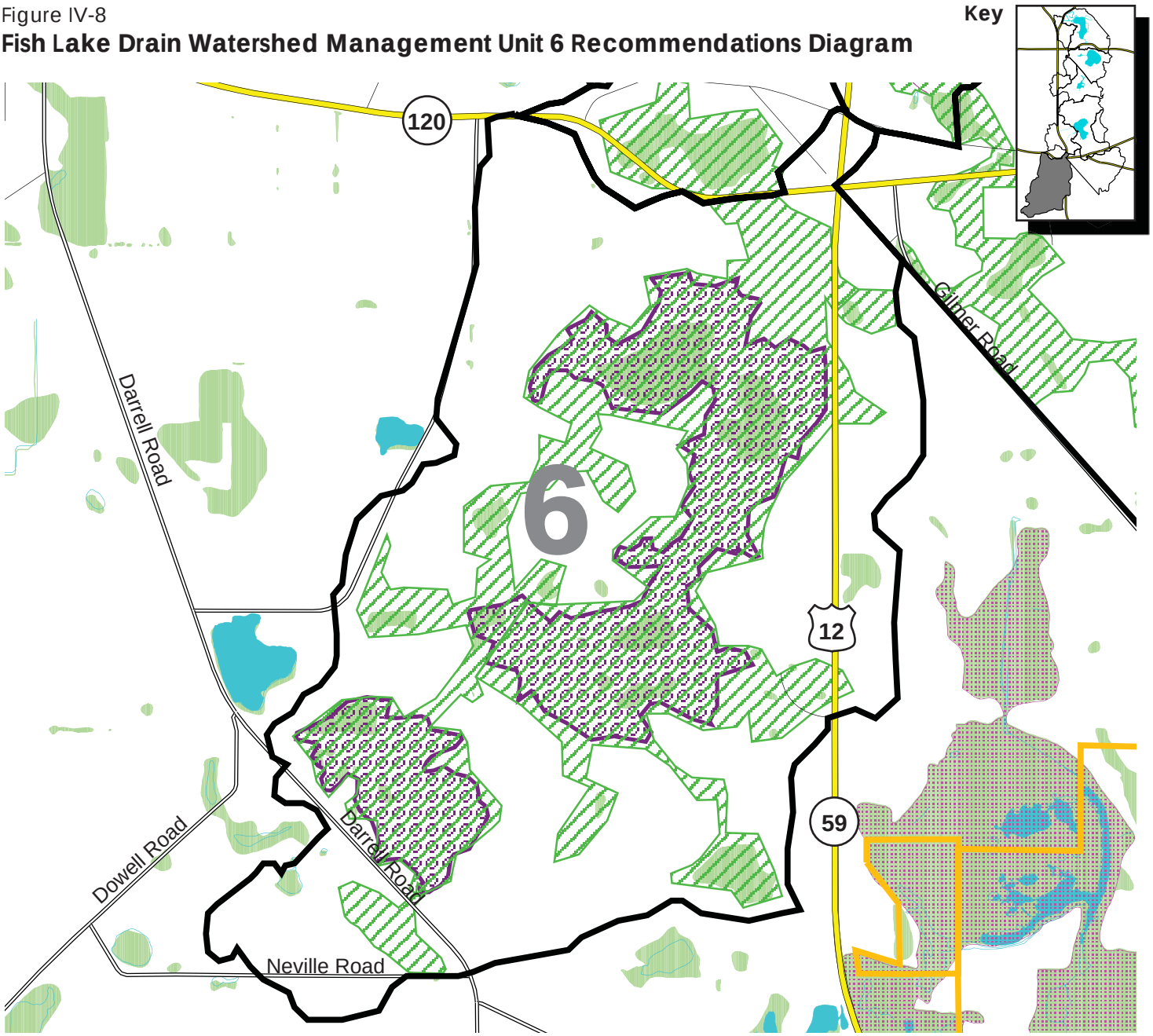
- Retrofit stormwater BMPs in the existing developed areas: There are businesses at the north end of the unit that front US-12/IL-59 and have no detention or other BMPs. Relatively simple retrofit opportunities include replacement of asphalt parking lots with permeable paving or installation of bioswales within and at the edge of the parking lots. These projects should be coordinated with pavement maintenance and replacement projects to minimize costs. Permeable paving and unlined bioswales should not be implemented at gas stations or marinas with outdoor refueling facilities (i.e., at the corner of US-12 and IL-120).

  There are several wet detention basins that serve development along US-12 at the south end of the unit that could benefit from retrofitting. Replacing the existing turf banks and shorelines with native vegetation could improve water quality and habitat and provide for long term stability of the shoreline.

- Create/restore large wetland complex as a regional detention facility or wetland bank: The extensive complex of hydric soils in this unit should be restored by breaking drain tiles to rehydrate this large former wetland/prairie complex. A restoration management plan should be prepared to guide restoration. Utilizing this large complex as a regional detention facility may be a method of financing the restoration and building support for incorporating such a large area into the Green Infrastructure Plan. If this area is used as regional detention, control of the two-year event should continue to occur within individual developments to protect the water quality of the restoration and to minimize water level fluctuations. Establishing the complex as

Figure IV-8

Fish Lake Drain Watershed Management Unit 6 Recommendations Diagram



Legend & Recommendations

- Sub-Unit Boundary
- Rail Road
- Highway
- Major Road
- Minor Road
- Stream

General Recommendations:

- Retrofit Stormwater BMPs in Developed Areas
- Implement Management Unit Specific Runoff Volume and Release Rate Standards
- Develop Using Conservation Design Principles
- Implement Agricultural BMPs

- Implement Green Infrastructure Plan
- Protect and Manage ADID Wetlands
- Protect and Manage Wetlands
- Restore Large Wetland Complex

a wetland bank is another strategy for financing the restoration. The northern of the two recommended restoration sites is identified for commercial development in Lakemoor's comprehensive plan and this conflict should be addressed.

- Implement agricultural BMPs.

C. Summary of Watershed Management Recommendations and Impact

Table IV-1 summarizes the Watershed Management Recommendations (WMRs) and provides best estimates and/or ranges of pollutant load reductions that can be achieved for WMRs in the quantities indicated. Load reduction estimates, whether indicated as ranges of percentages or as an estimated ability to meet reduction objectives, are based on a variety of studies examining the potential effectiveness of BMPs. Ranges of percentages indicate the broadest possible range of effectiveness based on these studies. Ability to meet reduction objectives (ranging from 1—minimally achieves objective, to 3—fully achieves objective), are derived from the Chicago Metropolitan Agency for Planning (formerly the Northeastern Illinois Planning Commission) BMP Effectiveness table (Price and Dreher, 1994). Load reduction estimates for Total Suspended Solids (TSS) and Phosphorous (P) are based on the IEPA Pollutant Load Reduction Spreadsheet.

Pollutant load reduction targets are indicated in two ways and are based on professional opinion of feasibility: (1) Impairment Reduction Targets indicate potential reduction of the indicated impairment based on full (100%) implementation of the WMR; (2) Area Improvement Targets indicate the area that can be reasonably expected to be addressed by the WMR. Actual load reduction estimates (for TSS and P) are calculated on the quantity of WMRs for the Area Improvement Target (e.g., 100%, 75%, etc.).

Table IV-1 Pollutant Load Reduction Estimates

Pollutant reduction	Pollutant prevention	Sub-Unit	Reach	Lake	Recommendation	Quantity	Unit	# of sides	Area Improvement Target (percent)	Pollutant Load Reduction Estimates	Water Quality	Water Quality	Water Quality	Water Quality	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Flood flows	Flood flows	Flood damages	Flood damages
									Impairment-->		Water Quality	Water Quality	Water Quality	Water Quality	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Flood flows	Flood flows	Flood damages	Flood damages
									Source---->		Total suspended solids / turbidity (lbs/yr)	Nutrients - Phosphorous (lbs/yr)	Nutrients (BOD)	Aquatic life toxicity	Lack of habitat characteristics	Hydrologic disturbance / flow alterations	Draining, filling, and degradation of wetlands	Exotic and invasive species	Loss/ reduction/ degradation of natural riparian buffer	Loss of natural "management" mechanisms	Increased rate and volume of runoff	Loss / drainage of depressional storage	Past encroachments on floodplain	Creek obstruction
									Impairment Reduction Target---->		75%	50%	50%	25%	25%	50%	90%	25%	75%	50%	75%	90%	100%	100%
Management Unit 1																								
x		A			Floodproofing of floodprone structures	58	each	1	1%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3	NA
	x	A			Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
x	x	A			Develop and implement restoration management plan for large wetland east of Duck Lake	110	acres	1	100%	28,892	60.6	63% BOD	90% HC; 36-69% TM	NA	NA	3	3	2	3	NA	NA	NA	NA
x		A			Repair gully erosion north of 134 and west of wilson rd (Load reduction estimate uses moderate streambank stabilization figures.)	525	feet	1	100%	10,395	4.7	30-50% BOD	62-75% HC; 14-71% TM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
x		A	1A		Vegetative Management (burning) to re-establish native riparian plant communities	2400	feet	2	100%	3,854	6.5	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
x		A	1B		Repair failing sheetpile wall (Load reduction estimate uses low streambank stabilization figures.)	940	feet	2	100%	10,152	3.4	30-50% BOD	62-75% HC; 14-71% TM	NA	NA	NA	NA	2	NA	NA	NA	NA	NA
x		A	2A		Establish native buffer along streambank	1950	feet	1.5	100%	2,349	3.9	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
x		A	2A		Woodland management south of creek, east of Forest Way	5.5	acres	1	100%	1,445	3.0	30-50% BOD	NA	NA	NA	NA	2	NA	3	NA	NA	NA	NA
x		A	2B		Re-establish wooded wetland plant community (riparian buffer)	290	feet	2	100%	466	0.8	30-50% BOD	62-75% HC; 14-71% TM	NA	NA	3	3	NA	3	2	NA	NA	NA
x		A	2C		Woodland riparian corridor management	630	feet	2	100%	1,012	1.7	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
x		A	2C		Selected streambank stabilization	630	feet	2	100%	163,296	68.0	30-50% BOD	62-75% HC; 14-71% TM	2	NA	NA	NA	2	NA	NA	NA	NA	NA
x				Duck	Source controls & lot-level BMPs surounding lake (swales)	21,780	feet	1	75%	8,984	9.8	30-90% BOD	62-90HC; 14-100% TM	NA	1	NA	NA	NA	NA	1	NA	NA	NA
x		A		Duck	Shoreline stabilization	2000	feet	1	100%	10,800	3.6	30-50% BOD	62-75% HC; 14-71% TM	3	NA	NA	NA	2	NA	NA	NA	NA	NA
x		A		Duck	Establish native buffer along shoreline	3400	feet	1	100%	2,730	4.6	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
	x	B			Do not increase hydrologic connection of depressional storage areas				100%	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	3	NA	NA
	x	B	1B		Preserve drainage characteristics / site BMPs				75%	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	1	NA	NA	NA

Table IV-1 Pollutant Load Reduction Estimates (Continued)

									Impairment-->	Water Quality	Water Quality	Water Quality	Water Quality	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Flood flows	Flood flows	Flood damages	Flood damages
									Source---->	Total suspended solids / turbidity (lbs/yr)	Nutrients - Phosphorous (lbs/yr)	Nutrients (BOD)	Aquatic life toxicity	Lack of habitat characteristics	Hydrologic disturbance / flow alterations	Draining, filling, and degradation of wetlands	Exotic and invasive species	Loss/ reduction/ degradation of natural riparian buffer	Loss of natural "management" mechanisms	Increased rate and volume of runoff	Loss / drainage of depressional storage	Past encroachments on floodplain	Creek obstruction
									Impairment Reduction Target--->	75%	50%	50%	25%	25%	50%	90%	25%	75%	50%	75%	90%	100%	100%
Pollutant reduction	**Pollutant prevention**	**Sub-Unit**	**Reach**	**Lake**	**Recommendation**	**Quantity**		**Unit**	**Area Improvement Target (percent)**	**Pollutant Load Reduction Estimates**													
Management Unit 2																							
x					Floodproofing of floodprone structures	2	each	1	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	95%	NA
	x				Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
x	x				Develop and implement restoration management plans for ADID wetlands	133	acres	1	75%	26,199	54.9	63% BOD	90% HC; 36-69% TM	NA	NA	3	3	3	3	2	NA	NA	NA
x					Restore isolated wetland east of Wooster Lake and address drainage	4.3	acres	1	100%	1,129	2.4	63% BOD	90% HC 36-69% TM	NA	NA	3	3	2	3	2	NA	NA	NA
x			3		Management of invasives (reed canary grass)	1700	feet	2	100%	2,730	4.6	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
x			3		Streambank regrading to address erosion	1700	feet	2	100%	67,320	30.6	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	NA	2	NA	NA	NA	NA	NA
x				Wooster	Source controls & lot-level BMPs surounding lake (swales)	13504	feet	1	75%	5,570	6.1	30-90% BOD	62-90HC; 14-100% TM	NA	1	NA	NA	NA	NA	1	NA	NA	NA
x				Wooster	Retrofit curb and gutter area on NE side of lake	3300	feet	1	100%	4,719	5.0	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	NA
x				Wooster	Shoreline stabilization (plantings)	8500	feet	1	100%	45,900	15.3	30-50% BOD	62-75% HC; 14-71% TM	3	NA	NA	NA	2	NA	NA	NA	NA	NA
				Wooster	Shoreline stabilization (weir replacement)	1	each	1	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Wooster	Develop hydrologic and nutrient budgets for Wooster Lake	1	each	1	100%	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA	NA	NA
x				Wooster	Perform in-Lake restoration activities as recommended in LCHD report				100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
x				Wooster	Establish native buffer along shoreline	8500	feet	1	100%	6,826	11.5	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
Management Unit 3																							
	x	A			Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
x		A			Implement & continue use of agricultural BMPs on cropland and landscape nurseries (filter strip / native buffer)*	11100	feet	1	75%	6,685	11.2	30-50% BOD	45-70% TM	NA	2	NA	NA	2	NA	2	NA	NA	NA
x		A			Address runoff from landscape nursery (filter strip / native buffer)*	7500	feet	1	75%	4,517	7.6	30-50% BOD	45-70% TM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
x		A	4A		Regrade banks	600	feet	2	100%	155,520	2.2	30-50% BOD	62-75% HC; 14-71% TM	2	3	NA	2	3	3	2	NA	NA	NA

Table IV-1 Pollutant Load Reduction Estimates (Continued)

									Impairment-->	Water Quality	Water Quality	Water Quality	Water Quality	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Flood flows	Flood flows	Flood damages	Flood damages
									Source---->	Total suspended solids / turbidity (lbs/yr)	Nutrients - Phosphorous (lbs/yr)	Nutrients (BOD)	Aquatic life toxicity	Lack of habitat characteristics	Hydrologic disturbance / flow alterations	Draining, filling, and degradation of wetlands	Exotic and invasive species	Loss/ reduction/ degradation of natural riparian buffer	Loss of natural "management" mechanisms	Increased rate and volume of runoff	Loss / drainage of depressional storage	Past encroachments on floodplain	Creek obstruction
									Impairment Reduction Target---->	75%	50%	50%	25%	25%	50%	90%	25%	75%	50%	75%	90%	100%	100%
Pollutant reduction	Pollutant prevention	Sub-Unit	Reach	Lake	Recommendation	Quantity	Unit	# of sides	Area Improvement Target (percent)	Pollutant Load Reduction Estimates													
		A	4A		Establish native riparian buffer	600	feet	2	100%	964	1.6												
x		A	4A		Establish emergent and rooted aquatic vegetation through channel bottom (Distance estimated from plan map; Uses low bank erosion figures.)	330	feet	1	50%	891	0.2	30-50% BOD	62-75% HC; 14-71% TM	3	NA	NA	1	NA	NA	NA	NA	NA	NA
x		A	4B		Energy dissipation at culvert outfall (Uses 200 ft of severe erosion to calculate load.)	1	ea	1	100%	25,920	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
x		A	4B		Debris removal	NA	NA	NA	100%	NA	NA	NA	NA	1	3	NA	NA	NA	NA	NA	NA	NA	3
x		A	4B		Artificial riffles to reduce erosion pressure at toe of slope	260	feet	1	100%	33,696	14.0	NA	NA	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
x		A	4B		Bioengineering streambank stabilization	260	feet	1	100%	33,696	14.0	30-50% BOD	62-75% HC; 14-71% TM	2	NA	NA	2	2	NA	NA	NA	NA	NA
x		A	4C		Perform modest bank regrading along shoreline	1800	feet	2	100%	71,280	32.4	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
x		A	4C		Establish native buffer along shoreline	1800	feet	2	100%	2,891	4.9	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
x		A		Fischer	Source controls & lot-level BMPs surounding lake (swales)	12197	feet	1	75%	5,031	5.5	30-90% BOD	62-90HC; 14-100% TM	NA	1	NA	NA	NA	NA	1	NA	NA	NA
x				Fischer	Shoreline stabilization of Lake and Island	4000	feet	1	100%	21,600	7.2	30-50% BOD	62-75% HC; 14-71% TM	2	NA	NA	2	2	NA	NA	NA	NA	NA
x				Fischer	Establish native buffer along shoreline	8000	feet	1	100%	6,424	10.8	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
	x			Fischer	Perform Lake restoration activities as recommended in LCHD report				100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	x	B			Implement Sub Unit specific runoff rate and volume standards				50%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	3	NA	NA	NA
	x	B			Use Conservation Design Principals to prevent increases in runoff volumes				50%	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	3	NA	NA	NA
	x	C			Use Conservation Design Principals to prevent increases in runoff volumes				50%	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	3	NA	NA	NA
	x	C			Conservation easements for natural areas identified in comprehensive plans (See Green Infrastructure Plan & Future Land Use Map)				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
	x	C			Do not increase hydrologic connection of depressional storage areas				100%	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	3	NA	NA

Table IV-1 Pollutant Load Reduction Estimates (Continued)

									Impairment-->	Water Quality	Water Quality	Water Quality	Water Quality	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Flood flows	Flood flows	Flood damages	Flood damages
									Source---->	Total suspended solids / turbidity (lbs/yr)	Nutrients - Phosphorous (lbs/yr)	Nutrients (BOD)	Aquatic life toxicity	Lack of habitat characteristics	Hydrologic disturbance / flow alterations	Draining, filling, and degradation of wetlands	Exotic and invasive species	Loss/ reduction/ degradation of natural riparian buffer	Loss of natural "management" mechanisms	Increased rate and volume of runoff	Loss / drainage of depressional storage	Past encroachments on floodplain	Creek obstruction
									Impairment Reduction Target---->	75%	50%	50%	25%	25%	50%	90%	25%	75%	50%	75%	90%	100%	100%
Pollutant reduction	**Pollutant prevention**	**Sub-Unit**	**Reach**	**Lake**	**Recommendation**	**Quantity**	**Unit**	**# of sides**	**Area Improvement Target (percent)**	**Pollutant Load Reduction Estimates**													
	x	D			Implement Sub Unit specific runoff rate and volume standards				50%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	3	NA	NA	NA
	x	D			Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland				50%	NA	NA	NA	NA	NA	2	2	NA	NA	NA	3	NA	NA	NA
Management Unit 4																							
	x	A			Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
	x	A&C			Develop and implement restoration management plan for ADID wetlands	200	acres	1	75%	39,398	82.6	63% BOD	90% HC; 36-69% TM	NA	NA	3	3	3	3	2-3	NA	NA	NA
	x	A			Restore/create wetlands in areas of hydric soils SE of Fish Lake	9	acres	1	25%	591	1.2	63% BOD	90% HC; 36-69% TM	NA	NA	3	3	3	3	2-3	NA	NA	NA
x		A			Implement agricultural BMPs (filter strip / native buffer)*	22700	feet	1	75%	13,671	23.0	30-50% BOD	45-70% TM	NA	2	NA	NA	2	NA	2	NA	NA	NA
x		A			Address runoff from landscape nursery (filter strip / native buffer)*	8500	feet	1	75%	5,119	8.6	30-50% BOD	45-70% TM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
x		A	5A		Stabilize eroding streambanks and establish contigious riparian buffer	1200	feet	2	100%	12,960	4.3	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	3	3	2	2	NA	NA	NA
x		A	5B		Woodland management	475	feet	2	100%	249,518	523.3	30-50% BOD	NA	NA	NA	NA	2	NA	3	NA	NA	NA	NA
x		A	5C		Woodland management	1015	feet	2	100%	533,180	1118.1	30-50% BOD	NA	NA	NA	NA	2	NA	3	NA	NA	NA	NA
x		A	5C		Streambank stabilization	1015	feet	2	100%	263,088	109.6	30-50% BOD	62-75% HC; 14-71% TM	2	NA	NA	NA	2	NA	NA	NA	NA	NA
x		A		Fish	Manage shoreline vegetation (included in ADID restoration cost)	9600	feet	1	100%	51,840	17.3	30-50% BOD	62-75% HC; 14-71% TM	2	2	NA	2	3	3	2	NA	NA	NA
	x	B			Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
x		B			Implement agricultural BMPs (filter strip / native buffer)*	12700	feet	1	75%	7,649	12.9	30-50% BOD	45-70% TM	NA	2	NA	NA	2	NA	2	NA	NA	NA
	x	C			Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
	x	C			Implement Sub Unit specific runoff rate and volume standards				50%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	3	NA	NA	NA
	x	C			Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland				50%	NA	NA	NA	NA	NA	2	2	NA	NA	NA	3	NA	NA	NA
x		C			Replace regional drain tile from 120 with naturalized wetland swale	1600	feet	1	100%	880	1.0	30-50% BOD	62-75% HC; 14-71% TM	NA	2	NA	NA	2	NA	NA	NA	NA	NA

Table IV-1 Pollutant Load Reduction Estimates (Continued)

									Impairment-->	Water Quality	Water Quality	Water Quality	Water Quality	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Flood flows	Flood flows	Flood damages	Flood damages
									Source---->	Total suspended solids / turbidity (lbs/yr)	Nutrients - Phosphorous (lbs/yr)	Nutrients (BOD)	Aquatic life toxicity	Lack of habitat characteristics	Hydrologic disturbance / flow alterations	Draining, filling, and degradation of wetlands	Exotic and invasive species	Loss/ reduction/ degradation of natural riparian buffer	Loss of natural "management" mechanisms	Increased rate and volume of runoff	Loss / drainage of depressional storage	Past encroachments on floodplain	Creek obstruction
									Impairment Reduction Target---->	75%	50%	50%	25%	25%	50%	90%	25%	75%	50%	75%	90%	100%	100%
Pollutant reduction	**Pollutant prevention**	**Sub-Unit**	**Reach**	**Lake**	**Recommendation**	**Quantity**	**Unit**	**# of sides**	**Area Improvement Target (percent)**	**Pollutant Load Reduction Estimates**													
	x	D			Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
x		D			Retrofit stormwater BMPs in existing developed areas**	6000	feet	1	75%	2,475	2.7	30-90% BOD	62-90HC; 14-100% TM	NA	2	NA	NA	NA	NA	1	NA	NA	NA
	x	D			Do not increase hydrologic connection of depressional storage area				100%	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	3	NA	NA
Management Unit 5																							
	x				Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
	x				Develop & implement restoration plan for Monihan Lake	35	acres	1	100%	NA	NA	2	2	3	NA	NA	2	3	3	NA	NA	NA	NA
	x				Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland				50%	NA	NA	NA	NA	NA	2	2	NA	NA	NA	3	NA	NA	NA
x					Retrofit stormwater BMPs in existing developed areas**	16750	feet	1	75%	6,909	7.5	30-90% BOD	62-90HC; 14-100% TM	NA	2	NA	NA	NA	NA	1	NA	NA	NA
x					Vegetative management of wetland areas	65	acres	1	100%	17,072	35.8	63% BOD	90% HC; 36-69% TM	NA	NA	3	3	3	3	2	NA	NA	NA
x					Implement agricultural BMPs (filter strip / native buffer)	43600	feet	1	75%	26,258	44.1	30-50% BOD	45-70% TM	NA	2	NA	NA	2	NA	2	NA	NA	NA

Table IV-1 Pollutant Load Reduction Estimates (Continued)

									Impairment-->	Water Quality	Water Quality	Water Quality	Water Quality	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Habitat degradation	Flood flows	Flood flows	Flood damages	Flood damages
									Source---->	Total suspended solids / turbidity (lbs/yr)	Nutrients - Phosphorous (lbs/yr)	Nutrients (BOD)	Aquatic life toxicity	Lack of habitat characteristics	Hydrologic disturbance / flow alterations	Draining, filling, and degradation of wetlands	Exotic and invasive species	Loss/ reduction/ degradation of natural riparian buffer	Loss of natural "management" mechanisms	Increased rate and volume of runoff	Loss / drainage of depressional storage	Past encroachments on floodplain	Creek obstruction
									Impairment Reduction Target---->	75%	50%	50%	25%	25%	50%	90%	25%	75%	50%	75%	90%	100%	100%
Pollutant reduction	**Pollutant prevention**	**Sub-Unit**	**Reach**	**Lake**	**Recommendation**	**Quantity**	**Unit**	**# of sides**	**Area Improvement Target (percent)**	**Pollutant Load Reduction Estimates**													
Management Unit 6																							
	x				Protect lands identified in Green Infrastructure Plan				50%	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
	x				Implement Sub Unit specific runoff rate and volume standards				50%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	3	NA	NA	NA
	x				Use Conservation Design Principals to prevent increases in runoff volumes				50%	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	3	NA	NA	NA
x					Implement agricultural BMPs (filter strip / native buffer)	19800	feet	1	75%	11,925	20.0	30-50% BOD	45-70% TM	NA	2	NA	NA	2	NA	2	NA	NA	NA
x					Retrofit stormwater BMPs in existing developed areas**	5280	feet	1	75%	2,178	2.4	30-90% BOD	62-90HC; 14-100 TM	NA	2	NA	NA	NA	NA	1	NA	NA	NA
x					Restore/create wetlands in areas of hydric soils	200	acres	1	25%	13,133	27.5	63% BOD	90% HC; 36-69% TM	NA	NA	3	3	3	3	2	NA	NA	NA

Notes:

TSS and P reduction calculations assume: lake shoreline erosion is low severity; woodland management is the same as native buffer establishment. Swale feet assumes 20 square feet of swale per 1 linear foot of swale. Percentages for load reductions represent expected pollutant load reduction under full (100%) implementation of the recommendation.

Ability to meet reduction objectives are listed as: 3 = Fully achieves objective (67-100%) ; 2 = partially achieves objective (34-66%); 1 = minimally achieves objective (0-33%)

HC = Hydrocarbons; TM = Trace Metals

* Figures are estimated based on linear feet of perimeter to be treated with the BMP.

** Figures are estimated based on linear feet of roadside swale

^ Administrative, Regulatory, or Planning related recommendations

V Prioritized Action & ImplementationPlan

Chapter IV cites the goals and objectives from Chapter I and identifies action items to achieve the goals and objectives. The action items are generally not site-specific, but instead represent watershed-wide actions that should be conducted. The chapter also provides Management Unit-specific recommendations for "on-the-ground activities" and provides greater specificity than under the action items. Chapter V provides a summary of the recommendations along with prioritization, funding sources, budgets, and responsible parties.

A. Prioritization

There are a number of factors that will affect prioritization of the recommendations outlined in Chapter IV. Perhaps the overriding factors are need, urgency, and opportunity. For example, there are a number of locations of relatively severe streambank erosion that will continue to be a sediment source if not addressed. However, there may not be funds currently available to repair these areas and therefore limited opportunity. Conversely, while it may not be urgent that some of the degraded wetland areas be restored, there may be a significant opportunity to restore particular wetlands as part of residential or commercial development projects.

Because it is difficult to predict opportunity, the prioritization of projects in this chapter is based on need and urgency as determined by the watershed stakeholders. As described in Chapter I and shown in Table I-2, the greatest concern (greatest need) was prevention of negative impacts to the watershed as it develops. Interestingly, the issue that garnered the greatest number of points was "prevention of additional flooding" (see Chapter I). Remediation of existing flooding, however, was not identified as a need by the stakeholders that participated in the issues identification meeting. (However, a number of homes are located in the draft LCSMC floodplain and flood mitigation needs were identified in the Flood Problem Areas Inventory.) The next several highest points were related to water quality issues and protection, enhancement, and remediation of natural resources.

Priorities were intentionally classified as "1", "2", or "3" instead of "high", "medium", and "low" to avoid the perception that recommendations in Priority Level 3 were a low priority. All recommendations should be considered a high priority and, therefore, priority was determined primarily based on urgency and logical order. For example, the sooner that additional regulatory requirements can be implemented in the watershed, the fewer number of areas will need to be retrofitted in the future to meet the new standards. The following criteria were used to assign priority level.

Priority 1

- Ordinance modifications to prevent negative development impacts
- Protection of existing natural areas from direct modification (Green Infrastructure Plan)
- Remediation of significant existing sources of water quality impairment (e.g. shoreline buffers and "High" streambank erosion)

Priority 2

- Remediation of existing flooding problems as determined by structures located in the floodplain and identified in the Flood Problem Area Inventory (FPAI)
- Remediation of less significant existing sources of water quality impairment (e.g. source controls and "Moderate" streambank erosion)

Priority 3

- Remediation of potential flooding problems as determined by location within the floodplain or hydric soils but not reported in the FPAI

- Restoration of existing stream and wetland areas that are not a significant source of water quality problems in the Fish Lake Drain Watershed or lakes (e.g. vegetation management to improve biodiversity but not necessarily to reduce erosion and to remediate "Low" streambank erosion)

B. Implementation

Implementation of the Fish Lake Drain Watershed -based Plan will require a coordinated effort between many parties. The parties that will be most directly involved in implementation of the plan include:

Municipalities

The municipalities in the watershed include the villages of Fox Lake, Round Lake, and Volo, Lakemoor. The municipalities have planning and zoning authority in the incorporated areas of the watershed. During annexation, municipalities have the ability to negotiate standards, open space allowances, etc. Often times, the negotiations provide greater ability to implement open space and other plans than standard zoning and subdivision code. Finally, incentives for conservation development and other planning related considerations to reduce stormwater impacts and to protect natural areas are more readily implemented through the site plan review process than through stormwater standards.

Many municipalities implement streambank and shoreline stabilization projects and others will manage natural areas on public land within their jurisdiction.

Municipalities have the authority to develop and enforce stormwater standards more restrictive than the countywide standards.

Townships

The watershed is contained within Grant and Wauconda Townships. The townships are responsible for maintenance of township roads, including drainage. Grant Township has acted as fiscal agent for at least one streambank stabilization project in unincorporated areas.

County

- LCSMC - Lake County Stormwater Management Commission
  The LCSMC is the ultimate enforcement authority for stormwater management and has authority to implement watershed-specific stormwater standards. They provide many forms of assistance, including financial and technical assistance on flood reduction and water quality improvement projects, and public education for shoreline management and source control projects.

- LCSWCD - Lake County Soil and Water Conservation District
  The LCSWCD can provide technical and financial assistance for implementation of agricultural BMPs. Some streambank stabilization and wetland restoration funds are available through the LCSWCD (however, it is state and federal funding).

- LCHD - Lake County Health Department
  The LCHD prepares lake studies, monitors lake water quality, and provides technical assistance to shoreline property owners.

- LCFPD - Lake County Forest Preserve District
  The LCFPD responsibilities are limited to management of their land holdings, however, they can provide technical assistance to other public agencies and private owners of natural lands.

- Lake County Planning, Building, and Development Department
  For the unincorporated portions of Lake County, the County government generally has the same planning and regulatory authorities as the municipalities.

Private Parties

- Property Owners
  This includes both property owners (residential and commercial) and homeowners associations. In many ways, private land owners will be responsible for implementing many aspects of this plan, as many of the actions include stabilization, restoration, and water quality improvement activities on private land. (See Table V-3 and Figure V-1 for detention basin information.)

- Developers
  Many elements of this plan have the potential to be implemented as part of the development process. This includes implementation of conservation development practices and protection and restoration of on-site natural areas (streams and wetlands).

- Business Community
  The business community may be a resource for volunteers, materials, and funding. For example, businesses could participate in an "adopt a stream" program with signs honoring their participation at the nearest road crossings.

C. Technical and Financial Assistance

Implementation of this plan will require the development of partnerships with local, state, and federal organizations for implementation, technical assistance, and funding. Table V-1 summarizes estimated financial assistance needed to implement the Watershed Management Recommendations. It includes quantities for WMR implementation, unit costs, and anticipated LCSMC staff administrative effort. Where BMP implementation is expected to be performed by a consultant or party other than SMC, administrative effort is indicated as low. Initial costs indicate cost for installation and/or establishment; annual costs indicate cost for ongoing management and maintenance.

The Reference and Resources section "Potential Funding Sources for Watershed Restoration Activities" outlines various funding sources and the types of projects that are funded under the various programs. Most of the programs require a local match of funds or in-kind services. Although these funding sources can provide a significant source of revenue, significant local investment of time and financial resources will be required to implement this plan. If fully implemented, however, the quality of the watershed lakes, stream reaches, and wetlands could be significantly improved despite significant development that is planned for the watershed.

Table V-1 Estimated Finanaical Assistance Needed

Sub-Unit	Reach	Lake	Recommendation	Quantity	Unit	# of sides	Initial	Annual	Initial	Annual		Notes
Management Unit 1							Unit Cost		Cost		Admin Effort	
A			Floodproofing of floodprone structures	58	each	1	$10,000.00	$0.00	$580,000	$0	L	
A			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
A			Develop and implement restoration management plan for large wetland east of Duck Lake	110	acres	1	$500.00	$200.00	$55,000	$22,000	H	Assumes staff preparation with outside tech support.
			Repair gully erosion north of 134 and west of wilson rd	525	feet	1	$50.00	$0.00	$26,250	$0	L	Annual management is part of surrounding wetland management
A	1A		Vegetative management (burning) to re-establish native riparian plant communities	2400	feet	2	$5.00	$3,500.00	$24,000	$3,500	L	Annual costs approximately $3500 for less than ~8 acres
A	1B		Repair failing sheetpile wall	940	feet	2	$250.00	$0.25	$470,000	$470	L	
A	2A		Establish native buffer along streambank	1950	feet	1.5	$20.00	$1.50	$58,500	$4,388	L	
A	2A		Woodland management south of creek, east of Forest	5.5	acres	1	$8,000.00	$3,500.00	$44,000	$3,500	L	Annual costs approximately $3500 for less than ~8 acres
A	2B		Re-establish wooded wetland plant community	290	feet	2	$10.00	$1.50	$5,800	$870	L	
A	2C		Woodland riparian corridor management	630	feet	2	$10.00	$1.50	$12,600	$1,890	L	
A	2C		Selected streambank stabilization	630	feet	2	$100.00	$1.50	$126,000	$1,890	L	
		Duck	Source controls & lot-level BMPs surounding lake (swale)	21,780	feet	1	$0.25	$0.25	$5,445	$5,445	H	Costs based on $500 / acre of swale and annual native buffer mgt costs
A		Duck	Shoreline stabilization	2000	feet	1	$20.00	$1.50	$40,000	$3,000	L	
A		Duck	Establish native buffer along shoreline	3400	feet	1	$1.00	$0.25	$3,400	$850	L	
B			Do not increase hydrologic connection of depressional storage areas	Regulatory	NA	NA	NA	NA	NA	NA	H	Admin costs to revise ordinance and enforce
B	1B		Preserve drainage characteristics / site BMPs	Regulatory	NA	NA	NA	NA	NA	NA	H	Admin costs to revise ordinance and enforce
Management Unit 2												
Sub-Unit	Reach	Lake	Recommendation									
			Floodproofing of floodprone structures	2	each	1	$10,000.00	$0.00	$20,000	$0	L	
			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
			Develop and implement restoration management plans for ADID wetlands	133	acres	1	$500.00	$200.00	$66,500	$26,600	L	
			Restore isolated wetland east of Wooster Lake and address drainage	4.3	acres	1	$500.00	$200.00	$2,150	$860	L	
	3		Management of invasives (reed canary grass)	1700	feet	2	$5.00	$1.50	$17,000	$5,100	L	
	3		Streambank regrading to address erosion	1700	feet	2	$40.00	$1.50	$136,000	$5,100	L	
		Wooster	Source controls & lot-level BMPs surounding lake	13504	feet	1	$0.25	$0.25	$3,376	$3,376	H	Costs based on $500 / acre of swale and annual native buffer mgt costs
		Wooster	Retrofit curb and gutter area on NE side of lake	3300	feet	1	$20.00	$0.20	$66,000	$660	L	Naturalization of swales
		Wooster	Shoreline stabilization (plantings)	8500	feet	1	$20.00	$1.50	$170,000	$12,750	L	
		Wooster	Shoreline stabilization (weir replacement)	1	each	1	$35,000.00	$0.00	$35,000	$0	L	
		Wooster	Develop hydrologic and nutrient budgets for Wooster Lake	1	each	1	$5,000.00	$0.00	$5,000	$0	L	Admin costs to prepare budgets (LCHD)
		Wooster	Perform in-Lake restoration activities as recommended in LCHD report	NA	NA	NA	NA	NA	NA	NA	L	Figures not provided in LCHD reports
		Wooster	Establish native buffer along shoreline	8500	feet	1	$1.00	$0.25	$8,500	$2,125	L	

Table V-1 (continued) Estimated Finanaical Assistance Needed

Sub-Unit	Reach	Lake	Recommendation	Quantity	Unit	# of sides	Initial	Annual	Initial	Annual		Notes
Management Unit 3												
Sub-Unit	Reach	Lake	Recommendation									
A			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
A			Implement & continue use of agricultural BMPs on cropland and landscape nurseries	NA	NA	NA	NA	NA	NA	NA	L	Assumes implementation by SWCD / federal ag BMPs
			Address runoff from landscape nursery	1	each	1	$60,000.00	$6,000.00	$60,000	$6,000	L	Load reductions are by area; costs by each
A	4A		Regrade banks	600	feet	2	$40.00	$1.50	$48,000	$1,800	L	
	4A		Establish native riparian buffer	600	feet	2	$1.00	$0.25	$1,200	$300	L	
A	4A		Establish emergent and rooted aquatic vegetation through channel bottom	3	acre	1	$2,000.00	$1.50	$6,000	$5	L	
A	4B		Energy dissipation at culvert outfall	1	ea	1	$20,000.00	$100.00	$20,000	$100	L	
A	4B		Debris removal	1	ea	1	$5,000.00	$1,000.00	$5,000	$1,000	L	Annual costs assume debris removal every 5 years
A	4B		Artificial riffles to reduce erosion pressure at toe of slope	260	feet	1	$10.00	$0.50	$2,600	$130	L	
A	4B		Bioengineering streambank stabilization	260	feet	1	$100.00	$1.50	$26,000	$390	L	
A	4C		Perform modest bank regrading	1800	feet	2	$40.00	$1.50	$144,000	$5,400	L	
	4C		Establish native buffer along shoreline	1800	feet	2	$1.00	$0.25	$3,600	$900	L	
A		Fischer	Source controls & lot-level BMPs surounding lake	12197	feet	1	$0.25	$0.25	$3,049	$3,049	H	
		Fischer	Shoreline stabilization of Lake and Island	4000	feet	1	$20.00	$1.50	$80,000	$6,000	L	
		Fischer	Establish native buffer along shoreline	8000	feet	1	$1.00	$0.25	$8,000	$2,000	L	
		Fischer	Perform Lake restoration activities as recommended in LCHD report	NA	NA	NA	NA	NA	NA	NA	L	Figures not provided in LCHD reports
B			Implement Sub Unit specific runoff rate and volume standards	Regulatory	NA	NA	NA	NA	NA	NA	H	
B			Use Conservation Design Principals to prevent increases in runoff volumes	Regulatory	NA	NA	NA	NA	NA	NA	M	Part of development review; admin costs only
C			Use Conservation Design Principals to prevent increases in runoff volumes	Regulatory	NA	NA	NA	NA	NA	NA	M	Part of development review; admin costs only
C			Conservation easements for natural areas identified in comprehensive plans (See Green Infrastructure Plan & Future Land Use Map)	NA	NA	NA	NA	NA	NA	NA	M	Costs negotiated as part of development agreements
C			Do not increase hydrologic connection of depressional storage areas	Regulatory	NA	NA	NA	NA	NA	NA	H	Admin costs to revise ordinance and enforce
D			Implement Sub Unit specific runoff rate and volume standards	Regulatory	NA	NA	NA	NA	NA	NA	H	
D			Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland	NA	NA	NA	NA	NA	NA	NA	M	Part of development review; admin costs only

Table V-1 (continued) Estimated Finanaical Assistance Needed

Sub-Unit	Reach	Lake	Recommendation	Quantity	Unit	# of sides	Initial	Annual	Initial	Annual		Notes
Management Unit 4												
Sub-Unit	Reach	Lake	Recommendation									
A			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
A&C			Develop and implement restoration management plan for ADID wetlands	200	acres	1	$500.00	$200.00	$100,000	$40,000	L	
A			Restore/create wetlands in areas of hydric soils SW of Fish Lake	9	acres	1	$500.00	$200.00	$4,500	$1,800	L	
A			Implement agricultural BMPs	NA	NA	NA	NA	NA	NA	NA	L	Assumes implementation by SWCD / federal ag BMPs
A			Address runoff from landscape nursery	1	each	1	$60,000.00	$6,000.00	$60,000	$6,000	L	Load reductions are by area; costs are by each
A	5A		Stabilize eroding streambanks	1200	feet	2	$40.00	$1.50	$96,000	$3,600	L	
A	5A		Establish contigious riparian buffer	1200	feet	2	$1.00	$0.25	$2,400	$600	L	
A	5B		Woodland management	475	feet	2	$10.00	$1.50	$9,500	$1,425	L	
A	5C		Woodland management	1015	feet	2	$10.00	$1.50	$20,300	$3,045	L	
A	5C		Streambank stabilization	1015	feet	2	$40.00	$1.50	$81,200	$3,045	L	
A		Fish	Manage shoreline vegetation (included in ADID restoration cost)	9600	feet	1	$5.00	$1.50	$48,000	$14,400	L	
B			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
B			Implement agricultural BMPs	NA	NA	NA	NA	NA	NA	NA	L	Assumes implementation by SWCD / federal ag BMPs
C			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
C			Implement Sub Unit specific runoff rate and volume standards	Regulatory	NA	NA	NA	NA	NA	NA	H	
C			Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland	Regulatory	NA	NA	NA	NA	NA	NA	M	Part of development review; admin costs only
C			Replace regional drain tile from IL120 with naturalized wetland swale	1600	feet	1	$100.00	$150.00	$160,000	$240,000	L	
C			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
D			Retrofit stormwater BMPs in existing developed areas	NA	NA	NA	NA	NA	NA	NA	M	Costs will be site specific
D			Do not increase hydrologic connection of depressional storage area	Regulatory	NA	NA	NA	NA	NA	NA	H	Admin costs to revise ordinance and enforce
Management Unit 5												
			Recommendation									
			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
			Develop & implement restoration plan for Monihan Lake	35	acres	1	$500.00	$200.00	$17,500	$7,000	L	
			Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland	Regulatory	NA	NA	NA	NA	NA	NA	M	Part of development review; admin costs only
			Retrofit stormwater BMPs in existing developed areas	NA	NA	NA	NA	NA	NA	NA	M	Costs will be site specific
			Vegetative management of wetland areas	65	acre	1	$500.00	$200.00	$32,500	$13,000	L	
			Implement agricultural BMPs	NA	NA	NA	NA	NA	NA	NA	L	Assumes implementation by SWCD / federal ag BMPs
Management Unit 6												
			Recommendation									
			Protect lands identified in Green Infrastructure Plan	Regulatory	NA	NA	NA	NA	NA	NA	M	Much of land area can be protected via zoning and other ordinances.
			Implement Sub Unit specific runoff rate and volume standards	Regulatory	NA	NA	NA	NA	NA	NA	H	
			Use Conservation Design Principals to prevent increases in runoff volumes	Regulatory	NA	NA	NA	NA	NA	NA	M	Part of development review; admin costs only
			Implement agricultural BMPs	NA	NA	NA	NA	NA	NA	NA	L	Assumes implementation by SWCD / federal ag BMPs
			Retrofit stormwater BMPs in existing developed areas	NA	NA	NA	NA	NA	NA	NA	M	Costs will be site specific
			Restore/create wetlands in areas of hydric soils	200	acres	1	$500.00	$200.00	$100,000	$40,000	H	

D. Budget

Planning-level budgets were calculated for each of the management unit recommendations. These budget numbers include construction and other out-of-pocket expenses and do not include staff time. These numbers should not be used for bidding. In most cases, budgets include estimated costs of both initial implementation and annual maintenance or management. On many projects, initial implementation is performed but funds are never budgeted for inspection, management, and maintenance. To maximize longevity and success of the various remedial recommendations and the ecological health of the stream and wetland restoration activities, it is important that ongoing maintenance and management be performed.

E. Prioritized Action and Implementation Plan

Table V-2 summarizes the action items described in Chapter IV and includes the following information.

Goals and Objectives

This column lists the primary goals and objectives that the recommendation addresses. It should be noted that in many cases, an activity will address numerous goals and objectives.

Priority

The priority of the recommendation from Priority 1 to Priority 3, with Priority 1 being the highest. Prioritization was based on the criteria discussed previously in Chapter III.

Budget

This includes initial implementation and annual estimated maintenance budgets as described previously for the various recommendations.

Responsible Parties

The parties primarily responsible for the implementation of these recommendations are included with a P, while a C indicates those parties that will also contribute to the implementation process.

F. Information and Education Plan

A watershed improvement plan must include a strategy for informing and educating the public and stakeholders about watershed issues and encouraging them to take action and change behavior. This is especially true for non-point source pollution prevention because it is the product of activities of many people in the watershed. Furthermore, the general public is often unaware of the environmental impact of day-to-day activities on environmental resources. An understanding of watershed issues and how individual activities can play a role in protecting water quality helps provide the motivation and basis for changing behavior. Informing and educating, providing opportunities for the public to get involved in watershed activities, and installing demonstration projects can help effect behavioral change.

This section of the plan provides a general overall strategy for information, education, and public involvement specifically for addressing the water quality impairments in the watershed. However, the ideas and approach presented here can be adopted for a wide variety of watershed topics and issues from recreation to terrestrial habitat improvement. The primary Fish Lake Drain watershed organizations should consider developing a separate education committee to help build and implement a more detailed information and education campaign. Different strategies may be appropriate for different scales, e.g., a watershed wide storm drain stenciling campaign or a targeted one-on-one outreach campaign for streamside business owners.

Table V-4 summarizes the public information and education implementation and evaluation plan for the Fish Lake Drain Watershed.

Target Audiences

To define the audience for educational outreach, contacts should be made with people, organizations, and decision-makers within the watershed community to determine their level of understanding of watershed issues and needs for further education. The intent is to include both

existing partners, as well as stakeholders that previously have not been participants, and to be responsive to their needs for information.

The primary target audiences for this plan are residents and other landowners, land and resource managers, and government officials. More specifically, potential target audiences include:

- Landowners and property managers along the stream bank, tributaries, and lakes.
- Developers and property owners that will propose intensive land use changes.
- Municipalities, counties, park districts, forest preserve districts, and other local governments that manage land within the watershed.
- Residents and landowners within the watershed.
- Consultants (architects, engineers, planners, landscapers) working in the watershed.
- Organizations, committees, agencies, and groups interested in the future and management of watershed resources.

The various target audiences will need to hear different messages through different delivery mechanisms, as determined through the initial contact mentioned above. A number of strategies for crafting and delivering messages for watershed information and education are provided below. While water quality and non-point source pollution are the primary issue areas for this plan, these messages should be linked with other related issues, such as terrestrial habitat improvement, recreation, water supply, and flooding.

Possible Partnering Organizations

Organizations that will be responsible for implementing the watershed plan recommendations can also help deliver education and information strategy as well as be target audiences. Each partner should couple plan implementation efforts with parallel efforts to inform and educate.

- Citizen Advocacy Groups (CAG)
- Corporate and Business Landowners (CBL)
- Counties (all departments) (CO)
- Developers (D)
- Federal Emergency Management Agency (FEMA)
- Forest Preserve Districts (FPD)
- Golf Courses (GC)
- Homebuilders (H)
- Illinois Department of Natural Resources (IDNR)
- Illinois Department of Transportation (IDOT)
- Illinois Emergency Management Agency (IEMA)
- Illinois Environmental Protection Agency (IEPA)
- Illinois Tollway Authority (ITA)
- Municipalities (all departments) (M)
- Natural Resources Conservation Service (NRCS)
- Chicago Metropolitan Agency for Planning (formerly Northeastern Illinois Planning Commission)
- Park Districts (PD)
- Private Residential Landowners (PRL)
- Soil and Water Conservation Service (SWCD)
- Townships (T)
- United States Army Corps of Engineers (USACE)

Ideas for Implementing the Information and Education Strategy

Estimated costs are included below, using ($ Amount) boldface notation, if they have been implemented or calculated in the course of past projects.

General Guidance

- Keep messages simple and straightforward, with only two or three take-home points at a time, and use graphics and photos to illustrate the message.
- Identify and provide for the different needs of various audience groups. When interacting with a group, stress the dimensions of the project that apply most to them. For example, when interacting with homeowners, focus on items like rain gardens, lawn care, riparian buffers etc. Develop a similar "menu" of topics for each target audience.
- Coordinate the information and education strategy with partner organizations.
- All materials and messages should promote the local watershed groups with contact

information and "how to get involved" information.

- Work to correct perception problems, such as Fish Lake Drain being viewed as a drainage ditch rather than as a community asset to be protected, enhanced, and enjoyed.
- Basic watershed science education (e.g., biology, the water cycle, stream ecology) may be needed when the audience has little knowledge about the creek or watershed.

Direct Mailing and Outreach

- Materials targeted to landowners and businesses along the creek to help them understand riparian systems, streambanks, and ways to improve them. ($3,000)
- Individual quick-read "issue fact sheets" on watershed issues periodically sent to municipal officials as well as other leaders and decision-makers. ($5,000)
- One-on-one outreach, especially to municipal officials and other local decision makers. ($30,000)
- Email survey of stakeholders to assess current state of education. ($1,500)

Media and Marketing Campaign

- To respond to public inquiries prompted by media coverage, prepare a brochure for mailing that describes local watershed organizations to those interested.
- Develop a website, email list, list serve, or weblog to publicize watershed efforts, events, basic watershed information, resources, and useful links.
- Create and implement a public relations and marketing campaign to include advertisements and outreach via local newspapers, village newsletters, homeowner association newsletters, community meetings, and local watershed organization newsletters.
- Create a media kit and identify media outlets (radio, TV, newspaper), using the IDNR list of contacts as a starting point. ($2,500)
- Use paid advertising — direct mail, newspaper ads, cable TV commercials — targeted to streamside landowners and residents.
- Send e-mail "alerts" to municipalities regarding water-related conferences, information, strategies, etc.
- Contribute articles to local periodicals and publications.
- Determine appropriate elements of a media packet, including a map of the watershed.
- Coordinate an entertaining outdoor event for media representatives.
- Develop on-going media relations procedures.

Technical Workshops and Conferences

- Coordinate hands-on educational workshops highlighting non-point source pollution and existing restoration activities (e.g., streambank stabilization projects).
- Organize and fund a series of technical workshops targeted towards separate stakeholders, e.g., government officials, developers, professional consultants like engineers, landscape architects, etc., and private citizens. The workshops should educate each group as to what the current problems are in the watershed, what caused the problems, and what actions each target group can take to facilitate a solution. These technical workshops may be sponsored by organizations such as CMAP (NIPC), Illinois Water & Environment Association (IWEA), IEPA, American Public Works Association (APWA), the Illinois Society of Professional Engineers (ISPE), and others. ($5,000 each)
- General and technical workshops and presentations targeting municipal leaders, engineers, public works officials, planners, and others to teach basics of water quality and watershed management.

Manuals and Technical Resources

- Encourage watershed communities to pursue technical assistance from the appropriate agencies to encourage compatible development in the watershed which minimizes non-point source impacts.
- Identify funding and sources of support and distribute to potential implementers in the watershed. Distribute IDNR list of grantors for watershed protection projects. ($3,000 for a funding guide.)
- Provide annual grant writing workshops to target audiences.

Public Involvement, Stewardship, and Community

Events

- Encourage development of sub-basin or lake leaders and groups to promote watershed education, volunteer, and stewardship opportunities. Encourage involvement of or leadership by municipalities in these new groups.
- Emphasize direct involvement opportunities such as stream clean-up events, canoe trips, watershed bus tours, river walks, restoration projects, and hands-on learning events. Hold special events for public officials and staff.
- Create a self-guided tour of the watershed highlighting scenic spots, natural areas, wetlands, trails, and areas of concern such as streambank erosion sites, stormwater outfalls, and urban runoff sites.
- Develop a recognition program for watershed improvement efforts of industry, business, schools, citizens, elected officials, and environmental groups implementing non-point source pollution control projects. Hold an annual award ceremony. Publish a directory of outstanding watershed management projects.
- Develop a storm drain stenciling or button campaign. Distribute door hangers to explain storm drain stenciling efforts.
- Develop an "Adopt a Stream" program.
- Arrange site visits and interpretive signs installed at BMP installation sites.
- Establish a hotline or notification system to report fly dumping or illicit sanitary sewer connections.

School-Based Education

- Create a hands-on watershed curriculum, including hands-on watershed ecology and non-point source pollution training for teachers, field trips, chemical test kits, nets, sampling equipment, wildlife identification books, etc. (The Soil and Water Conservation Districts may help sponsor these.)
- Hold workshops for teachers and an annual student congress.
- Develop and disseminate to educators a list of watershed education resources for use in K-12 classrooms.
- Maintain a group of trained student and teacher volunteers and create service learning opportunities for 1000 students annually such as clean ups and monitoring.
- Create and maintain a school network web site and water quality database.

Public Education

- Develop multiple messages — one broader message for the general public and a series of more specifically targeted messages for specific audiences along the creek (landowners, business owners, municipalities, etc.)
- Watershed map/poster/brochure that includes pollution control strategies, watershed principles, factoids about the watershed, etc. Focus on recreational opportunities.
- Install watershed road signs at stream crossings: "You are entering the Fish Lake Drain Watershed. Please help protect our stream." ($500 each)
- Create an education program and materials as well as watershed conferences, workshops, and meetings for community leaders, government agencies, and the public.
- Hold stream conferences and workshops for various audiences – municipalities, landscapers, riparian owners, etc.
- Create general watershed and water quality education materials including a watershed slide show on CD and enlist volunteers for distribution. ($3,000)
- Develop hands-on educational workshops focused on restoration activities as well as a traveling exhibit.
- Design a set of BMP manuals for your various target audiences: residents, streamside landowners, business, municipalities, corporate campuses, educational campuses, religious organizations, etc.
- Create a database of grantors, grant programs and grant writing workshops.
- Create and disseminate a guide for responsible stormwater management in the watershed or a pamphlet for landowners with small-scale practices. ($8,000)
- Hold stormwater open houses for professionals, engineers, consultants,

and planners to share knowledge and techniques.

- Coordinate the publication and distribution of a professionally produced watershed-awareness video developed to educate concerned citizens and students via classroom science classes.

Demonstration Projects

- Restoration projects.
- Demonstration projects such as parking lot biofilters. Capital projects are typically expensive, but they can provide both direct, physical improvement as well as public education.

Possible Message Delivery Mechanisms

- One on one contact.
- Presentations to targeted groups.
- Press releases and news articles in local papers.
- Public service announcements or programs on local cable channel.
- Watershed project newsletter.
- Watershed project website with links to related sites.
- Watershed tours.
- Watershed signs.
- Inserts in agency newsletters.
- Workshops targeted to specific audiences.
- Special events and activities such as water festivals, stream clean-ups, or storm drain stenciling.
- Presentations at regularly scheduled meetings of townships, planning commissions, associations, or other groups.

Evaluating the Outreach Plan

Evaluation provides a feedback mechanism for ongoing improvement of your outreach effort and for assessing whether the effort is successful. It also builds support for further funding. The following ideas should be customized to particular needs of the party responsible for implementing the education and information campaign. For a number of these evaluation strategies, baseline information should be collected before the outreach activities begin and checked periodically throughout the outreach campaign to help measure progress and effectiveness.

Actual reduction in impairment of water quality in Fish Lake Drain is perhaps the best indicator of outreach effectiveness. While it is difficult to attribute water quality improvement to specific outreach strategy programs or actions, there is little doubt that increased understanding and involvement in the watershed is essential to watershed improvement. Specific information on monitoring and evaluating an education strategy are identified below.

Watershed Information and Education Resources

The following resources include effective outreach messages, delivery techniques, and strategies to assist with developing an outreach campaign.

The following Lake Notes Fact Sheets are produced by the Chicago metropolitan Agency for Planning (www.chicagoareaplanning.org) for the Illinois Environmental Protection Agency.

Lake Management

- Aquatic Exotics
- Aquatic Plant Management Options
- Lake Dredging
- Shoreline Buffer Strips
- Shoreline Stabilization: Bioengineering Alternatives
- Canada Geese and Your Lake

Water Quality

- Common Lake Water Quality Parameters
- Fertilizers and Pesticides:
  Options for Lawn and Garden Use
- Home and Yard
- Monitoring Lake Quality
- Septic Systems
- Stormwater Detention Ponds

General Lake Information

- Illinois Clean Lakes Program
- Lake Aeration and Circulation
- Lake Stratification and Mixing
- Volunteer Lake Monitoring Program
- Where to Go for Lake Information

See http://clean-water.uwex.edu/basins/basined.html for links to University of Wisconsin Extension and Wisconsin Priority Watershed Program resources, including "how-to" guides on educational programming and the promotion of voluntary approaches to reducing non-point source pollution. The following Water Quality Fact Sheets are available from the University of Wisconsin.

- The Shoreland Stewardship Series — Water quality and natural resources articles of special interest to farmers, urban property owners, waterfront property owners and others.
- Stormie's Clean Water Tips Series — A series of water quality fact sheets about stormwater runoff, featuring the character "Stormie."
- Yard Care & the Environment Series — A series of water quality fact sheets for residential areas.
- Polluted Urban Runoff – A Source of Concern — A detailed look at urban runoff pollution, including tips on how to prevent it.
- Erosion Control for Home Builders — Methods of preventing soil erosion during home construction, including a look at lawn sodding and seeding, silt fences and sample erosion control plan.
- Standard Erosion Control Plan for 1-and 2-family dwelling construction sites — This worksheet includes a site diagram template and a checklist of site characteristics, erosion control practices, and management strategies.
- Pet Waste and Water Quality — Why pet waste is a concern, and what you can do about it.
- Brown Water, Green Weeds: Familiar Signs of Runoff Pollution — This worksheet includes information about the effects of runoff pollution on streams and wildlife. Sediments and nutrients cause many of the problems we see in streams and lakes.
- Shoreline Slideshow — http://clean-water.uwex.edu/pubs/margin/sld001.htm
- Land and Water stewardship articles — http://cleanwater.uwex.edu/pubs/stewards/index.html
- Educator Gateway page — http://clean-water.uwex.edu/bassites.html

The Stormwater Manager's Resource Center (www.stormcenter.net) has good information and includes a "program resources" page that provides a list of materials useful for watershed education.

- The Practice of Watershed Protection: Section Ten — Compiles articles on watershed stewardship from all past issues of the Center's technical journal, Watershed Protection Techniques. The articles are available for viewing and download in PDF format and cover topics such as watershed education, watershed advocacy, and pollution prevention.

- Key topics are covered elsewhere in The Practice of Watershed Protection (numbers below refer to chapter numbers):

  - Watershed Education
    126. Understanding Watershed Behavior
    127. On Watershed Education

  -Advocacy
    128. Choosing the Right Watershed Management

  -Structure Pollution Prevention at Home
    129. The Peculiarities of Perviousness
    130. Toward a Low Input Lawn
    131. Homeowner Survey Reveals Lawn

  -Management Practices in Virginia
    132. Nitrate Leaching Potential from Lawns and Turfgrass
    133. Insecticide Impact on

  -Urban and Suburban Wildlife
    134. Minimizing the Impact of Golf Courses on Streams
    135. Groundwater Impacts of Golf Course Development in Cape Cod

  -Pollution Prevention at Work
    136. Practical Pollution Prevention Practices

  -Outined for West Coast Service Stations
    137. Practical Pollution Prevention

  -Emphasized for industrial Stormwater
    138. Milwaukee Survey Used to

  -Design Pollution Prevention Program
    139. Rating Deicing Agents: Road Salt Stands Firm
    140. Pollution Prevention for Auto Recyclers

GREEN (Global Rivers Environmental Education Network) at www.green.org/resources/ includes

resources for watershed information and education programs as well as a helpful list of technical resources.

The Washington State Department of Ecology, Water Quality Program Showcase of Exceptional Education Products at http://www.ecy.wa.gov/forms/showcase/ is primarily designed for environmental educators in the Pacific Northwest to find outstanding products related to nonpoint source water pollution. The site comes with a searchable database of education products that come in a variety of formats, such as publications, videos, classroom materials, etc. Contact information is provided for products, along with a brief description and a rating system based on execution, effectiveness, relevance, and adaptability.

The USEPA Office of Water, Office of Wetlands Oceans, and Watersheds provides a variety of educational products.

- Outreach Page — Many materials available to help educators understand and promote watershed protection. The types of materials available include watershed-related pictures and clip art, activities for children, watershed education events, and links to watershed related web sites. http://www.epa.gov/owow/watershed/outreach/outreachnonjs.html

- Watershed Academy Web http://www.epa.gov/watertrain/ — The Watershed Academy was started by the U.S. Environmental Protection Agency's Office of Water in 1994 to provide training courses and educational materials on the basics of a watershed approach. The website includes web-based training modules that present a broad, basic introduction to watershed management. The training modules cover many watershed management topics and are divided into six watershed training themes. Web modules contain 25 to 50 color illustrations and photos on various topics and contain links for those seeking greater detail. Self-tests enable trainees to check their retention and see immediate results. The length and complexity of each module vary, requiring 0.5 to 2 hours each to complete. Completing a series of 15 of these modules earns a Watershed Academy Web Training Certificate.

- Getting in Step: A Guide for Conducting Watershed Outreach Campaigns is available from the EPA at www.epa.gov/owow/watershed/outreach/documents — This guide provides a detailed outline of a watershed outreach program designed to educate and involve the public and key stakeholders in your planning efforts.

Purdue University's "Know Your Watershed" website at www.ctic.purdue.edu/KYW/ provides information for watershed partnerships.

The Illinois Watershed Management Clearinghouse at www.watershed.uiuc.edu provides assistance both for individuals seeking to form a watershed group and for more experienced groups that need to research a specific topic in detail. The References and Resources page provides links and descriptions to other websites and online tools related to watershed planning.

The Conservation Foundation at www.thecons ervationfoundation.org provides education and outreach materials for watershed groups and other conservation organizations.

USEPA Nonpoint Source Control Branch at www.epa.gov/owow/nps/index.html provides educational resources specifically for non point source pollution control.

The Center for Watershed Protection at www.cwp.org provides resources for watershed education and outreach.

G. Monitoring

Purpose of Monitoring

The implementation and effectiveness of the watershed plan and recommendations, and an assessment of whether plan goals are being achieved, can be measured through monitoring. Simply, monitoring is observing and tracking watershed conditions and indicators for positive or negative changes that may be attributed to the implementation of the plan. These indicators can then be compared with water quality monitoring data to determine whether there is a correlation between them. If no discernible correlation can be made, and if satisfactory progress is not being made towards watershed goals, the watershed implementation team should consider whether recommended strategies are having the desired effect or should be modified accordingly.

Recommendations that are physical or structural in nature, such as streambank stabilization or riparian buffers, can be assessed in terms of reduced pollutant loads discharged into the watershed, improved biological and habitat health, and the degree of change in stormwater runoff volume and flow. The effectiveness of non-structural recommendations, however, such as education, policies and regulations, and coordination, can be difficult to measure due to long feedback time. Changes in behavior following the implementation of non-structural recommendations can be assessed by gathering feedback through meetings with implementation partners and tools such as surveys and focus groups, as suggested in Table V-5.

Monitoring Strategy for Fish Lake Drain

The monitoring strategy (Table V-5) is intended to help track and measure the implementation of recommendations made in this plan using a variety of indicators that are monitored regularly, typically on an annual or monthly basis. Progress should be reviewed using the milestones and indicators every 5 years and the plan should be updated as needed. The empty cells of the table (mode of collection, number of actions, and location of implementation) are to be filled in by the parties responsible for monitoring as identified in the table. Mode of collection refers to how data was collected, for example, using aerial photographs, water quality sampling, or reviewing reports of repetitive flooded structures. Number of actions is the actual data collected, for example, the concentration of phosphorous or the # of floodproofed structures in the floodplain. Location of implementation refers to geographical location, such as where streambanks or wetlands were restored.

Since water quality is one of the primary goals of this plan, stream and lake water quality impairments should be monitored by regularly collecting and testing water samples, either manually or using constant monitoring equipment. A regular sampling strategy should be initiated and new data should be added to existing data so that trends can be tracked. An expanded water quality monitoring protocol is essential to better locate and identify the causes and sources of impairment that have been identified in this plan.

Some of the impairments also can be monitored visually and anecdotally by those living along the stream and those involved in stream monitoring activities such as RiverWatch (IDNR). Visual and anecdotal monitoring should be done regularly (weekly in summer months and monthly in winter months is recommended) by trained volunteers. Specifically, increases in nutrient loading may be identified by the increase or presence of algal blooms. Acute aquatic life toxicity may be identified visually by watching for fish kills or other kills of aquatic species such as insects or plant species. Strange smells, slicks, or sheens on the water may also indicate the discharge of a problem pollutant.

Quality Assurance Project Plans

Watershed partners can apply for water quality monitoring funding through the Illinois Environmental Protection Agency's Clean Water Act Section 319 program. Monitoring that is funded by the IEPA requires the submission of a Quality Assurance Project Plan (QAPP), which describes the proposed monitoring strategy in detail. The QAPP helps to assure the IEPA that the data collected under its guidance and using its funding will be credible and of sufficient quality to be used in its reporting to the USEPA. Regardless of whether the watershed partners decide to apply for Section 319 funds to implement its monitoring component, the QAPP process is a valuable aid in the development of a sound water quality monitoring program (QAPP guidance can be found at www.epa.gov/quality/qapps.html).

Table V-2 Prioritized Action and Implementation Plan

Management Area	Recommendations	Goal-Obj	Priority	Timeframe	Budget		Responsible Parties								
					Initial	Annual	Municipalities	Townships	County				Private		Others
					($)	($)			LCSMC	LCHD	LCFPD	Lake County	Property Owner	Developer	
Watershed General	Perform stream and lake monitoring using volunteers and profesional staff	1-1, 1-2, 4-1, 4-6, 5-2	1	1-5 years	-	-				P			P		
	Develop zoning and subdivision code to implement Green Infrastructure Plan	1-6, 4-4, 4-5	1	1-5 years	-	-	P					P			
	Implement watershed-wide runoff reduction program	1-4, 2-3	1	1-5 years	-	-	P		C			P	P		
	Perform annual stream inspections for debris and other conditions	2-3	1	1-5 years	-	-	P	P			P				
	Conduct floodproofing workshops	3-4	2	5-10 years	-	-	C		P						
	Perform periodic updates to Flood Problem Area Inventory	3-1	3	10+ years	-	-	C		P						
	Perform demonstrations and provide incentives for retention-based stormwater management approaches	3-2, 3-4, 3-5, 3-6	1	1-5 years	$500,000	$50,000	C		P			C			
	Provide technical guidance on design and implementation of retention-based BMPs and conservation design	3-6, 4-4, 4-5	1	1-5 years	$50,000	$5,000			P						
	Increase level of enforcement of soil erosion and sediment control through certified inspector program or other measures	3-5, 3-7	1	1-5 years	-	-	P		P			P			
	Develop and distribute educational materials on source control and lot-level BMPs	1-4, 3-5, 4-7	2	5-10 years	-	-	C		P						
	Hire watershed manager to lead watershed implementation	4-2, 5-1	1	1-5 years	-	$80,000	P					P			
	Form Plan Implementation Committee to provide prioritization direction and lead periodic plan updates	4-2	1	1-5 years	-	-	P	P	P				P		
	Adopt plan at municipal and county level. Obtain IEPA approval as a Watershed-Based Plan to ensure eligibility for grants, etc.	4-1, 4-2	1	1-5 years	-	-	P		P						
	Stewardship education for stream, lake, and wetland property owners	1-1, 1-2, 1-3, 4-1, 4-6	2	5-10 years	-	-			C	P					Riverwatch
	Incorporate watershed processes and issues into school curricula	4-6	3	10+ years	-	-			C						Schools
	Publicize Fish Lake Drain activities and resouces to improve interest in watershed stewardship and Plan implementation	4-6	1	1-5 years	-	-				P					
	Develop prioritized monitoring program to target resources and evaluate success in meeting watershed goals	5-2	1	1-5 years	$40,000	$15,000	C		P	C		C			

Management Unit 1			Recommendations	Goal-Obj	Priority		Budget		Responsible Parties								
							Initial	Annual	Municipalities	Townships	County				Private		Others
Sub-Unit	Reach	Lake					($)	($)			LCSMC	LCHD	LCFPD	Lake County	Property Owner	Developer	
1A			Floodproofing of floodprone structures (58 structures)	2-4	2	5-10 years	$580,000	$0	C		C			C	P		
			Protect lands identified in Green Infrastructure Plan	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-	P				C	P	C	C	
			Develop & implement restoration management plan for large wetland east of Duck Lake	1-3	3	10+ years	$55,000	$22,000	C				C	C	P	P	
			Repair gully erosion north of IL-134 & west of Wilson Road	1-3	2	5-10 years	$26,250	$0						C	P		
	1A		Vegetative management (burning) to re-establish native riparian plant communities	1-2	3	10+ years	$24,000	$3,500					C		P		
	1B		Repair failing sheetpile wall		3	10+ years	$470,000	$470							P		
	2A		Establish native buffer along streambank	1-2	1	1-5 years	$58,500	$4,388							P		
			Woodland management south of creek, east of Forest Way	1-2	3	10+ years	$44,000	$3,500					C				
	2B		Re-establish wooded wetland plant community	1-2	2	5-10 years	$5,800	$870									
	2C		Woodland riparian corridor management	1-2	1	1-5 years	$12,600	$1,890					C		P		
			Selected streambank stabilization	1-2	1	1-5 years	$126,000	$1,890		C	C			C	P		
		Duck	Source controls & lot-level BMPs surounding lake	1-4	2	5-10 years	$5,445	$5,445	C		C			C	P		
			Shoreline stabilization	1-1	2	5-10 years	$40,000	$3,000	C		C			C	P		
			Establish native buffer along shoreline	1-1	1	1-5 years	$3,400	$850	C		C			C	P		
1B			Do not increase hydrologic connection of depressional storage areas	3-2, 3-4, 3-5	1	1-5 years	-	-	P		C					C	

Note:

Responsible Parties

P - Party *primarily* responsible for the implementation of the recommendation

C - Party *contributing* to the implementation of the recommendation

Priority

Levels 1 to 3, with 1 being the highest priority

Table V-2 Prioritized Action and Implementation Plan (continued)

Management Unit 2			Recommendations	Goal-Obj	Priority		Budget		Responsible Parties								
							Initial	Annual	Municipalities	Townships	County				Private		Others
	Reach	Lake					($)	($)			LCSMC	LCHD	LCFPD	Lake County	Property Owner	Developer	
2			Floodproofing of structures in the floodplain (two structures)	2-4	3	10+ years	$20,000	$0			C			C	P		
			Protect lands identified in Green Infrastructure Plan	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-	C				P	C			
			Develop & implement restoration management plans for ADID wetlands	1-3	3	10+ years	$66,500	$26,600	C				C	C	P	P	
			Restore isolated wetland east of Wooster Lake & address drainage	2-2, 1-3	3	10+ years	$2,150	$860			C			C	P		
	3		Management of invasives (reed canary grass)	1-2	2	5-10 years	$17,000	$5,100			C		C		P		
			Streambank regrading to address erosion	1-2	2	5-10 years	$136,000	$5,100		C	C				P		
		Wooster	Source controls & lot-level BMPs surounding lake	1-4	2	5-10 years	$3,376	$3,376	C		C			C	P		
			Retrofit curb and gutter area on NE side of lake	1-4	1	1-5 years	$66,000	$660			C			C	S		
			Shoreline stabilization (plantings)	1-1	2	5-10 years	$170,000	$12,750	C		C			C	P		
			Shoreline stabilization (weir replacement)	1-1	2	5-10 years	$35,000	$0									
			Develop hydrologic and nutrient budgets for Wooster Lake	1-7, 5-2	1	1-5 years	$5,000	$0						C	P		
			Perform in-lake restoration activities as recommended in LCHD report	1-1	2	5-10 years	-	-	C			C		C	P		
			Establish native buffer along shoreline	1-1	1	1-5 years	$8,500	$2,125	C		C			C	P		

Management Unit 3			Recommendations	Goal-Obj	Priority		Budget		Responsible Parties								
							Initial	Annual	Municipalities	Townships	County				Private		Others
Sub-Unit	Reach	Lake					($)	($)			LCSMC	LCHD	LCFPD	Lake County	Property Owner	Developer	
3A			Protect lands identified in Green Infrastructure Plan	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-	P					C		C	
			Implement & continue use of agricultural BMPs on cropland and landscape nurseries	1-5	1	1-5 years	-	-							P		C
			Address runoff from landscape nursery	1-5	1	1-5 years	$60,000	$6,000	C						P		C
	4A		Regrade banks	1-2	1	1-5 years	$48,000	$1,800		C	C			C	P		
			Establish native riparian buffer	1-2	1	1-5 years	$1,200	$300									
			Establish emergent and rooted aquatic vegetation through channel bottom	1-2	1	1-5 years	$6,000	$5		C	C			C	P		
	4B		Energy dissipation at culvert outfall	1-2	1	1-5 years	$20,000	$100		C	C			C	P		
			Debris removal	1-2	1	1-5 years	$5,000	$1,000		C	C			C	P		
			Artificial riffles to reduce erosion pressure at toe of slope	1-2	1	1-5 years	$2,600	$130		C	C			C	P		
			Bioengineering streambank stabilization	1-2	1	1-5 years	$26,000	$390		C	C			C	P		
	4C		Perform modest bank regrading	1-1	2	5-10 years	$144,000	$5,400									
	4C		Establish native buffer along shoreline	1-1	2	5-10 years	$3,600	$900		C	C			C	P		
		Fischer	Source controls & lot-level BMPs surounding lake	1-4	2	5-10 years	$3,049	$3,049			C			C	P		
			Shoreline stabilization of lake and island	1-1	2	5-10 years	$80,000	$6,000			C			C	P		
			Establish native buffer along shoreline	1-1	1	1-5 years	$8,000	$2,000			C			C	P		
			Perform lake restoration activities as recommended in LCHD report	1-1	2	5-10 years	-	-				C		C	P		
3B			Implement sub-unit specific runoff rate and volume standards	3-2, 3-4, 3-5, 3-7, 4-4	1	1-5 years	-	-	P		P					C	
			Use conservation design principles to prevent increases in runoff volumes	3-2, 3-4, 3-5, 3-6	1	1-5 years	-	-	C		C					P	
3C			Use conservation design principles to prevent increases in runoff volumes	3-2, 3-4, 3-5, 3-6	1	1-5 years	-	-	C		C					P	
			Conservation easements for natural areas identified in comprehensive plans (See Green Infrastructure Plan & Future Land Use Map)	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-	P					C		C	
			Do not increase hydrologic connection of depressional storage areas	3-2, 3-4, 3-5	1	1-5 years	-	-	P		P					C	
3D			Implement sub-unit specific runoff rate and volume standards	3-2, 3-4, 3-5, 3-7, 4-4	1	1-5 years	-	-	P/C		P					C	
			Use conservation design principles to prevent increases in runoff volumes and protect ADID wetland	3-2, 3-4, 3-5, 3-6	1	1-5 years	-	-	C		C					P	

Note

Responsible Parties

P - Party *primarily* responsible for the implementation of the recommendation

C - Party *contributing* to the implementation of the recommendation

Priority

Levels 1 to 3, with 1 being the highest priority

Table V-2 Prioritized Action and Implementation Plan (continued)

Management Unit 4			Recommendations	Goal-Obj	Priority		Budget		Responsible Parties								
							Initial	Annual	Municipalities	Townships	County				Private		Others
Sub-Unit	Reach	Lake					($)	($)			LCSMC	LCHD	LCFPD	Lake County	Property Owner	Developer	
4A			Protect lands identified in Green Infrastructure Plan	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-						P		C	
A&B			Develop & implement restoration management plans for ADID wetlands	1-3	3	10+ years	$100,000	$40,000	C				C	C	P	P	
4A			Restore/create wetlands in areas of hydric soils SE of Fish Lake	1-3	3	10+ years	$4,500	$1,800	C				C	C	P		
			Implement agricultural BMPs	1-5	1	1-5 years	-	-							P		C
			Address runoff from landscape nursery	1-5	1	1-5 years	$60,000	$6,000	C						P		C
	5A		Stabilize eroding streambanks	1-2	3	10+ years	$96,000	$3,600									
	5A		Establish contigious riparian buffer	1-2	3	10+ years	$2,400	$600						C	P		C
	5B		Woodland management	1-2	2	5-10 years	$9,500	$1,425					C		P		
	5C		Woodland management	1-2	2	5-10 years	$20,300	$3,045					C		P		
	5C		Streambank stabilization	1-2	2	5-10 years	$81,200	$3,045						C	P		C
		Fish	Manage shoreline vegetation (included in ADID restoration cost)	1-1	3	10+ years	$48,000	$14,400				C		C	P		
4B			Protect lands identified in Green Infrastructure Plan	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-					P	P		C	
			Implement agricultural BMPs	1-5	2	5-10 years	-	-							P		C
4C			Protect lands identified in Green Infrastructure Plan	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-	P					C		C	
			Implement sub-unit specific runoff rate and volume standards	3-2, 3-4, 3-5, 3-7, 4-4	1	1-5 years	-	-	P		P					C	
			Use conservation design principles to prevent increases in runoff volumes and protect ADID wetland	3-2, 3-4, 3-5	1	1-5 years	-	-	C		C					P	
			Replace regional drain tile from 120 with naturalized wetland swale	1-2	2	5-10 years	$160,000	$240,000	C						P	P	
4D			Protect lands identified in Green Infrastructure Plan	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-	P					C		C	
			Retrofit stormwater BMPs in existing developed areas	1-4	2	5-10 years	-	-	P		C						
			Do not increase hydrologic connection of depressional storage area	3-2, 3-4, 3-5	1	1-5 years	-	-	P		C					C	

Management Unit 5	Recommendations	Goal-Obj	Priority		Budget		Responsible Parties								
					Initial	Annual	Municipalities	Townships	County				Private		Others
					($)	($)			LCSMC	LCHD	LCFPD	Lake County	Property Owner	Developer	
Unit 5	Protect lands identified in Green Infrastructure Plan	1-2, 1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-	P					C		C	
	Develop & implement restoration management plans for Monihan Lake	1-3	3	10+ years	$17,500	$7,000					P				
	Use conservation design principles to prevent increases in runoff volumes and protect ADID wetland	3-2, 3-4, 3-5, 3-6	1	1-5 years	-	-	C		C					P	
	Retrofit stormwater BMPs in existing developed areas	1-4	2	5-10 years											
	Vegetative management of wetland areas	1-3	3	10+ years	$32,500	$13,000	C				C	C	P	P	
	Implement agricultural BMPs	1-5	2	5-10 years	-	-							P		C

Management Unit 6	Recommendations	Goal-Obj	Priority		Budget		Responsible Parties								
					Initial	Annual	Municipalities	Townships	County				Private		Others
					($)	($)			LCSMC	LCHD	LCFPD	Lake County	Property Owner	Developer	
Unit 6	Protect lands identified in Green Infrastructure Plan	1-3, 1-6, 3-1, 3-2, 3-3, 3-6	1	1-5 years	-	-	P					C		C	
	Implement sub-unit specific runoff rate and volume standards	3-2, 3-4, 3-5, 3-7, 4-4	1	1-5 years	-	-	P		P					C	
	Use conservation design principles to prevent increases in runoff volumes	3-2, 3-4, 3-5, 3-6	1	1-5 years	-	-	C		C					P	
	Implement agricultural BMPs	1-5	2	5-10 years	-	-							P		C
	Retrofit stormwater BMPs in existing developed areas	1-4	2	5-10 years	-	-									
	Restore/create wetlands in areas of hydric soils	1-3	3	10+ years	$100,000	$40,000	C				C	C	P		

Note

Responsible Parties

P - Party *primarily* responsible for the implementation of the recommendation

C - Party *contributing* to the implementation of the recommendation

Priority

Levels 1 to 3, with 1 being the highest priority

Table V-3 LCSMC Detention Basin Inventory and Retrofit Opportunities

Basin #	Basin Name	Predominant Land Use	Side Slope Character	Shoreline Erosion	Preliminary Retrofit Opportunities
1	Larkin Ln.				Access Issues: No trespassing signs, plus do not enter
2	Larkin Ln.	residential	40% turf 60% native	Med	Plant natives along banks. Decrease turbidity,
3	Tanneron Bay	residential	50% turf 50% rip rap	No	Plant natives along banks
4	Tanneron Bay	residential	50% turf 50% rip rap	No	Plant natives along banks
5	Cambridge at Holiday	residential	100% native	Low	Decrease turbidity.
6	Molidor Rd.	residential	10% turf 80% native 10%	No	Plant natives where turf grass is.
7	Molidor Rd.	residential	70% turf 30% native	Low	Plant more natives along basin.
8	Fish Lake Nursery	commercial	20% turf 80% native	No	Plant more natives on slopes.
9	Levi Waite Rd.	residential	50% turf 50% rocks	Low	Plant native plants along banks. Replace plastic
10	McAllister Equipment Co.	commercial	50% turf 50% rocks	No	Plant natives along banks. Reduce turbidity. Remove
11	Hwy 59/12	commercial	100% native	No	Unclog inlet B
12	Fish Lake Beach Trailer	residential	100% turf	Med	Plant natives along banks. Basin water quality needs
13	Volo Commerce Center	commercial	100% turf	No	Plant natives along banks. Reduce turbidity.
14	Volo Commerce Center	commercial	100% turf	No	Plant natives along banks.
15	Hwy 120 + Hwy 59/12	commercial	100% native	No	None
16	Oak Dr.	residential	80% turf 20% rocks	No	Decrease turbidity and sediment.
17	Stonewall Orchars Golf	commercial	20% turf 80% native	No	Plant natives along banks.
18	Stonewall Orchard Golf	commercial	40% turf 60% native	No	Add native plants on west side of basin.
19	Levrey's Landscaping	commercial	100% turf	No	Plant natives along banks. Reduce algae.
20	Levrey's Landscaping	commercial	100% turf	No	Plant natives along banks. Reduce algae.
21	Levrey's Landscaping	commercial	100% turf	No	Plant natives along banks. Reduce algae.
22	Levrey's Landscaping	commercial	100% turf	No	Plant natives along banks. Reduce algae. Unclog

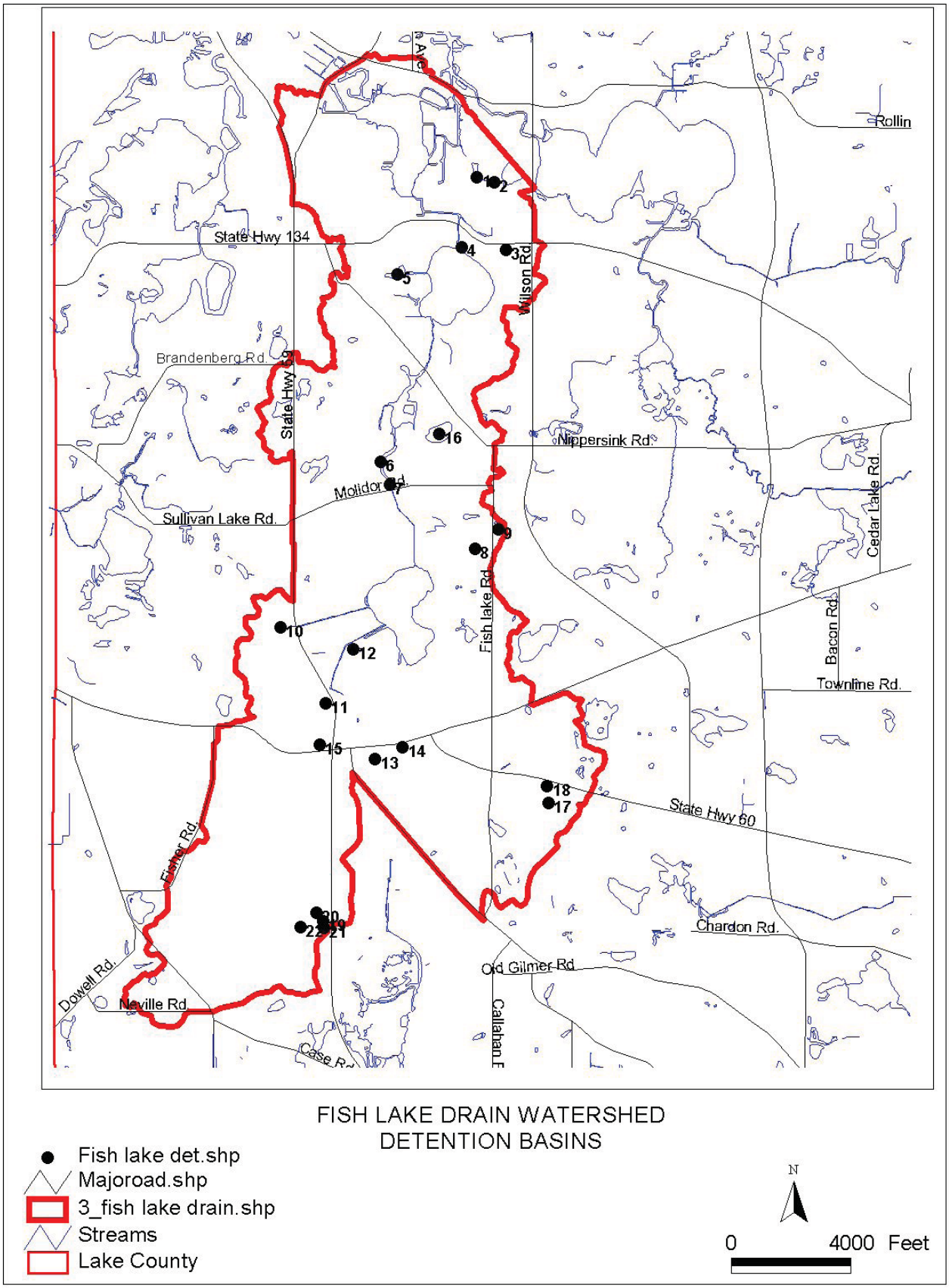


Figure V-1 LCSMC Detention Basin Inventory Locations

Table V-4 Public Information and Education Plan

Impairment	Cause	Source	Target Audiences	Priority	Messages	Delivery Mechanism	Anticipated Behavioral Changes	Evaluation Measure	Organization Responsible for Education	Milestones	Timeline
Water Quality (TSS/turbidity)	Total suspended solids / turbidity	Urban runoff	A		The effects of soil erosion on water quality and the importance of control measures, particularly on construction projects and agricultural land. Stormwater BMP practice and installation for urban runoff management. Highway and parking lot maintenance for improved water quality (e.g., regular sweeping, salt application procedures and alternatives, etc.). Volunteer stream and lake monitoring.	One-on-one direct contact; presentations, workshops, and meetings; media and mailings; signage	Voluntary installation of stormwater BMPs; improved highway and parking lot maintenance practices (e.g., additional street sweeping, salt application more tailored to location within the watershed); greater volunteer base for stream and lake monitoring.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls; direct response / calls	IEPA, LCSMC		
		Bank modification and destabilization	R, S, L, G		The importance of streambanks and buffers in controlling erosion and reducing TSS loads; bank and buffer management and stabilization measures for landowners and land managers. Volunteer stream and lake monitoring.	One-on-one direct contact; presentations, workshops, and meetings; media and mailings; watershed events and stewardship	Improved bank and buffer management; wider natural / vegetated riparian buffers; greater volunteer base for stream and lake monitoring.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls; attendance / response to invitation, event evaluation, follow up	IDNR, LCSMC		
		Agricultural activity / nursery operations	Farmers and owners of agricultural land and nurseries		The effects of agricultural / nursery practices and land management (e.g., wetland preservation, stream buffers and filter strips) on TSS loads and water quality and the importance and effectiveness of controlling agricultural and nursery runoff with appropriate BMPs.	One-on-one direct contact; presentations, workshops, and meetings; media and mailings	Voluntary installation of stormwater BMPs on agricultural land and nursery operations such as filter strips.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls.	NRCS		
		Development / Land use conversion	L, S, G, Developers		The effects of soil erosion on water quality and the importance of control measures, particularly on development / construction projects. Stormwater BMP design and engineering for new development. Conservation development and stormwater management practices for new development.	One-on-one direct contact; presentations, workshops, and meetings	Voluntary installation of stormwater BMPs in new development; greater number of conservation development designs.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up.	Municipalities, County / LCSMC		
		Inappropriate land management	R, S, L, G		The impacts of different land uses on TSS loads and improved land management measures for reducing TSS loads on a variety of land use types (residential, agricultural, commercial).	One-on-one direct contact; presentations, workshops, and meetings; media and mailings	Modification of land management practices to reduce erosion ans sediment contribution to runoff.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls.	Municipalities, County / LCSMC		
		Online lakes / impoundment / dams	R, S, L, G		Better lake and dam management for improved TSS control, including dam removal and lake flushing / dredging.	One-on-one direct contact; presentations, workshops, and meetings; media and mailings	Improved lake, impoundment, and dam management.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls.	IEPA, LCHD		
Water Quality (nutrients, algal growth, low DO)	Nutrients (phosphorous), algal growth, low DO	Urban runoff	A		Stormwater BMP practice and installation for urban nutrient runoff management (e.g., raingardens, swales, naturalized detention, natural landscaping, etc.). Better turf and land management practices (appropriate fertilizer application and mowing/ maintenance practices) for residences, parks, schools, and other expanses of turf area. Volunteer stream and lake monitoring.	One-on-one direct contact; presentations, workshops, and meetings; media and mailings; signage	Voluntary installation of stormwater BMPs; improved turf and land management practices (e.g., less frequent mowing, less fertilizer application); greater volunteer base for stream and lake monitoring.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls; direct response / calls	IEPA, LCSMC, Municipalities		
		Agricultural activity / nursery operations	Farmers and owners of agricultural land and nurseries		The effects of agricultural / nursery practices and land management (e.g., fertilizer application, filter strips) on nutrient loads and water quality and the importance and effectiveness of controlling agricultural and nursery runoff with appropriate BMPs.	One-on-one direct contact; presentations, workshops, and meetings; media and mailings	Voluntary installation of stormwater BMPs on agricultural land and nursery operations such as filter strips; improved land management practices (e.g., less fertilizer application).	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls.	NRCS		
		Animal waste	A		Better turf and land management practices (e.g., fertilizer and/or manure application, geese and/or seagull control) and encouragement of animal waste pick-up in residential areas.	One-on-one direct contact; presentations, workshops, and meetings; media and mailings	Modification of land management and waste pick-up practices; seagull and goose control measures; reduced manure application.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls; direct response / calls	Municipalities, NRCS, LCSMC		
		Unsewered residential (septic) [modeled as a cause]	R, G		The impacts of inappropriate management & maintenance and the importance of appropriate septic system management and maintenance practices such as regular inspection and repair of tanks, fields, and infrastructure.	One-on-one direct contact; presentations, workshops, and meetings; media and mailings	Increased inspection and maintenance of septic systems.	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls.	IEPA, Municipalities, LCHD		
Water Quality (toxicity)	Aquatic life toxicity (total dissolved solids, chlorides)	Urban runoff (heavy metals, organics)	A		Stormwater BMP practice and installation for urban runoff management, especially for areas contributing metals, chlorides, and organics. Highway and parking lot maintenance to reduce the runoff of metals and organic materials (e.g., regular sweeping, salt application procedures and alternatives, etc.).	One-on-one direct contact; presentations, workshops, and meetings; media and mailings; signage	Voluntary installation of stormwater BMPs; improved highway and parking lot maintenance practices (e.g., additional street sweeping, salt application more tailored to location within the watershed).	Direct feedback / receptiveness, commitment to action, follow up; attendance / response to invitation, event evaluation, pre- and post-testing, commitment to action, follow up; circulation area and number, direct response / calls; direct response / calls	IEPA, LCSMC		

Table V-5 Monitoring Strategy

Goal	Objective	Indicators	Frequency of Monitoring	Milestone	Party Responsible	Priority	Mode of Collection	Number of Actions	Location of Implementation
1. Improve Water Quality and Stream, Lake, and Wetland Resources	1.1. Perform in-lake management measures to improve water quality and aquatic habitat of the watershed lakes.	# of lakes with active management plans and activities; water quality data; biologic indices	Annual; monthly; annual	100% of lakes have active management plans and activities by 2010; water quality improvement trend established by 2012; biologic index improvement by 2012	LCHD				
	1.2. Restore and enhance water quality and habitat of existing drainage corridors.	linear feet of streambank restored; water quality data; biologic indices	Annual; monthly; annual	75% of impaired corridors restored by 2015; water quality improvement trend established by 2012; biologic index improvement by 2012	IEPA, IDNR, landowners, LCSMC				
	1.3. Restore and enhance water quality, habitat, and floristic quality of existing and former watershed wetlands.	acres of wetland restored; water quality data; biologic indices and floristic quality	Annual; monthly; annual	50% of wetlands restored or undergoing restoration activities by 2012; water quality improvement trend established by 2012; biologic index and floristic quality improvement by 2012	IDNR, LCSMC				
	1.4. Address the quality and quantity of runoff from existing development.	# of BMPs installed (acres, feet); water quality data; biologic indices	annual	50 BMP practices installed by 2012; water quality improvement trend established by 2012; biologic index improvement by 2012	IEPA, LCHD, LCSMC				
	1.5. Address the quality and quantity of runoff from agricultural land uses.	# of BMPs installed (acres, feet); water quality data; biologic indices	annual	25 BMP practices installed by 2012; water quality improvement trend established by 2012; biologic index improvement by 2012	IEPA, NRCS, LCHD, LCSMC				
	1.6. Implement a "Green Infrastructure" plan to guide preservation, restoration, and management activities.	Completion of plan; # of action items completed	annual	50% of plan action items implemented by 2010	Local government, LCSMC, LCFPD				
	1.7. Develop and maintain a database of water quality assessment information and collect additional data.	Database establishment and data collection	annual	Database established by 2008; data collection annually	IEPA, LCHD, LCSMC				
2. Identify and Mitigate Existing Watershed Flooding Problems	2.1. Identify existing overbank flooding sources, properties that flood, and damages associate with flooding.	# of properties assessed	annual	100% of properties assessed by 2009	LCSMC, local government				
	2.2. Identify existing local drainage flooding sources, properties that flood, and damages associate with flooding.	# of properties assessed	annual	100% of properties assessed by 2009	Local government, LCSMC				
	2.3. Reduce existing flooding through the implementation of flood damage reduction projects that lower the flood water levels.	# of projects implemented	annual	10 projects implemented by 2012	Local government, LCSMC				
	2.4. Reduce existing flood damage potential by floodproofing structures.	# of structures floodproofed	annual	100% of structures floodproofed by 2115	Local government, LCSMC				
3. Prevent Negative Impacts of New Development on Flooding and Watershed Resources	3.1. Discourage development in flood-prone areas.	# of structures in flood prone areas	annual	0 new structures in flood prone areas	LCSMC, local government				
	3.2. Protect existing floodplain and depressional storage.	acres of floodplain and depressional areas impacted		0 acres of floodplain and depressional areas lost	LCSMC, local government				
	3.3. Protect stream and wetland resources from unnecessary modifications, and mitigate all necessary modifications and impacts.	linear feet of stream and acres of wetland modified	annual	0 feet / acres of streams and wetlands modified	Local government, LCSMC, USACE, IDNR				

Table V-5 Monitoring Strategy (continued)

Goal	Objective	Indicators	Frequency of Monitoring	Milestone	Party Responsible	Priority	Mode of Collection	Number of Actions	Location of Implementation
	3.4. Minimize increases in runoff rates and volumes (as conditions allow) associated with new development.	Ordinance modifications to address volume	annual	Incorporate volume standard into ordinance by 2008	LCSMC, local government, developers				
	3.5. Minimize water quality impacts of new development.	# of SESC violations	annual	No SESC violations by 2008	LCSMC, IEPA, local government, developers				
	3.6. Evaluate, and where feasible, adopt, win-win strategies to enhance existing natural resources in concert with new development.	# of new developments using conservation development practices	annual	75% of new development using conservation development practices by 2012	Local government, developers				
	3.7. Identify and implement additional regulatory standards and enforcement needs.	# of new standards established / needs addressed.	annual	50% of regulatory needs addressed by 2012	Local government, LCSMC				
4. Provide Tools to Implement Watershed Protection and Enhancement Measures	4.1. Identify and secure resources to implement the Plan recommendations.	# of technical and financial assistance secured	annual	50% of necessary resources secured by 2012	Local government, LCSMC / Watershed Planning Committee				
	4.2. Continually identify strategies for facilitating the Plan implementation.	# of plan updates	annual	5 year plan update schedule in place	LCSMC / Watershed Planning Committee				
	4.3. Improve coordination between municipalities and the County agencies in watershed planning and protection.	# of coordinated projects	annual	Annual municipal / agency watershed coordination meeting	Local government, LCSMC				
	4.4. Provide municipalities with sources for, and/or copies of, watershed-beneficial regulatory standards and land use planning methods.	# of municipalities reached	annual	100% of municipalities reached by 2008	IEPA, LCSMC				
	4.5. Educate local officials, planners, and engineers on the benefits and methods of conservation planning and development.	# of workshops held; # of individuals reached	annual	One design workshop annually; 50 individuals reached annually	IEPA, local government, LCSMC				
	4.6. Provide educational, management, and restoration opportunities for residents to foster watershed stewardship.	# of events held; # of individuals participating	annual	25% increase in events and participation each year until 2012	IEPA, IDNR, LCSMC, local government				
	4.7. Educate residents on source control and runoff reduction measures that may be used on their properties.	# of residents reached	annual	25% increase in residents reached each year until 2012	IEPA, SMC				
5. Evaluate Success in Plan Implementation	5.1. Monitor implementation of recommendations.	# of recommendations implemented	annual	75% or recommendations implemented by 2020	LCSMC / Watershed Planning Committee				
	5.2. Perform hydrologic, water quality, and biological monitoring of the watershed to evaluate success in meeting watershed goals and objectives.	Sampling and monitoring plan established and in process	annual	Sampling plan in place by 2008; 100% of plan in progress by 2012	IEPA, IDNR, LCSMC				
Note: since chemical water quality and flow monitoring can be cost prohibitive, biological indices may be a preferred method of monitoring.									

Reference & Resources

References

Lake County, 2001, Regional Framework Plan Draft.

LCHD and Community Health Center, 1997, 1997 Fish Lake Water Quality Report.

LCHD Environmental Health Services Lakes Management Unit, 2002, 2001 Summary Report of Fischer Lake, Lake County, Illinois.

LCHD Environmental Health Services Lakes Management Unit, 2001, 1999 Summary Report of Wooster Lake, Lake County, Illinois.

LCHD Environmental Health Services Lakes Management Unit, 2002, 2001 Summary Report of Duck Lake, Lake County, Illinois.

LCSMC, 2003, Fish Lake Drain Floodplain Study Final Draft.

LCSMC, 2000, North Branch of the Chicago River Watershed Management Plan.

LCSMC, 1999, Lake County Flood Hazard Mitigation Plan Workshop.

LCSMC, 1990, Fox River Watershed Draft Planning Document.

Max McGraw Wildlife Foundation, 1999, Abundance and Diverstity of Wildlife Communities in Mitigation and Natural Wetlands of the Chicago Region, Annual Report.

USEPA, 1992, Advanced Identification (ADID) Study, Lake County, Illinois.

Resources/Organizations

Planning/Watershed Planning

- Northeastern Illinois Planning Commission (NIPC),
  www.nipc.org
- Prince George's County Planning Department
  www.mncppc.org/pgco
- The Countryside Program
  www.countrysideprogram.org
- Center for Watershed Protection
  www.cwp.org
- Fox River Ecosystem Partnership
  www.foxriverecosystem.org

Stormwater BMPs/Conservation Design

- Center for Watershed Protection
  www.cwp.org
- Low Impact Development (LID) Center
  www.lowimpactdevelopment.org
- Prince George's County Department of Environmental Resources
  www.goprincegeorgescounty.com
- Puget Sound Action Team
  www.psat.wa.gov
- Green Roofs

  Greenroofs.com
  www.greenroofs.com

  Green Roofs for Healthy Cities
  www.greenroofs.org

  Pennsylvania State University, Center for Green Roof Research
  http://hortweb.cas.psu.edu/research/greenroofcenter/
- Rain Gardens

  University of Wisconsin Extension Water Resources Programs
  http://clean-water.uwex.edu/pubs/raingarden

  City of Maplewood, Minnesota
  www.maplewoodmn.govoffice.com/index.asp?Type=B_BASIC&SEC={1305A6BC-1D9C-48D1-81FE-6226AF4BD322}

  Rain Gardens of West Michigan
  www.raingardens.org

Stormwater BMPs/Conservation Design (continued)

- Porous Pavement

  Paveloc Industries, Inc.
  www.paveloc.com

  Unilock Ltd.
  www.unilock.com

Landscaping

- Native Landscaping

  Chicago Wilderness
  www.chicagowilderness.org/wildchi/landscape/index.cfm

  EPA
  www.epa.gov/glnpo/greenacre

- Lawn Maintenance

  University of Illinois Extension Service
  www.urbanext.uiuc.edu/lawntalk

Floodproofing

- Illinois Association for Floodplain and Stormwater Management
  www.illinoisfloods.org
- Federal Emergency Management Agency
  www.fema.gov

Suggested References

Floodproofing

Elevated Residential Structures. Federal Emergency Management Agency. Publication #54. March 1984.

Floodproofing Non-Residential Structures. Federal Emergency Management Agency. Publication #102. May 1986.

Homeowners Guide to Retrofitting: Six Ways to Protect Your House from Flooding. Federal Emergency Management Agency. Publication #312. June 1998.

Above the Flood: Elevating Your Floodprone House. Federal Emergency Management Agency. Publication #347. May 2000.

Flood Proofing Systems and Techniques: Examples of Flood Proofed Structures in the United States. US Army Corps of Engineers. December 1984.

Flood-Proofing Regulations. Office of the Chief of Engineers, US Army Corps of Engineers. June 1972.

Flood Proofing Tests: Tests of Materials and Systems for Flood Proofing Structures. National Flood Proofing Committee, US Army Corps of Engineers. August 1988.

Raising and Moving the Slab-on-Grade House: with Slab Attached. National Flood Proofing Committee, US Army Corps of Engineers. 1990.

Design Manual for Retrofitting Flood-Prone Residential Structures. Federal Emergency Management Agency. Publication #114. September 1986.

Local Flood Proofing Programs. National Flood Proofing Committee, US Army Corps of Engineers. June 1994.

Protect Your Home from Flood Damage. Local Assistance Series 3B. Illinois Department of Transportation, Division of Water Resources. January 1985.

Flood Basements: A Homeowners Guide. Illinois Department of Transportation, Division of Water Resources. August 1987.

Guide to Flood Protection in Northeastern Illinois: Floodproofing Techniques to Reduce Flood Damage to Your Home and Property. Illinois Association for Floodplain and Stormwater Management. April 1997.

Flood Mitigation Programs

Flood Hazard Mitigation in Northeastern Illinois: A Guide for Local Officials. Northeastern Illinois Planning Commission. July 1995.

Design Guidelines for Flood Damage Reduction. Federal Emergency Management Agency. Publication #15. December 1981.

Flood Hazard Mitigation Strategy for McHenry County, Illinois. Northeastern Illinois Planning Commission. December 1995.

Butterfield Creek Flood Hazard Mitigation Plan. Northeastern Illinois Planning Commission. August 1991.

Detention Retrofitting

Flossmoor Stormwater Detention Basin Retrofit: A Demonstration of Detention Basin Modifications to Improve Nonpoint Source Pollution Control. Northeastern Illinois Planning Commission. August 1995.

Stormwater Management and Site Design for New Development

Environmental Considerations in Comprehensive Planning: A Manual for Local Officials. Northeastern Illinois Planning Commission. March 1994.

Reducing the Impacts of Urban Runoff: The Advantages of Alternative Site Design Approaches. Northeastern Illinois Planning Commission. April 1997.

Best Management Practice Guidebook for Urban Development. Northeastern Illinois Planning Commission. July 1992.

Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement. USDA Natural Resource Conservation Service for Illinois Environmental Protection Agency. 1995.

Protecting Water Quality in Urban Areas: Best Management Practices for Minnesota. Minnesota Pollution Control Agency. October 1989.

Fundamentals of Urban Runoff Management: Technical and Institutional Issues. Watershed Management Institute in cooperation with US Environmental Protection Agency. August 1994.

Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use. Delaware Department of Natural Resources and Environmental Control and The Brandywine Conservancy. September 1997.

Design of Stormwater Filtering Systems. Center for Watershed Protection. December 1996.

Native Plant Guide for Stormwater facilities in Northeastern Illinois. USDA Natural Resource Conservation Service Chicago Metro Urban and Community Assistance Office in cooperation with US Environmental Protection Agency Region V, US Fish and Wildlife Service Chicago Field Office, and US Army Corps of Engineers Chicago District. 1997.

Urban Stormwater Best Management Practices for Northeastern Illinois: Course Notebook. Northeastern Illinois Planning Commission. May 1998.

Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Metropolitan Washington Council of Governments. July 1987.

Design of Stormwater Wetland Systems: Guidelines for Creating Diverse and Effective Stormwater Wetland Systems in the Mid-Atlantic Region. Metropolitan Washington Council of Governments. October 1992.

Better Site Design: A Handbook for Changing Development Rules in Your Community. Center for Watershed Protection. August 1998.

Natural Approaches to Stormwater Management: Low Impact Development in Puget Sound. Puget Sound Action Team. March 2003. www.psat.wa.gov

Prince George's County Bioretention Manual. Department of Environmental Resources, Prince George's County, MD. Revised December 2002

Low Impact Development Design Strategies. Prince George's County Department of Environmental Resources. 1999

Growing Greener, A Conservation Planning Workbook for Municipal Officials in Pennsylvania. Natural Lands Trust. 1999.

Native Landscaping

Natural Landscaping for Public Officials: A Source Book. Northeastern Illinois Planning Commission. May 1997.

Native Plant Guide for Stormwater facilities in Northeastern Illinois. USDA Natural Resource Conservation Service Chicago Metro Urban and Community Assistance Office in cooperation with US Environmental Protection Agency Region V, US Fish and Wildlife Service Chicago Field Office, and US Army Corps of Engineers Chicago District. 1997.

Stream and Lake Maintenance, Management, and Restoration

Stream Obstruction Removal Guidelines. Stream Renovation Guidelines Committee, The Wildlife Society, and American Fisheries Society in cooperation with International Association of Fish and Wildlife Agencies. 1983.

Stream Preservation Handbook. Illinois Department of Transportation, Division of Water Resources. October 1981.

Restoring and Managing Stream Greenways: A Landowner's Handbook. Northeastern Illinois Planning Commission. June 1998.

Streambank Stabilization Program. DuPage County Department of Environmental Concerns. June 1996.

Flint Creek Watershed Restoration Projects. Northeastern Illinois Planning Commission. September 1997.

Stream Analysis and Fish Habitat Design: A Field Manual. Newbury, R.W. and M.N. Gaboury, Newbury Hydraulic Ltd. 1993.

Stream Corridor Restoration Handbook: Principals, Processes, and Practices. United States Department of Agriculture. October 1998.

Lakescaping for Wildlife and Water Quality Benefits. Minnesota DNR, Nongame Wildlife Program.

Lake Notes. Series of fact sheets on lake management prepared by Northeastern Illinois Planning Commission.

Model Ordinances

Model Stormwater Drainage and Detention Ordinance: A Guide for Local Officials. Northeastern Illinois Planning Commission. July 1990.

Model Floodplain Ordinance for Communities within Northeastern Illinois. Illinois Department of Natural Resources, Office of Water Resources and Northeastern Illinois Planning Commission. July 1996.

Model Soil Erosion and Sediment Control Ordinance: A Guide for Local Officials. Northeastern Illinois Planning Commission. September 1991.

Model Stream and Wetland Protection Ordinance for the Creation of a Lowland Conservancy Overlay District: A Guide for Local Officials. Northeastern Illinois Planning Commission. October 1988.

Conservation Design Resource Manual: Language and Guidelines for Updating Local Ordinances. Northeastern Illinois Planning Commission. March 2003.

Blackberry Creek Watershed Zoning Code Analysis and Ordinance Language Recommendations. Conservation Design Forum for Kane County Department of Environmental Management. April 2004.

WHO TO CALL IN LAKE COUNTY, IL

DRAINAGE ISSUES

Refer To:	When the Calls Relate To:	Additional Information:
Lake County Stormwater Management Commission **(847) 918-5260** **www.co.lake.il.us/smc**	**1.** Neighborhood, watershed or regional scale problems **2.** Interjurisdictional issues **3.** Involves a violation of the Lake County Watershed Development Ordinance [related to new development and in non-certified communities]	Relies on other governmental units to respond to smaller scale problems; has field staff to investigate drainage complaints in non-certified communities; funding available for repair or maintenance of drainage facilities and drainage problems; compiles drainage data for watershed planning and should be notified by Certified Communities of major problems.
Lake County Planning, Building, & Development Department, Engineering and Environmental Services Division (E&ES) **(847) 377-2600**	1. Complaint is on a parcel located in an unincorporated area 2. Drainage complaints, erosion control, Site Development Permits 3. Individual, neighborhood, watershed scale problems 4. Involves a violation of the Lake County Unified Development Ordinance (related to older or new development)	Has field staff to inspect and respond to drainage complaints in unincorporated areas; can require remedial activity if in violation of the Lake County Unified Development Ordinance; funding available for repair or maintenance of drainage facilities; provides notification to SMC of regional scale problems.
Local Municipalities	1. Lot and Neighborhood level drainage concerns 2. Emergency response: sandbags, evacuation procedures	Usually have staff or budget through public works to handle common problems; have authority to enter lands to remove blockages even outside own boundaries.
Township Highway Departments **(See below for phone #'s)**	1. Drainage concerns are within the right-of-way of a township road	Sometimes staff is able to reduce local flooding problems by improvements along ROW but is not common; policies vary from township to township; not able to assist in areas outside its own ROW.
Lake County Division of Transportation (LCDOT) **(847) 362-3950**	1. Bridges, culverts, and ditches located within the right-of-way of county roads	Maintains all bridges, culverts and ditches within the ROW of county highway signs signified by blue and gold route markers saying Lake County.
Lake County Health Department (LCHD), Division of Environmental Health **(847) 984-5000**	1. Contamination of an individual well 2. Failure of individual septic	Primary concern for water quality specifically public beaches, individual wells & septics; will assist if flooding problem results in failure of septic or contamination of well.
Lake County Soil and Water Conservation District (SWCD) **(847) 223-1056**	1. Agricultural drainage issues or drainage issues related to soil erosion	Provides technical assistant and education; has some information on farm tiles; field staff to make site visits in severe ag/soil erosion situations.
Drainage Districts **(See below for phone #'s)**	1. Problem associated with drainage ditches and streams within a drainage district	Provides information, technical assistance; field staff may be available for site visits in cases of severe drainage, soil erosion.
Fox Waterway Agency **(847) 587-8540**	1. Debris removal, shoreline protection, flood control, flood warning for Chain O' Lakes area.	Primarily responsible for dredging, debris removal, shoreline protection, flood control, flood warning for Chain O'Lakes area; has staff to do site visits.
Lake County Emergency Management Agency (LCEMA) (Sheriffs Office) **(847) 377-7100**	1. Request for sandbags and evacuation procedures is coordinated by municipal EMA coordinators and township officials	Primarily responsible for emergency services in a disaster; works closely with local ESDA coordinators during a disaster/flood event. Refer requests for sandbags and evacuation procedures to local municipality or to township; does not distribute insurance claims.
US Geological Survey – Urbana, IL **(217) 344-0037**	1. Provides real-time, unofficial river/stream stage information, rain totals (SMC rain/stream gages are the same as USGS gages)	Data available at: http://il.water.usgs.gov

For updates to this contact sheet, please go to the following website:
http://www.co.lake.il.us/citizens/Whotocall_050605.pdf

DRAINAGE ISSUES – WHO TO CALL IN LAKE COUNTY, IL

TOWNSHIP HIGHWAY ROAD COMMISSIONERS		HIGHWAY DEPARTMENT	TOWNSHIP OFFICE
Antioch Township	Mark Ring	395-2070	395-3378
Avon Township	Patrick Anderson	546-7480	546-1446
Benton Township	Eugene Gross	746-2070	746-2100
Cuba Township	Tom Gooch	381-7793	381-1924
Ela Township	Bill Kruckenberg	438-2371	438-7823
Fremont Township	William Grinnell	223-2848	223-2847
Grant Township	Kim Kiesgen	740-7623	740-2233
Lake Villa Township	Jim Jorgensen	356-5831	356-2116
Libertyville Township	Bill Morgan	362-3350	816-6800
Newport Township	Daniel Dziekan	336-9698	731-6430
Shields Township	Bill Goodman	234-0888	234-0802
Vernon Township	Bryant Schroeder	634-4600	634-4600
Warren Township	Gerald Rudd	244-1101	244-1101
Wauconda Township	Jodeph Munson	526-8085	526-2631
Waukegan Township	Mark Stricklin	662-7280	244-4900

Townships Without Highway Commissioners (Lake County has 18 Townships)

Moraine Township	432-3240
West Deerfield Township	945-0614
Zion Township	872-2811

ACTIVE DRAINAGE DISTRICTS*			GENERAL AREAS OF COVERAGE
Avon-Fremont Drainage District	Dennis Sandri, Chairman	(847) 223-2037	Avon and Fremont Townships
Beach Park Drainage District	Vincent Varsek, Chairman	(847) 336-2985	Beach Park, Park City, North Chicago, Waukegan
East Skokie Drainage District	James Bradner, Chairman	(847) 606-6760	Highland Park, Lake Forest, Highwood, Lake Bluff, North Chicago, Waukegan
Grubb School Drainage District	Thomas Doolittle, Chairman	(847) 395-5787	Antioch
Slocum Drainage District	Ed McGlade, Chairman	(847) 526-1355	Cuba and Wauconda Townships
Squaw Creek Drainage Districts	Pete Tekampe. Chairman	(847) 223-2847	Avon, Grant and Fremont Townships
Union Drainage Dist 1 (West Fork)	Gordon McKavanagh, Chairman	(847) 945-0600	West Deerfield, Lake County; Northfield, Cook County
Union Drainage Dist 1 (Middle Fork)	Karl Halperin, Chairman	(773) 481-2700	
West Skokie Drainage District	James Cunningham, Chairmam	(312) 782-4780	Libertyville, Moraine, and Vernon Townships

* Members and Chairmen appointed and reappointed by County Board

FOR MORE INFORMATION CALL:
LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
(847) 918-5260

For updates to this contact sheet, please go to the following website:
http://www.co.lake.il.us/citizens/Whotocall_050605.pdf

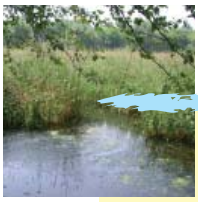
WATER QUALITY ISSUES

Refer To:	When the Calls Relate To:	Additional Information:
Lake County Planning, Building, & Development Department, Engineering and Environmental Services Division (E&ES) **(847) 377-2600**	1. Construction site soil erosion and sediment control problems in Unincorporated Lake County	Has field staff to inspect and respond to water quality complaints in unincorporated areas; can require remedial activity if in violation of the Lake County Unified Development Ordinance; provides notification to SMC of regional scale problems.
Local Municipalities	1. Construction site soil erosion and sediment control problems in incorporated areas	Usually have staff or budget through public works to handle common problems in addition to construction site problems. If construction activity is in a non-certified community, may be referred to LCSMC.
Lake County Health Department (LCHD), Division of Environmental Health **(847) 360-6740**	1. Well & septic-related problems 2. Lake water quality issues	Primary concern for water quality specifically public beaches, individual wells & septics; will assist if flooding problem results in failure of septic or contamination of well.
Lake County Soil and Water Conservation District (SWCD) **(847) 223-1056**	1. Technical assistance on soil erosion issues	Agricultural, urban, and water body-related technical guidance; Provides technical assistant, education, and information on cost-share programs; field staff may make site visits in severe soil erosion situations.
Illinois Environmental Protection Agency **Joan.Muraro@epa.state.il.us** **(217) 782-0610** **Chris Kalis**	1. Water pollution problems	Enforce stormwater pollution prevention plan on development sites greater than 1 acre in size; address contaminant spills, point source discharges, etc. Secondary contact: Chris Kalis (847) 294-4000
Lake County Stormwater Management Commission (LCSMC) **(847) 918-5260**	1. As referred by entities listed above	Relies on other governmental units to respond to smaller scale problems; has field staff to investigate construction-related water quality concerns in non-certified communities; funding available for repair or maintenance of drainage facilities and drainage problems; compiles drainage data for watershed planning and should be notified by Certified Communities of major problems.

NATURAL AREAS ISSUES

Refer To:	When the Calls Relate To:	Additional Information:
Natural Resource Conservation Service of the U.S. Dept. of Agriculture (NRCS) **(847) 223-1056**	1. Technical assistance on natural resource issues 2. Information about cost-share programs	Can prepare Natural Resource Inventories for a property.
Illinois Department of Natural Resources (IDNR) **(217) 782-6302**	1. State natural areas 2. Wildlife and fisheries 3. Regulatory requirements	
Lake County Forest Preserve District (LCFPD) **(847) 367-6640**	1. Lake County Forest Preserve properties and programs 2. Technical assistance for vegetative issues in natural areas 3. Volunteer opportunities	Numerous natural areas owned by the residents of Lake County are managed by the LCFPD.
Chicago Wilderness **www.chicagowilderness.org**	1. The region's natural lands and the plants and animals that inhabit them	Serves northwestern Indiana, northeastern Illinois, and Southeastern Wisconsin. Focus is on protection of natural plant communities and biodiversity.
U.S. Army Corps of Engineers **(312) 353-6400**	1. Wetlands	Requires for activities within most wetlands. May refer some questions to LCSMC.

For updates to this contact sheet, please go to the following website:
http://www.co.lake.il.us/citizens/Whotocall_050605.pdf



Appendix 1 - Stakeholders Meeting Minutes

Stakeholders meetings play an important role in the Fish Lake Drain Watershed Management Plan project. The meetings facilitate a collaborative efforts and ecourage residents and local communities to be aware of environmental issues and to be involved in the planning process. This appendix includes 13 meeting minutes that during the process of this report. Concerns and issues discussed in the first meeting served as a foundation of Fish Lake Drain Watershed goals and objectives. Prioritized action plan and implementation measures were developed as a result of discussions with stakeholders through several meetings. Stakeholder meeting is an on-going process to ensure the Plan addresses each identified issues and concerns in the watershed and to facilitate implementation of the Plan. After August 2003, stakeholders maintain monthly meeting and continue to review the plan. Those meeting minutes, however, are not included in this report,

The following table shows the schedule, subject, topic, and presenter/hosts for each meeting and corresponding page numbers for each meeting minutes in this appendix. As part of the Fish Lake Drain Watershed Plan upgrade, multiple public meetings were held to discuss the nine elements of the plan upgrade. Evening meetings were held to ensure a larger turnout from watershed stakeholders. Discussions at the meetings ranged from overall planning within the watershed to revising portions of the plan to incorporate the nine elements.

Subject	No.	Date	Topic	Presenter / Hosts	Appendix 1 Page No.
Kick-off Meeting	1	7/10/2002	Concerns and Issues	LCSMC/CDF	2
Education	2	8/7/2002	Lake studies in the Fish Lake Drain Watershed Area	LCHD	5
	3	9/4/2002	Ecology of Northern Fox Valley in Lake County	CDF	9
	4	10/2/2002	Sustainable Site Planning and Design	CDF	12
	5	11/6/2002	Flood Problem Worksheet Workshop	LCSMC	15
Plan Visions	6	12/4/2002	Mission Statement	LCSMC/CDF	16
Inventory and Analysis	7	1/8/2003	Inventory and Analysis Results	LCSMC/CDF	20
Goals and Objectives	8	2/5/2003	Goals & Objectives	LCSMC/CDF	23
	9	4/2/2003	Goals & Objectives	LCSMC/CDF	25
Action Plan	10	5/7/2003	Draft Action Plan	LCSMC/CDF	28
	11	6/4/2003	Draft Action Plan	LCSMC/CDF	30
	12	0702/03	Funding Resources	NRCS/LCSW/ CD/LCSMC	33
Draft Final Plan Presentation	13	8/13/2003	Final Draft Report	CDF	37
Plan Review	14	9/3/2003	Final Draft Report	LCSMC	N/A
	15	10/1/2003	Final Draft Report	LCSMC	N/A
	16	11/5/2003	Final Draft Report	LCSMC	N/A
	17	12/3/2003	Final Draft Report	LCSMC	N/A
	18	2/4/2004	Final Draft Report	LCSMC	N/A
	19	3/4/2004	Final Draft Report	LCSMC	N/A
Plan Upgrade	20	1/26/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	21	4/5/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	22	5/24/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	23	6/21/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	24	7/19/06	Watershed Planning / Plan Revisions	LCSMC	N/A
	25	9/20/06	Watershed Planning / Plan Revisions	LCSMC	N/A

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Kick-off Meeting
July 10, 2002 at the Lake Co. SMC Office

Meeting Attendees (based on sign-in sheet): Joe Rippel (Grant Twsp Zoning Com.), Gerry Stimpson (Wooster Lake), Pete Chartier (GTTA – Fisher Estates), Ken & Faith Calvert (Wooster Lake Conservation & Control Assoc.), Bob Napora (GTTA – Fischer Est.), Betty Napora (GTTA – Fischer Est.), Mary Colwell (Lake County Health Dept. Lakes Unit), Debbie Maurer (Lake County Forest Preserve Dist.), Kim Kiesgen (Grant Twp. Hwy.), Bonnie T. Carter (LCB #5), Richard Hartman (GTTA), Alyssa Vaughn (LCSWCD), M. Hechmann (GTTA/Fish Lake Property Owner), Marion Ambery (GTTA), Ward Miller (SMC), Tom Chefalo (LCPB&D), Ken Berwanger (Grant Twp Planning Com.), Helen Reed (Ingleside), Tom Price (CDF), Jason Obergfell (LCSMC), Sean Wiedel (LCSMC)

I. Welcome and Introductions – Jason Obergfell, P.E., SMC Watershed Engineer

A. Self-introductions

II. Opening Remarks – Bonnie Thomson Carter, District 5 County Board Member

A. Welcomed everyone and thanked them for their participation
B. Indicated that this is an important opportunity to plan for the future of the watershed

III. Background on Lake County SMC – Ward S. Miller, SMC Executive Director

A. History of SMC.
    1. Information provided meeting handout packet
B. SMC funding
    1. Owner of a $200,000 home pays about $3/year in property taxes for SMC services.
C. Watershed Development Ordinance
    1. Original intent was to have custom ordinances for each sub-watershed in the County
    2. Decision was made to have countywide standards established
    3. Specific provisions can still be appended to the countywide Watershed Development Ordinance (WDO)
    4. Question – What is penalty for not following WDO?
        a. If a certified community, it could be de-certified. A certified community is responsible for enforcing WDO.
        b. SMC attempts to work with communities before de-certification, because reviews and enforcement would come to SMC and reduce the amount of time SMC could dedicate to planning and watershed improvement projects.

D. Comprehensive Plan Update
   1. Comprehensive Plan is the document that defines SMC's roles and acts as our guidance document.
   2. Comp Plan is currently in an update process. The draft document is available for public comment.

E. Encourage your local government to participate in the planning process

IV. Watershed Planning – Sean Wiedel, SMC Watershed Planner

A. Purpose and Benefits
   1. Proactive
   2. Vision for improved management and restoration of watershed
   3. Shows connections between activities and impacts on watershed
   4. Brings stakeholders together

B. Components of Plan – information included in meeting handout packet
   1. Goals and Objectives
   2. Watershed Assessment
   3. "Toolbox" for addressing issues
   4. Action Plan

C. Lessons Learned from the North Branch of Chicago River project
   1. Use existing information as much as possible, realizing limits of existing data and explaining shortfalls
   2. Seek stakeholder input regularly

V. Brief Background on Fish Lake Drain Work To-Date – Tom Price, CDF

A. Delayed until later in the meeting

VI. Facilitated Workshop – Tom Price, Conservation Design Forum

A. Environmental Problems/Opportunities and Natural Resource Concerns listed

B. Preliminary Prioritization of Issues by attendees
   1. Each attendee was given 5 votes, each with varying point values from 5 (highest) to 1 (lowest) to assign to a listed problem/opportunity
   2. A summary of the list and prioritization results is provided in Table 1 (attached).

VII. Closing Comments - Jason Obergfell, SMC

A. Next Meeting: August 7, Location and Time T.B.D.*
   1. Mary Anne Hechmann volunteered her yard as a meeting location.
   2. SMC asked for additional suggestions, such as Village Halls and Township offices.

VIII. Brief Background on Work To-Date – Tom Price, CDF

A. More extensive background information will be presented at future mtgs.

B. Review of information from Geographic Information System (GIS)

C. Photo review of stream walk by CDF staff

D. Questions

Fish Lake Drain Watershed Meeting on 7-10-02 Meeting Notes

1. Are there restrictions on moving Threatened and Endangered species (to help populate another area)? Answer: Species typically occupy the environment that they can tolerate. If moved, they would probably either move or not survive.
2. Can a cattail marsh perform same nutrient uptake functions as a high quality wetland? Answer: A cattail marsh will probably perform nutrient uptake as well as a high quality wetland. If a high quality/ high diversity wetland is overloaded with nutrients, some of the species that are able to tolerate the lower quality water will probably begin to dominate the area and lower the biodiversity and/or quality.

IX. Adjourned at approximately 12 PM.

* Future meetings will be held on the first Wednesday of each month. The time and location are variable. Please check our website at: www.co.lake.il.us\smc and click on "Watershed Planning" or "Projects" for current information.

Issue	Total Voters	Total Points
A. Preventing additional flooding due to development	10	37
D. Water quality in Wooster Lake (ADID area)	8	31
R. Increased enforcement ability and improvement of enforcement procedures	8	24
C. Effect of changes to drainage network on lake water quality	6	17
B. Development effect on streambank erosion	5	17
F. Development respecting natural resources	5	17
Q. More compliant development	6	14
E. Increasing phosphorus levels causing increases in aquatic plant growth	4	12
I. Lack of interagency cooperation	4	10
V. Lack of education by residents on individual stormwater management opportunities	4	8
L. Maintain, create, and restore natural shorelines	2	8
N. Changing flow direction, including groundwater infiltration become surface water	3	6
H. Developments using township right-of-ways for drainage-responsibility for problems	2	6
F.F. Information on Illinois drainage law	2	6
G. Shoreline erosion	1	4
T. Potential development area at upstream part of watershed (affects downstream)	2	3
D.D. Education of general public on what to look for throughout watershed	1	3
U. Need to identify high-quality natural areas in watershed	2	2
J. Ridge issue adjacent to Wooster Lake (drainage divide change)	0	0
K. Maintenance and enhancement of Forest Preserve property (habitat, etc.)	0	0
M. Funding for lake restoration, specifically for smaller community groups	0	0
O. Additional water quality testing in water bodies	0	0
P. Debris accumulation in waterways	0	0
S. Road runoff effect on water quality	0	0
W. Establish additional guidelines for development (water quality)	0	0
X. Resource/contact list for watershed issues	0	0
Y. Impact of nursery operations on runoff	0	0
Z. Powerboat and jet ski traffic on lakes (water quality impacts)	0	0
A.A. Identify depressional areas	0	0
B.B. Runoff volume (lack of controls in WDO, UDO)	0	0
C.C. Lack of numerical water quality standards in countywide regulations (WDO, UDO)	0	0
E.E. Funding for implementation of Watershed Management Plan	0	0
G.G. Compensatory storage issues - review regulations	0	0

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
August 7, 2002 at the Volo Village Office

Meeting Attendees (based on sign-in sheet): Bill Brumbach (Grant Twp. Board), Burnell Russell (Village of Volo), Joe Rippel (Grant Twp. Zoning Com.), Ken Buchardt (Volo), Randy Crow (Fish Lake Beach), Delmar Marshall (Fish Lake Beach), Pete Manhard (Volo), Dan Owczarski (GTTA), Gerry Stimpson (Wooster Lake), Betty & Bob Napora (GTTA – Fischer Est.), Rich Stueber (Grant Twp. Trustee), Mary Colwell (Lake County Health Dept. Lakes Unit), Jennifer Filipiak (Lake County Forest Preserve Dist.), Kim Kiesgen (Grant Twp. Hwy.), Dave Misek (NRCS), Bonnie T. Carter (LCB #5), Richard Hartman (GTTA), Alyssa Vaughn (LCSWCD), M. Hechmann (GTTA/Fish Lake Property Owner), Tom Chefalo (LCPB&D), Helen Reed (Ingleside), Jason Obergfell (LCSMC), Sandra Kosek (CDF), Gordy Kiesgen (Grant Twp. Supervisor), Michael Russo (Duck Lake)

I. Welcome and Introductions – Jason Obergfell, P.E., SMC Watershed Engineer

A. Self Introductions
B. Thanks to Volo for hosting
C. Pamphlet on being a volunteer "river watcher" available at meeting. Volunteers sample water bodies to monitor water quality and aquatic health.

II. Lakes in the Watershed & Lake Issues – Mary Colwell, L.C. Health Dept.

A. Lake County Health Dept. – Lakes Mgmt. Unit has sampled Fish, Fischer, Wooster, and Duck Lakes.
B. Oldest sampling data in the watershed – 1995 for Wooster Lake.
C. Recently began assessing more than just water quality
    1. Aquatic plants
    2. Shoreline condition
    3. Wildlife
D. **Lake reports available on internet at:** http://www.co.lake.il.us/health/ehs/lakesrep.htm
E. Water Clarity
    1. Measurement is depth to still see Secchi disk.
    2. Clarity decreases with algal blooms and suspended sediment
F. TSS measured – Total Suspended Solids in water column
G. Phosphorus measured – contributes to nuisance algal blooms
    1. Value greater than 0.05 mg/L signifies a nutrient rich lake.
H. Trophic State Index – measurement of productivity in a lake.
    1. 102 Lake County lakes ranked on TSI.
        a. Wooster – 28, Fischer – 98

b. Sediment resuspension is a source of phosphorus. Resuspension and shoreline erosion appear to be big sources for Fischer Lake.

I. Aquatic Plants – number of species and coverage noted

J. Shoreline – type of shoreline protection and degree of erosion noted

1. Riprap & sheet pile good for protecting against erosion, but bad for wildlife habitat.
2. Mowing right up to water's edge contributes to erosion.
3. Discussed benefits of buffer zones around lakes.

K. Wildlife – recorded what they saw rather than full inventory.

1. Canadien geese fesces has high phosphorus content
2. Leopard frog #'s seem to be declining, don't know why.

L. Lake Issues

1. Poor water clarity
2. High nutrient levels
3. Shoreline erosion
4. Invasive species (non-native)
5. Algal growth
6. Poor wildlife habitat in most developed areas

M. Questions & Answers

- Q: Can we get a copy of the aquatic plant mapping?
- A:. The reports are available online, but the aquatic plants weren't formally mapped.
- Q: Are the nurseries a big source of the high phosphorus content in Fischer's Lake?
- A: Not necessarily. Lots of other sources. I can't quantify the amount from each source based on the data collected. In comparison though, Wooster Lake is deep and doesn't have as much of a problem with resuspension of sediment.
- Q: Is there a way to determine the sources?
- A: We can't point to a specific source, but sediment resuspension is likely a primary source.
- Comments: 1)Mr. Fischer owns strip of eroding shoreline that is contributing. 2) Fischers Lake excavated from a peaty bog in 70's. 3) In late 80's NIPC did a study of phosphorus levels in Fischer Lake and others. The phosphorus level at that time was the same as current levels.
- Q: Any fix for Fischer? What is depth?
- A: Depth is shallow – only 10 feet in deep parts. Watershed approach is the way to manage the lakes.
- Comment: I became a Duck Lake monitor in 1984 when the lawncare boom started, and I noticed more algae along the lawns with lawn treatments, etc.
- Comment: I'd like to see a ban on the use of phosphorus on established lawns.
- Comment: Less than 5 for the middle number on fertilizers is supposed to be OK, and Chem Lawn uses a fertilizer with a 2 for the middle #.

- Q: Wouldn't Loosestrife be good for a shoreline if it has a good root structure?
- A: It is a double-edged sword. It does have decent root structure, but it becomes a monoculture.
- Q: What is the effect of septic systems?
- A: If it is failing, it can have a big effect. If not failing, the phosphorus has a tendency to adsorb to the soil particles.
- Q: What about information on the channels?
- A: The Health Dept didn't study those.
- Q: Who controls the lake levels?
- A: Individuals or homeowner associations typically control them. In some instances, modifications may require IDNR involvement.
- Q: I keep track of wildlife on Fischer Lake. Should we send that information to you?
- A: You can send it to us, especially if it is special wildlife.

II. Village of Volo Work in Watershed – Mr. Burnell Russell, Volo

A. The President of Volo, Mr. Burnell Russell, discussed Volo's involvement in the watershed and floodplain studies. Copies of a letter from RHMG Engineers was available which described Volo's efforts.

1. Volo paid approximately $45,000 for cross section and hydraulic structure survey work in the watershed as part of an intergovernmental agreement with SMC.
2. Volo has stormwater discharge requirements that are more stringent than the WDO for parts of the watershed.
3. The cross section and structure survey is being used to prepare the floodplain study for the watershed.

III. Consultant Update – Ms. Sandra Kosek, Conservation Design Forum

A. CDF reviewed the stream inventory fieldwork that they have performed.

1. SMC originally performed a stream inventory.
2. CDF updated the inventory and subdivided reaches to help add detail to the inventory.
3. Inventory typically included data on the channel bottom, channel banks, erosion, and vegetative cover. A qualitative assessment of the aquatic life was noted, but a complete inventory was not compiled.
4. Buckthorn, an invasive shoreline shrub, exudes chemicals from the roots that prevent other plants from growing. Buckthorn does not have a good root structure for stabilizing banks. It is not fire tolerant, but we suppress fire.
5. Reviewed photos throughout stream inventory boundary.

B. Questions & Answers

- Q: Can we get ordinance limitations on fertilizer use?

- A: That is something that can be included in the Plan, and it would probably be implemented at the homeowners' association and village level rather than via a County ordinance.
- Comment: If we don't get the nurseries to limit their fertilizer use, then it is worthless.
- Comment: Not really worthless. A lot of factors on nutrient loading, and a reduction in use on lawns will help. It will take time, and sediment resuspension and other factors will affect the changes that occur within each water body.

IV. Closing Comments - Jason Obergfell, SMC

- Next Meeting: September 4th from 9 AM to 11 AM at the Grant Township Office

V. Adjourn

* Future meetings will be held on the first Wednesday of each month. The time and location are variable. Please check our website at: www.co.lake.il.us\smc and click on "Watershed Planning" or "Projects" for current information.

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
September 4th at Grant Township Office

Meeting Attendees (based on sign-in sheet): Bill Brumbach (Grant Twp. Board), Burnell Russell (Village of Volo), Joe Rippel (Grant Twp. Zoning Com.), Dan Owczarski (GTTA), Betty & Bob Napora (GTTA – Fischer Est.), Mary Colwell (Lake County Health Dept. Lakes Unit), Debbie Maurer (Lake County Forest Preserve Dist.), Kim Kiesgen (Grant Twp. Hwy.), Bonnie T. Carter (LCB #5), Tom Chefalo (LCPB&D), Jason Obergfell (LCSMC), Tom Price and Jerry Wilhelm (CDF), Gordy Kiesgen (Grant Twp. Supervisor), Bill Hart (Village of Fox Lake), Joseph Bogacz (Wauconda Twp.), Carol Bettis (Ingleside ILVM Prgm.), Rein Fischer (Fischer Bros. Constr.)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**
- A. Self Introductions
- B. Information on **2 grant programs** available at meeting.
  1. WMB grant program – administered by LCSMC
  2. Streambank Stabilization grant – contact LC Soil and Water Conservation

II. **Flora and Fauna – Gerould Wilhelm, Conservation Design Forum**
- A. Historically, rain mostly balanced by evaporation and infiltration
- B. Soils wash off and resources leave high ground and proceed to low ground
  1. Leads to imbalance of resources
     - a. Too little resources in higher ground
     - b. Too much in lower ground
- C. All **living things require stability**
  1. Runoff changes => flooding => instability
  2. Change habitat, change inhabitants
  3. Fish Lake Drain better than most watersheds in Illinois
     - a. Still problems
       - Water collects fertilizers from lawns
       - **More closely mowed lawns => more degraded root systems => less infiltration and less natural accommodation of nitrogen and phosphorus**
       - Many areas require curb and gutters which lead to quicker discharge
       - Nature used to constant temperatures for water
       - Rooftops and roads send hot water to a natural system => more weedy species, etc.

4. Must find a way to keep water where it falls and treat it as a resource and not a waste product
    a. Every **person with 1 acre of land is essentially the curator, or responsible for, 1 million gallons of water per year**. Usually we just add waste to it and send it to the neighbor.
    b. If amenities are degraded, the next generation will probably just leave the area.

D. Questions and Answers

1. Stakeholder (S): **How should these problems be dealt with**?
    a. G. Wilhelm (GW) **Rain gardens is one way**. Install a rain garden at each downspout.
    b. In Germany they charge for every cubic meter of water leaving a property.
    c. Some are making nicer looking parking lots with trees, plants, and natural processes.
    d. It requires a mind flip. Amenities become better with these efforts.
    e. Can't force all of these changes, but can make people feel guilty about not doing things a better way.
    f. Everyone has to know the problems and how to deal with them.
    g. Can change regulations about curbs, etc.
2. (S) What about apartments, condos, etc.?
    a. (GW) Still can be done if required
    b. (S) Middleton, WI has a requirement for rain gardens
3. Tom Price (TP) Probably will take time and we need to **think long-term**
    a. Took time to degrade, and it will take time to improve
    b. Methods and knowledge will become better over time
    c. (GW) Energy of trying to improve and thinking about our grandchildren will lead to more sustainability with many things.
4. (S) I have ground in floodplain that slopes to water. How do I do a rain garden?
    a. (GW) Do mostly excavation and build a small berm on downslope side.
5. Bonnie Thomson Carter (BC) – I see 2 issues:
    a. Need to view water as a resource
    b. Need to realize that in 20-30 years may have issues with drinking water shortages.
6. (S) What about issues of traffic related to dense development?
    a. (GW) The opposite leads to cars and roads being a necessity and mass transit becoming less feasible.
7. (S) My concept is that land has its limits and a "formula" exists for how many people can live in one place. What is your opinion on limits?
    a. (GW) That's a big issue in itself. I would say that the ability of an area to support itself with vegetables defines its population capacity. We typically subsidize food production now (ship food from other areas and apply lots of fertilizers to crops).
8. (BC) – I think we need to see where we are going too.
    a. Don't think Illinois is going to limit individuals from water or regulate population.
9. (S) Issues **negatively affecting ability to change** development methods:
    a. We have a lot of representatives from communities that are making decisions.
    b. Have developers threatening lawsuits
    c. Germany doesn't have same issues as USA. We allow people to do what they want with their land.
10. **Positives for ability to change** development methods:
    a. (GW) Informed individuals tend to make better decisions and people tend to try to do the right thing.
    b. (TP) A development moratorium in Lake Tahoe has held up in court because wanted

time to deal with development issues.

c. (GW) People may change if they start think about the "taking" from their grandchildren by current methods.

11. (S) You won't get anything accomplished unless it is required.
    a. (BC) Need personal ownership and individual support too.
    b. (JMO) Need to start with individuals willing to change and build support for bigger changes.
12. (GW) Need to deal with "First Principles" – those basic items of importance.
    a. (S) Lake County probably couldn't support too many people without some damage to resources.
    b. (GW) Have to determine what level of impacts are acceptable for grandchildren
    c. (GW) Even a razor blade looks chipped and bent if viewed closely with a microscope. We need to refine our vision for effects on our natural resources.
    d. (TP) We don't necessarily have all the answers today, but we can start to change how we see issues.
13. (BC) I see this as a great opportunity for GTTA and other groups to do something positive.
14. (S) I see it as a "First Principle" to have SMC require no runoff. Would SMC do that?
    a. (BC) I don't think that we have legal authority to do that.
    b. (JMO) Probably not enough public support for that level of regulation either.
    c. (TP) Can probably set limits on certain events, 2-year event for example.
15. (S) What about nurseries that apply lots of strong fertilizers?
    a. It is an agricultural practice that is protected.
    b. (S) Jerry, have you heard of this conflict before?
    c. (GW) I would say it is chronic through country.
16. (S) I think there is a **chasm between legal and ethical**. Too many groups are exempt.
17. (S) Are we coming to the conclusion that we need to start at the top?
    a. (JMO) I think that we need to work from both ends – the top: highest government to local government; and the bottom: individuals and small groups.

III. **Closing Comments - Jason Obergfell, SMC**

A. Next **Meeting: October 2nd from 9 AM to 11 AM at the Volo Village Office**

B. Please review draft mission statements and concerns from first meeting for discussion (in handout) at upcoming meeting.

C. Please consider opportunities for projects in your community – WMB grant

IV. **Adjourn**

* Future meetings will be held on the first Wednesday of each month. The time and location are variable. Please check our website at: www.co.lake.il.us\smc and click on "Watershed Planning" or "Projects" for current information.

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
October 2nd at Volo Village Office

Meeting Attendees (based on sign-in sheet): Ken & Faith Calvert (Wooster Lake Conservation and Control Assoc.), Gerry Stimpson (Eastshore Wooster Lake), Bill Brumbach (Grant Twp. Board), Burnell Russell (Village of Volo), Charles Schmidt (Village of Lakemoor), Joe Rippel (Grant Twp. Zoning Com.), Dan Owczarski (GTTA), Betty & Bob Napora (GTTA – Fischer Est.), Debbie Maurer (Lake County Forest Preserve Dist.), Bonnie T. Carter (LCB #5), Jason Obergfell (LCSMC), Tom Price (CDF), Joseph Bogacz (Wauconda Twp.), Carol Bettis (Ingleside ILVM Prgm.)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**
- A. **Information available at meeting**
  1. Pamphlets available with information on invasive plant species
  2. Rain garden brochures
  3. Article from Chicago Tribune on Prairie Crossing subdivision.
  4. Information on volunteer monitoring
- B. **Reminder on WMB grant program**
  1. WMB grant program – administered by LCSMC

II. **Alternative Development Practices – Tom Price, Conservation Design Forum**
- A. **Pre-Development Conditions**
  1. Uneven microtopography
  2. Organic layer at top
  3. Deep root systems
  4. Water generally held where it fell
     - a. Shallow ground infiltration
     - b. Wetlands often fed by groundwater rather than surface water
  5. Streams often had wide floodplains
     - a. Perennial, constant flow
     - b. Usually meandering, not necessarily for Fish Lk. Drain
- B. **Changing Landscape**
  1. Began draining land for farming
  2. Now more becoming urban
     - a. More surface runoff and less evapotranspiration
     - b. Accelerated runoff
  3. Streams became straighter and deeper
  4. Wetlands filled
  5. Flood problems produced
     - a. Response to flooding
       - Detention basins
         - (a) Still additional volume
         - (b) Often dirty water
         - (c) Prolonged discharge

6. EPA stream ratings – typically "fair" streams in Lake County
7. Biotic Integrity vs Population Density curve developed

C. **What can we do? Sustainable watershed and site planning principles:**
1. Protect and preserve streams, wetlands, and remnant landscapes
2. Preserve site hydrology
3. Manage water as a resource
4. Integrate people & the natural landscape

D. **Step 1 - Identification**
1. I.D. the areas of value
2. I.D. connections between these areas
3. I.D. where development can go

E. **Site Design**
1. Filter runoff
2. Utilize a systems approach
3. Identify critical areas on-site

F. **Ideas for Homes**
1. Roof runoff directed onto lawn rather than storm sewer
2. Rain barrels for collection and reuse of water
3. Native species planted around border of yard
4. Rain gardens
5. Permeable Paving
6. Infiltration trenches

G. **General Concepts for "Conservation Design"**
1. Evaluate needed width for streets
2. Use swales for roadside drainage
3. Utilize porous paving
4. Roof Gardens
5. Depressed filter strips in parking lots rather than islands
6. Plant native areas
7. Preserve and manage existing natural areas
   a. Coffee Creek development had extensive native growth without seeding just due to management of invasives.
8. Utilize wet bottom detention with natural sideslopes
   a. Recommend 10:1 slopes near water and 4:1 in uplands
9. Use a Systems Approach
   a. Lot Controls => Site Controls => Regional Controls

H. **Ideas for Getting More Concepts implemented**
1. Possibly tax incentives
2. Small grants for creation of rain gardens
3. Publicity for developers that utilize concepts
4. Modify local codes to make it easier to incorporate
5. Educate developers on the ability to sell this type of development
6. Educate public
7. Municipalities bring up concepts at initial stages of working with developers
8. *Potential Plan Action Item - maybe the County could do market research (countywide survey) and get feedback on popularity of these concepts => indicator of probable demand for these concepts and the conservation development product.*

III. **Closing Comments - Jason Obergfell, SMC**

A. **Next Meeting: November 6th from 9 AM to 11 AM at the Grant Township Office**

B. **Plan to go over filling out a Flood Problem Areas Worksheet at next meeting**

C. **Will discuss mission statement and Plan goals at next meeting**

IV. **Adjourn**

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Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
November 6th at Grant Township Office

Meeting Attendees (based on sign-in sheet): Faith Calvert (Wooster Lake Conservation and Control Assoc.), Gerry Stimpson (Eastshore Wooster Lake), Bill Brumbach (Grant Twp. Board), Dan Owczarski (GTTA), Debbie Maurer (Lake County Forest Preserve Dist.), Jason Obergfell (LCSMC), Tom Price (CDF), Kim Kiesgen (Grant Twp.), Richard Hartman (GTTA), Bill Hart (Village of Fox Lake), Ken Buchardt (Village of Volo)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**

II. **Flood Problem Areas Worksheet – Jason Obergfell**

A. **Purpose**

1. Countywide Inventory of Problem Areas
2. Lake County Flood Mitigation Plan
3. Fish Lake Drain Watershed Plan
   a. Project ideas developed for known flood problem areas
4. Site-specific planning done by SMC each year for high priority flood problem areas on our list
   a. SMC funds study effort
   b. Plan developed can be used to pursue grant funding – WMB, FEMA, IDNR
5. "Adequate downstream capacity" requirement of WDO
   a. Applies if <u>known</u> downstream flooding problems exist
   b. Helps prevent flooding problems from becoming worse due to upstream development
6. Helps with future floodplain study efforts
   a. Computer modeling can be calibrated to actual conditions
   b. Produces a better assessment of flood hazards

B. **Filling out the worksheet**

1. Does not have to be complete – fill out what you can
2. Work with your local municipality
3. Provide photos if possible
4. Include known high water reference marks
5. A written set of instructions will be developed to accompany worksheet

III. **Closing Comments - Jason Obergfell, SMC**

A. **Future meeting topics?**

1. Volo's stormwater requirements for certain parts of community
2. Wetlands issues, mitigation, ordinance provisions, etc.

IV. **Adjourn**

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
December 4th at Volo Village Office

Meeting Attendees (based on sign-in sheet): Bud Reed (Volo/Manhard), Bob Napora (GTTA), Gerry Stimpson (Eastshore Wooster Lake), Mary Colwell (LCHD), Dan Owczarski (GTTA), Jason Obergfell (LCSMC), Tom Price (CDF), Richard Hartman (GTTA), Burnell Russell (Village of Volo), John Ryan (Land and Water Resources), David Misek (USDA-NRCS), David Cassin (LCS&WCD), Joe Bogacz (Wauconda Twp. Resident), Bonnie Thomson Carter (LCB #5), Joe Hmieleski (LCSMC)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**
- A. Wetland informational booklets available at meeting
  - 1. "Living With Wetlands" booklet available on SMC website
  - 2. "Wetlands" booklet published by Brookfield Zoo
    - a. Two exhibits at Brookfield Zoo
      - The Swamp: Wonders of Our Wetlands
      - Salt Creek Wilderness, including Dragonfly Marsh

II. **Wetlands Issues – Joe Hmieleski, P.W.S., LCSMC**
- A. Introduction – Topics to be Discussed in Presentation
  - 1. Background on wetlands within Lake County
  - 2. Regulatory Issues
  - 3. Wetland Banking
  - 4. Functions of Wetlands
- B. Background on wetlands within Lake County
  - 1. Appearance
    - a. Can look like a marshy area
    - b. Can be a fringe around open water
    - c. Can be dry for the majority of the year
      - Only require water within 1 foot of ground surface for at least 2 weeks of the growing season
  - 2. Approximately 60,000 acres of Waters and wetlands in Lake County
  - 3. Lake County has twice as many Threatened and Endangered species as any other Illinois County, partially due to quantity of wetlands
- C. Regulatory Issues
  - 1. Jurisdiction
    - a. Corps of Engineers regulates all wetlands considered connected to "Waters of the U.S."
    - b. Lake County SMC regulates wetlands considered to be "Isolated" since 8/14/01.
      - Requirements included in the Countywide Watershed Development Ordinance (WDO)
  - 2. What is a Wetland Impact?
    - a. Corps – Primary a discharge of fill material into a wetland
    - b. SMC – Hydrologic disturbance or otherwise adversely affected by flooding, filling, excavation, or drainage.

3. Permit Categories
    a. SMC has 4 categories of impact that are regulated differently
        - I. < 1 acre & not a High Quality Aquatic Resource
        - II. >1 acre & <2 acres, & not a HQAR
        - III. > 2 acres or impacts a HQAR
        - IV. Restoration, creation, and enhancement of wetlands
    b. Corps has 2 primary categories of impact
        - Regional permits (activity specific, generally < 2 acres)
        - Individual permits (doesn't fit regional permit activity categories or involves a HQAR)
4. Consequences of Impact
    a. SMC (for "Isolated" wetlands)
        - I. Regular requirements – mitigation for impacts if >0.25 acres of wetland impacted. Mitigation required for all impacted acreage if >0.25 acres is impacted.
        - II. Must evaluate the possibility of avoidance and minimization of impacts and compare with mitigation
        - III. Must show that impacts have been avoided and minimized on the site before any mitigation can be considered.
        - IV. Only for restoration, creation, and enhancement
    b. Corps
        - Regional permits require mitigation if > 0.25 acres is impacted
        - Independent permit requires an alternatives analysis to show avoidance and minimization of impacts
5. Mitigation Requirements
    a. Mitigation is the creation of wetland area where one didn't exist for the purpose of replacing a wetland area that is impacted.
    b. The required mitigation area is larger than the area of the wetland impacted.
        - The ratio of mitigation area to impact area depends on the type of impact. See attached handout for details.
    c. SMC special requirements
        - Small on-site mitigation wetlands on a development site typically fail; therefore, SMC requires mitigation in a large wetland "bank" if the mitigation area required is less than 1.5 acres.
        - Mitigation can occur on-site for impacts less than 1 acre in size if the mitigated area will be part of a wetland that is greater than 1.5 acres in size.
        - If the wetland impact is greater than 1.5 acres in size, then on-site mitigation is preferred.

D. Wetland Functions
1. Store water
    a. Hold water naturally
    b. Release slowly into creeks and rivers
2. Act as "sinks" for some water borne constituents
    a. Sediment
    b. Nutrients
3. Provide habitat
    a. Food
    b. Water
    c. Shelter

4. Each function has its limits
    a. WDO specifically outlines water storage limitations
    b. WDO requires water quality treatment prior to stormwater discharge into wetlands
    c. WDO has a goal of "no net loss" of wetlands to maintain functions, including habitat
5. Stormwater Treatment Train
    a. See figure in handout
    b. Concept illustrated by Applied Ecological Services
    c. Illustrates that water borne constituents can be removed from the water column through a progression of water through swales & upland areas, wetlands, and lakes.
        - Buffers around wetlands are important
        - WDO requires buffer zones around wetlands, including wetland banks

III. **Questions and Answers**

A. What is the cost associated with mitigation?
1. That depends on how it is done and where
2. John Ryan (wetland bank owner)
    a. Probably a minimum of $60,000/acre of mitigation in Lake County
    b. Multiply the impact area by the required mitigation ratio and multiply that by the cost/acre of mitigation
3. Can create mitigation on site, but owner retains responsibility of meeting performance criteria
4. Wetland banking transfers the responsibility of performance to the wetland banker

B. Typically, a higher quality wetland is created in the wetland bank
1. High quantity of degraded wetlands with lower quality
2. Higher quality wetlands are less likely to be impacted due to higher degree of regulation on higher quality wetlands

C. What about the issue of moving wetlands from throughout the watershed to wetland bank locations?
1. Some of the functions of existing wetlands are maintained on-site, regardless of mitigation in a wetland bank
    a. Depressional stormwater storage is maintained on-site
    b. Water quality treatment is required on-site
2. SMC requires wetlands to be mitigated within their major watershed and in Lake County
    a. Four major watersheds are: Fox River, Des Plaines River, North Branch of Chicago River, and Lake Michigan
    b. Going outside watershed doubles the mitigation requirement
3. Not all wetlands will necessarily be impacted by development and moved to a wetland bank.
    a. Majority of existing wetland area will probably remain untouched after development.
    b. SMC has requirements for any developed condition discharges to a wetland
        - Water volume limitations
        - Water quality treatment requirements

D. Who are we to think that we can recreate what Mother Nature has done? I don't think that we should allow any of our existing wetlands to be impacted.

1. The origins and constitution of our country play a part in what can and can't be done.
   a. Private ownership is a factor
      - Can regulate uses, but can't fully prohibit use
      - "Takings" of complete use of a property without any compensation can be taken to court
      - If a "takings" is determined by the court, then either the restrictions would be lessened or the property purchased by the party restricting use (a municipality, for instance)
        (a) Value for purchase is based on appraisals.
      - Private ownership can be used to protect areas too
        (a) Individuals, municipalities, county agencies, etc. can protect areas by purchasing them
        (b) Lake County Forest Preserve District example
        (c) Tax benefits exist for purchasing land for the purpose of preserving natural areas

E. John Ryan comments

1. Wetlands are being kept in Lake County because of WDO. Mitigation wouldn't have necessarily have been required or kept in Lake County before the WDO requirements.
2. Buffers are required around wetland banks too.
   a. Typically 100 feet wide
   b. Start seeing diminishing benefits for additional buffer width beyond 100 feet wide.

IV. **Closing Comments - Jason Obergfell, SMC**

A. Next meeting on <u>second</u> Wednesday of month due to New Year's holiday

1. January 8, 2003 from 9-11 AM at the Grant Township Office
2. Will begin discussing Goals, Objectives, and Action Items at next meeting
3. Please review the draft mission statement before the next meeting

V. **Adjourn**

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
January 8th at Grant Township Office

Meeting Attendees (based on sign-in sheet): Bob Napora (Ingleside), Gerry Stimpson (Eastshore Wooster Lake), Mary Colwell (LCHD), Jason Obergfell (LCSMC), Tom Price (CDF), Richard Hartman (GTTA), David Misek (USDA-NRCS), David Cassin (LCS&WCD), Joe Bogacz (Wauconda Twp. Resident), Ken Buchardt (Village of Volo), Betty Napora (Ingleside), Debbie Maurer (LCFPD), Bill Brumbach (Grant Twp.), Kim Kiesgen (Grant Twp.), Tom Chefalo (LCPB&D)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**
   A. Self Introductions
   B. Information Available at Meeting
      1. C2000 Funding information
      2. EPA Section 319 Funding Information
      3. Articles on Fertilizers and Pesticides

II. **Watershed Inventory – Tom Price, P.E., CDF**
   A. Slide show presentation of the inventory
      1. Pre-settlement vegetation
      2. Future landuse
      3. Soils
      4. Erodible soils
      5. Annual pollutant loading estimates
         a. Has anyone contacted nurseries about fertilizers that they use? They have high level fertilizers.
            - Not that I'm aware of, but that can definitely be one of our actions to take.
            - NRCS can work with the nursery on conservation practices, but can't regulate their activities.
         b. Do we need to change the pollutant loading assumed for nurseries?
            - Right now nurseries are classified as agriculture in GIS and have agricultural loading values assumed in pollutant loading analysis.
         c. Were any samples taken for the input from the nursery?
            - Lake County Health Department didn't take any samples of the ditch input from the nursery.
            - Comment: Somebody has taken some.
            - CDF: If you are able to find sample data, please provide it.
      6. Stream erosion
      7. Substrate stability
         a. Is low substrate stability a big contributor to low water clarity?
            - Not necessarily. The muck soil sometimes provides benefits.
            - Deposited soil that has eroded might be good to remove. Artificial riffles are good for steeper parts of a stream that are eroding, where eroded material is being deposited downstream by the erosion.

8. Algae - based on visual appearance only
   a. Can algae be measured on the lake? Can samplers be installed?
      - CDF staff only evaluated algae based on visual appearance. Automatic samplers can be installed, but the cost can be relatively high.
9. Macroinvertebrate Quality
   a. Is area downstream of Fish Lake good or bad?
      - It has erosion but has high macroinvertebrate quality.
   b. Any study on vectors with the macroinvertebrate assessment?
      - No, but areas of habitat will have less mosquitoes than others
   c. Comment: A mosquito abatement guy presenting at our Township meeting said that the West Nile Virus mosquitoes come out of flood areas that drain down.
   d. What about mosquitoes from detention ponds?
      - Dry ponds are probably the worst for mosquitoes, and naturalized ponds are probably less of a problem.
10. Threatened and Endangered species locations
   a. Do you know what T&E species are present on Monohan Lake? (outside Fish Lake Drain watershed)
      - Often the agencies don't want to identify the species that are present or be specific about the exact location because people may attempt to remove the species for a variety of reasons.
11. Potential restoration sites
12. Significant Topographic Depression Areas
   a. Who maintains water levels in lakes?
      - Wooster Lake has some residents that want to put in extra stop logs because their connection to the lake is shallow.
      - IDNR regulates permanent water level changes
      - CDF can look at flood reduction potential from lake level adjustments
13. Draft greenway plan
   a. Have you performed a GAP analysis or are you familiar with it?
      - We have not performed a GAP analysis.
      - A GAP analysis looks at the native ecosystems and attempts to identify ecosystems that have not been preserved in the past (i.e. it attempts to identify gaps in the protection strategy.)
   b. What about upland areas? It appears that the greenway strategy is focused on wet areas.
      - The Lake County Forest Preserve District has done surveys on their own land, but most of the other upland areas do not have data available.
      - Significant upland areas could be added to the greenway plan. Most of the greenway zone for wet areas is already protected by regulation of those areas for floodplain and wetland issues.
   c. How long would it take to implement the greenway plan?
      - Essentially, it would probably be a continuing process for a long time.
      - The first step is to identify the areas that would be desirable to protect.
      - The next step would be to get the communities to agree to the intent of preserving the greenway. That would give developers a reference to work with before they even start to plan their development.

d. Stakeholders recommend contacting the mayors directly with information on the greenway plan.
   - Volo attendee said that the greenway concept is not completely foreign to their development concepts.
   - Schools and highways would be interested, because the way the land is developed would affect them.
   - We should list the benefits of a greenway plan
   - We should look at upland areas for potential inclusion in the greenway.

e. The Forest Preserve can sometimes front money to purchase land and get reimbursed.
   - Groups like CorpsLands may also be able to help
   - Stakeholders recommended talking to the state and federal representatives to see if they can help too.

III. **Discuss Draft Mission Statement - Jason Obergfell, SMC**

A. Draft mission statement has been provided in transmittals and agendas

B. If no comments are received by the next meeting, then we will assume that the mission statement is acceptable as shown.

IV. **Discuss Goals and Objective – All**

A. List of the Issues from the first meeting provided in the handout

B. An example of goals and objectives was provided in the handout

C. A table with the Fish Lake Drain issues and their relationship to potential goals was provided in a handout

D. Obergfell asked all to review the issues and sample goals before the next meeting to be prepared for discussion at the next meeting.

V. **Closing Comments - Jason Obergfell, SMC**

A. Next meeting

1. February 5, 2003 from 9-11 AM at the Volo Village Office
2. Will be discussing Goals, Objectives, and Action Items at next meeting

VI. **Adjourn**

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
February 5th at Volo Village Hall

Meeting Attendees (based on sign-in sheet): Bob Napora (Ingleside), Gerry Stimpson (Eastshore Wooster Lake), Jason Obergfell (LCSMC), Tom Price (CDF), Richard Hartman (GTTA), Ken Buchardt (Village of Volo), Betty Napora (Ingleside), Kim Kiesgen (Grant Twp.), Burnell Russell (Village of Volo), Bonnie T. Carter (L.C. Board #5), Dan Owczarski (Ingleside, GTTA)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**

II. **Discuss Goals and Objectives – All**

A. List of the Issues from the first meeting provided in the handout

B. An example of goals and objectives was provided in the handout

C. A table with the Fish Lake Drain issues and their relationship to potential goals was provided in a handout

1. Stakeholders commented that they now felt that funding and public education were much more important than they were ranked at the first meeting. They may be the highest priority items.
    a. Can funding be included in the mission statement?
2. Need to identify existing problems in the Plan.
3. Potential nutrient loading problems from nurseries
    a. Should contact the nurseries in the watershed to provide them with educational information about the effects of fertilizers on the downstream waterbodies.
    b. Should distribute information on land management measures and BMPs that can reduce the nutrient loading to water bodies.
    c. Opportunity for nurseries to voluntarily modify their operations based on better understanding of potential problems and ways to improve situation.

D. Need to watershed improvement projects that do occur. WMB grant projects are one example.

E. Tom Price with Conservation Design Forum displayed a shorter draft version of goals and objectives that he developed for the Fish Lake Drain watershed.

1. Stakeholders commented that they would like to review the draft version between meetings to be well-prepared to discuss these items at the next meeting.
2. Stakeholders commented that it was very important to have all of the stakeholders present at the next meeting to discuss the goals and objectives.
3. Action items should be cross-referenced to each of the goals and objectives that they address.

F. There should be a local Fish Lake Drain watershed stakeholder group that forms/continues beyond the current stakeholder group.
   1. Could be formatted similar to the North Branch of the Chicago River groups
      a. Friends of the Chicago River is a not-for-profit group
      b. The communities, not-for-profit, agencies, etc. are part of a larger stakeholder group for the watershed.
      c. Funding sources like to see the local commitment.
   2. Group discussed the importance of meeting with individual municipalities after completion of the Plan to improve use and implementation.

G. Obergfell asked all to review the issues and sample goals before the next meeting to be prepared for discussion at the next meeting.

III. **Closing Comments - Jason Obergfell, SMC**

A. Next meeting
   1. February 5, 2003 from 9-11 AM at the Volo Village Office
   2. Will be discussing Goals and Objectives at next meeting

IV. **Adjourn**

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
April 2, 2003 at Grant Township

Meeting Attendees (based on sign-in sheet): Bob Napora (Ingleside), Jason Obergfell (LCSMC), Tom Price (CDF), Richard Hartman (GTTA), Ken Buchardt (Village of Volo), Betty Napora (Ingleside), Kim Kiesgen (Grant Twp.), Burnell Russell (Village of Volo), Dennis Owczarski (Ingleside, GTTA), Mary Colwell (Lake Co. Health Dept.), Bill Brumbach (Grant Twp. Trustee), Bill Hart (Village of Fox Lake), Kay Starostovic (Grant Twp. Supervisor), David Misek (USDA-NRCS), David Cassin (LCSWCD), Bam Peterson (Village of Round Lake)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**

II. **Discuss Goals and Objectives – All**

A. List of the Issues from the first meeting provided in the handout and reviewed
   1. Relationship to potential goals was provided in a handout

B. A draft version of goals and objectives was provided in the handout
   1. Need to identify existing problems in the Plan.
      a. Add a goal between No. 2 and No. 3 in handout to address existing problems.
      b. Specifically identify existing flooding problems under this goal.

C. A set of possible supplements to the draft goals and objectives was provided in the handout
   1. Goal 4 of the draft goals and objectives did a good job of compiling several of the potential supplementary goals into one goal of "Provide tools to implement watershed protection and enhancement measures." (i.e.: implementation strategy)
      a. Addresses funding, coordination, education, continued development of supplementary documents for the Plan.

D. Formatting
   1. Can actions be shown under each objective that they apply to?
      a. Details only provided once, but a reference can be made under each applicable objective for a given action item.
   2. Should have outline-format and tabular format.

E. Need to inform people that the floodplain elevation is the controlling feature for identifying the floodplain location on their property.

F. Lake Water Quality issues (Mary Colwell's comments)
   1. Phosphorus in lakes doesn't leave. In agricultural fields the crop is harvested, taking the phosphorus with it.
   2. Phosphorus that settles to the bottom can be resuspended by the lake turning and by wind, fish, etc.
   3. Laundry detergents don't often have phosphates in them now. They did in the 1970s.
   4. In a terrestrial situation the phosphorus can be bound up and be existing in the soil but unusable, but it is different in aquatic systems.

G. Comments

1. Some of the watershed is flat and has little erosion from the land. A lot of the nutrients come from the property and shorelines around a lake.
2. Fischer Lake loading is probably coming from downstream of Fish Lake.
3. It is probably right that the agricultural area south of Fish Lake does not contribute much of the phosphorus loading in Fischer Lake.
4. Is the concern the runoff from lawns or the runoff of sediment?
   a. The runoff of water from lawns also contributes to phosphorus loading.
   b. It is true that nutrients bond to sediment, but runoff from lawns can also contribute nutrients.
5. The middle number on the fertilizers that they use on lawns in this area is low.
   a. That helps, but it also depends on the quantity that is being applied. A lot of excess fertilizer will not be used and will runoff instead.
6. I saw a study that showed more nutrients came off of the grazed pasture than a farm field for the sites monitored in the study.
7. The landuse of the watershed area will probably not be farm fields in the future anyway.
8. What about aeration in lakes?
9. Aeration comments by Mary Colwell:
   a. Fountains in lakes are ornamental and don't aerate.
   b. Aerators may be good, but not always
      - Timberlake benefited from turning off their aerators
        (a) Clarity improved
        (b) Oxygen levels were still OK in lake
   c. There are a lot of things to consider before adding an aerator to a lake.
10. How does a municipality use these tools (BMPs)?
    a. Performance criteria on volumes or release rates
    b. Usually treatment level for a practice is based on typical values rather than having the discharge tested
       - Obvious violations still checked
       - Construction is monitored and surveyed before acceptance
11. Can a shoreline vegetation figure be included in the Plan?
12. Can references to the WDO be included in the Plan where they are applicable?
13. Can we learn about the WDO and the different provisions that apply?
    a. Basically, the WDO provisions apply countywide, and only a few more stringent situations exist in the watershed.
       - Volo has a lower allowable release rate for part of the Village because a low rate of release exists in the current condition.
       - If a property is located in Unincorporated Lake County, then the Unified Development Ordinance applies. This ordinance combines the WDO with subdivision codes, etc. There are some watershed-related criteria, but they are indirectly beneficial. For instance, the UDO requires certain percentages of mature forests to be preserved on a site.
       - Should only need to list the few differences from the WDO. The entire WDO can be reviewed on the internet for free.

III. **Review Examples of Action Items**

A. Example action items were presented via the overhead projector.
B. Action items will be discussed at the next meeting
C. Please submit any suggestions for needed modifications to the goals and objectives before the next meeting
D. Please submit action items that you feel are specifically important to you before the next meeting. A draft will be compiled by SMC and Conservation Design Forum for discussion at the upcoming meeting.

IV. **Closing Comments - Jason Obergfell, SMC**

A. Next meeting
1. May 7, 2003 from 9-11 AM at the Volo Village Office
2. Will be discussing Action Items at next meeting

V. **Adjourn**

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
May 7, 2003 at Village of Volo Office

Meeting Attendees (based on sign-in sheet): Betty Napora (Ingleside), Jason Obergfell (LCSMC), Charles McGhee Hassrick (CDF), Chingwen Cheng (CDF), Ken Buchardt (Village of Volo), Kim Kiesgen (Grant Twp.), Richard Hartman (Ingleside, GTTA), David Misek (USDA-NRCS), David Cassin (LCSWCD), Bam Peterson (Village of Round Lake)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**

II. **Discuss Potential Action Items for Goal 1 – All**

A. Objective 1
1. Add "and collect data" to Objective 1 wording.
2. Add training to Volunteer monitoring action item?
   a. Not needed. Training is part of Volunteer Lakes Monitoring Program.
3. Add "expand" to the LCHD's monitoring action item.
4. Make "create and restore natural shorelines" 2 separate action items.
5. Add "evaluate and prioritize" to action item on implementing recommendations from LCHD lake mgmt reports.
6. Reword last action item to say: "Reduce the impacts of motorized boat traffic on lake quality"

B. Objective 2
1. Add "and monitor" to Objective 2 wording.
2. Add an action item for performing stream sampling

C. Objective 3
1. Reword the last part of Objective 3 to say "of existing and former wetlands in the watershed."
2. Remove the example part of last action item - (strategically remove farm tiles).
3. Add an action item – "Rate the quality and function of wetlands in the watershed"

D. Objective 4
1. Spell out the acronyms like BMPs (Best Management Practices)
2. Leave examples in or put them in the expanded description for each action item? General comments seemed to recommend putting the examples in a separate location that has an expanded description.
3. Add "Develop a management plan for existing stormwater infrastructure and identify the most logical management entities for infrastructure that is not being adequately maintained.
4. Add "Identify largest potential sources of water quality degradation and target those areas for sampling and further evaluation."

F. Objective 6
   1. Take the word "recreation" out of the first action item.
   2. Create a new action item that discusses identifying recreational opportunities within the Greenway Infrastructure corridor.

G. Objective 7
   1. Delete Objective 7 and move these actions to Objective Nos. 1 and 2.

III. **Discuss Watershed Management Plan Toolbox**

A. Two summary tables and 3 example "tool" fact sheets handed out
   1. The 3 example fact sheets were chosen for distribution because those tools may be useful to stakeholders prior to Plan completion.

B. One complete set of "tool" fact sheets available for review at the meeting

C. The toolbox and/or individual fact sheets will also include sources for additional information.
   1. websites
   2. reference books
   3. agencies

IV. **Closing Comments - Jason Obergfell, SMC**

A. Next meeting
   1. June 4, 2003 from 9-11 AM at the Grant Twp. Office
   2. Will continue discussing potential Action Items at next meeting

V. **Adjourn**

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
June 4, 2003 at the Grant Township Office

Meeting Attendees (based on sign-in sheet): Betty Napora (Ingleside), Bob Napora (Ingleside), Jason Obergfell (LCSMC), Tom Price (CDF), Ken Buchardt (Village of Volo), Kim Kiesgen (Grant Twp.), Richard Hartman (Ingleside, GTTA), Bob Kaplan (self), Judy Kaplan (self), Dennis Owczarski (GTTA), Bill Brumbach (Grant Twp.), Burnell Russell (Volo), M. Hechmann (GTTA)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**
   1.

II. **Consultant Update – Tom Price, P.E., CDF**
   A. Tasks that are basically complete
      1. Data Collection
      2. Toolbox
      3. Stream Assessment
      4. Goals and Objectives
   B. Tasks that are being worked on currently
      1. Draft Watershed Plan
      2. Action Items
   C. Future Tasks
      1. Finish draft of Watershed Plan by August meeting
   D. Implementation by stakeholders

III. **Next Meeting - All**
   A. CDF will not attend a meeting in July.
      1. Contract for CDF is for a specific budget and scope of work
         a. Contract only requires 12 meetings by CDF
      2. CDF will be working on draft Watershed Plan during July
   B. Do stakeholders want to meet in July for a specific topic?
      1. General response was "yes"
      2. Topic will be grant opportunities
         a. Will attempt to have Natural Resource Conservation Service staff and Lake County Soil and Water Conservation Service staff present the funding opportunities through their agencies.
         b. SMC will discuss the Watershed Management Board grant.
   C. Meeting will be held on July 2nd as normal schedule dictates
   D. August meeting will be held on August 13th due to schedule conflict for Tom Price on August 6th.

IV. **Discuss Potential Action Items for Goal No. 2 - All**

A. Objective 1

1. CDF has used the old floodplain mapping and aerial photography to identify potential flood damage locations.
2. Residents at Fischer Lake indicated that the Lakes Region Sanitary District has been interviewing residents about flooding. This would be a good source of additional information.
    a. Phil Smith at RHMG is the contact.

B. Objective 3

1. Should add "identify" to action item for removing debris blockages.
2.

V. **Discuss Potential Action Items for Goal No. 3 - All**

A. Objective 1

1. Add "and educational information" to the first action item, or make education an additional action item.
2. Add "Create and utilize a Green Infrastructure Plan to encourage other landuses in floodprone areas" as a potential action item.

B. Objective 2

1. Include other options (in addition to conservation easements) under the last potential action item.
2. Reference the Green Infrastructure Plan as a resource for guiding development to protect existing floodplain and depressional storage.

C. Objective 3

1. Local municipalities should evaluate additional regulatory standards, such as wider buffer requirements, for implementation at the local level.

D. Objective 4

1. Should clarify that potential runoff volume standards would be watershed specific and for Fish Lake Drain watershed.

E. Objective 5

1. Add "and consider enhancements to standards" to the stream and wetland buffer action item.
2. The more detailed description of the last action item should include methods of source control (e.g.: storm sewer stencil requirements in new subdivisions, no gravity discharge from detention basins during construction activities, enhanced requirements for temporary vegetation during construction, etc.)

F. Objective 6

1. For the first potential action item:
    a. Examples of strategies might include:
        - A required point system for landscaping and construction features (site must have a certain total, but developer is able to choose how to reach that total)
        - Density bonuses for desirable construction features

    b. Lake County's Unified Development Ordinance provides some examples
        - Obergfell to provide UDO examples at next meeting.

    c. Communities in DuPage County use a point system.

2. For the second action item, should list examples of how to provide guidance.
    a. Brochures
    b. Informational fliers
    c. Workshops

G. Objective 7
1. Certified Inspector program would be similar to Certified Wetland Specialist program.
    a. Better qualified people in field
    b. Person doing project would be responsible for supplying sufficient monitoring using a Certified Inspector.
    c. Certified Inspectors would be point of contact and could lose certification for not adequately enforcing on-site.
2. Need to list recommendations for improvements to enforcement procedures (e.g.: more staff time available).
3. Stricter standards action item will be difficult to pin down.
    a. Need a good definition for "high quality areas."
    b. Need good definition for "directly downstream."
4. Additional potential action item: Volunteer guidance for monitoring construction.
    a. Stakeholders would like guidance on what to look for on a construction site to determine if a violation may exist.
        - Check for orifice installation, blockage
        - Check silt fences
        - Etc.
    b. Stakeholders would like a contact list for reporting violations.
5. Additional potential action item: Evaluate fertilizer regulations
    a. Potential limits on Phosphorus content
    b. Able to dictate limitations for nurseries?

VI. **Goal 4**
A. Will discuss after presentation of draft Watershed Plan.
1. May be able to better comment on implementation with draft Plan in hand.

VII. **Closing Comments - Jason Obergfell, SMC**
A. Next meeting
1. July 2nd from 9-11 AM at the Volo Village Office
2. Will discussing potential funding options at next meeting
B. August meeting will be held on August 13th at Grant Twp.

VIII. **Adjourn**

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
July 2, 2003 at the Volo Village Office

Meeting Attendees (based on sign-in sheet): Betty Napora (Ingleside), Jason Obergfell (LCSMC), Ken Buchardt (Village of Volo), Kim Kiesgen (Grant Twp.), Richard Hartman (Ingleside, GTTA), Judy Kaplan (self), Dennis Owczarski (GTTA), Bill Brumbach (Grant Twp.), David Misek (USDA-NRCS), David Cassin (Lake Co. SWCD), Gerry Stimpson (Wooster Lake), Debbie Maurer (LCFPD)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**
- A. Handout information available at meeting
  1. Riparian Area Citizen's Guide
     a. SMC has plenty of copies available for distribution and use by your municipality or homeowner's association.
  2. Copy of Site Capacity Section in the Unified Development Ordinance
     a. Additional copies available upon request
     b. Entire document available online at: http://www.co.lake.il.us/planning/udo/udodocs.asp
  3. Grant Funding informational handouts
     a. Watershed Management Board grant application packet from 2002 (will be very similar for 2003)
     b. Grant Information Summary from the USDA-NRCS

II. **Funding Available through the NRCS – David Misek, NRCS**
- A. About the NRCS
  1. Part of the US Dept. of Agriculture
  2. Started in the Dust Bowl days w/ a focus on agriculture & soil erosion
  3. Now includes emphasis on natural resources (Natural Resources Conservation Service)
  4. Can provide free technical assistance
  5. Local partner is the Lake Co. Soil and Water Conservation Dist.
- B. Informational video played followed by Dave Misek
  1. 2002 Farm Bill is the source of funding
  2. Approximate 5 times as much funding in this Bill
     a. Funding for:
        - cost-share and technical assistance
        - wetland creations
        - buffer strips
        - vegetated drainage swales
        - other erosion reduction measures

3. More funding for conservation in 2002 Farm Bill
   a. Conservation Reserve Program - CRP
      - Property needs to be in agricultural use for 3 out of last 5 years.
      - 10 to 15 year contract length
      - In CRP, receive annual payment for land in addition to installation cost-share.
      - Improve and protect natural areas
      - Example: could have a buffer strip that surrounds agriculture. Buffer strip could be in place and stay in place if ag land gets developed in future.
   b. Environmental Quality Incentives Program – EquIP
      - For ag lands
      - Almost any conservation practice qualifies
      - Allows total payment up to $450,000 per individual
      - Can justify with any natural resource concern
      - Nurseries would qualify for funding
      - Up to 75% of practice installation paid
   c. Questions/Comments
      - Should hold a session for developers on NRCS and LCSWCD
      - Provide info on NRCS and LCSWCD programs at SE/SC meetings
      - Not a lot of privately owned farmland left in watershed
      - Need to create educational information on grant programs in a format that highlights how it would apply to potential applicants like developers, nurseries, etc.
      - Nutrient management plan could be developed for nurseries
      - Lawns possibly qualify for development of a nutrient management plan.
   d. Additional cost-share information
      - Labor can be counted as cost-share
      - Allow 90% cost-share for limited resource or starting farmers.
   e. Farmland Protection Program
      - Provides matching funds to organization w/ existing farmland protection programs to purchase conservation easements.
      - Could be permanent easements
      - Non-governmental Organizations (NGOs) are eligible and can hold easements
   f. Wetland Reserve Program
      - For farmland
      - Sites as small as 8 acres have participated
      - Annual participation limit is based on a maximum acreage total.
      - 90% of the enrollees in Illinois have permanent easements
   g. Wildlife Incentives Program
      - Available for any private land
      - Purpose is to improve habitat
   h. NRCS websites
      - State of Illinois - www.il.nrcs.usda.gov
      - Federal – www.nrcs.usda.gov
4. Some anticipated funding has already been cut due to economy

III. **Funding through the LCSWCD – David Cassin, LCSWCD**

A. About the Lake Co. Soil & Water Conservation District
1. Local Partner with NRCS
2. Share same office space in Grayslake
3. Can provide free technical assistance also

B. Grant Programs through the LCSWCD
1. Streambank Stabilization and Restoration Program (SSRP)
   a. Private land eligible
   b. Low cost vegetative and bioengineered techniques
   c. Up to 75% of cost funded to maximum of $25 per lineal foot
   d. Sweat equity can qualify as cost-share
   e. Fischer Lake may not qualify as "streambank"
   f. Rock riffles do qualify
2. Conservation Practices Program
   a. Assist landowners with erosion problems
3. Habitat Restoration Program
   a. Up to 75% of cost funded
   b. Improve water quality and provide public benefit
   c. Backyard prairies qualify
   d. A wetland buffer was funded last year for $5,390
4. Sustainable Agriculture Grant Program
   a. Mostly demonstration projects (e.g.: organic farming)

IV. **Funding through the LCSMC – Jason Obergfell, LCSMC**

A. Watershed Management Board Grant Program
1. Currently is funded using portion of SMC budget
   a. Approx. $130,000 per year countywide
2. Funding for watershed beneficial projects
3. Awarded 1 time per year.
   a. Application package usually available in mid-August
   b. Applications usually due in early October
4. Application should be sponsored by local official (e.g.: municipal official, County Board member, township official, drainage district)
5. Funds up to 50% of project cost
6. Labor can be counted toward required cost-share
7. Watershed Management Board makes funding decisions
   a. Local officials make up the Watershed Management Board
   b. SMC staff reviews applications and makes recommendations, but the WMB makes funding decisions.
8. WMB provides opportunity for watershed-beneficial decisions
   a. Ideally, WMB members could make annual contributions to the WMB grant fund for getting the best, watershed-beneficial projects implemented over time.
      - Should consider watershed "infrastructure" just like other municipal infrastructure (e.g.: roads, sewers, water, etc.)
      - WMB allows better decision-making through cooperation and focus on watershed improvement

b. One step down would be to have WMB members help sponsor local applications for funding.
c. A third option is for WMB members to provide staff time to help local stakeholders with their grant applications.

9. Dennis Owczarski provided personal experience
   a. Currently involved on a WMB project – Erosion study
   b. Worked with Grant Twp.
   c. Obtained a separate grant to cover the required cost-share
   d. Will need to obtain easements to do construction work and qualify construction activities for WMB funding in future.

V. **Next Meeting - All**

A. August meeting will be held on August 13th due to schedule conflict for Tom Price on August 6th.

VI. **Adjourn**

Meeting Notes for:
Fish Lake Drain Watershed Planning Committee
Planning Committee Meeting
August 13, 2003 at the Volo Village Office

Meeting Attendees (based on sign-in sheet): Jason Obergfell (LCSMC), Ken Buchardt (Village of Volo), Kim Kiesgen (Grant Twp.), Richard Hartman (Ingleside, GTTA), Judy Kaplan (self), Dennis Owczarski (GTTA), Bill Brumbach (Grant Twp), Debbie Maurer (LCFPD), Burnell Russell (Village of Volo), Tom Price (CDF), Patty Werner (SMC), Bob Kaplan (GTTA)

I. **Welcome and Introductions – Jason Obergfell, P.E., LCSMC**
- A. Handout information available at meeting
  - 1. "Introduction to Water Chemistry" and Volunteer Monitoring Information
    - a. Recent article in newspaper utilized volunteer monitoring data
    - b. Simple-method test kits exist for volunteer monitors
    - c. Lake County Health Dept. is always interested in volunteer data

II. **Draft Watershed Plan – Tom Price, CDF**
- A. Subdivided watershed into smaller sub-management units in the Plan
- B. Assessments and recommendations for sub-management units presented at the meeting
- C. Sub-Management Unit 1
  - 1. Description
    - a. Downstream of Wooster Lake.
  - 2. Assessment
    - a. Flooding at Duck Lake primarily due to backwater from Fox Lake.
    - b. Mostly built-out except for wetland and floodplain areas
    - c. Stream reaches qualitatively assessed for the following (low to high):
      - Substrate stability
      - Bank erosion
      - Algae
      - Macroinvertebrate Quality
    - d. Duck Lake nutrient levels lower than Fish and Fischer lakes.
  - 3. Recommendations
    - a. Non-structural measures to address flooding problems
    - b. Apply conservation easements to undeveloped natural areas
    - c. Source controls and lot level BMPs
    - d. Avoid improved drainage connection of Sub-unit 1B depressions.
    - e. Several stream corridor and Duck Lake recommendations listed.
- D. Sub-Management Unit 2
  - 1. Description
    - a. Nippersink Road to outlet for Wooster Lake.

2. Assessment
    a. Little remaining developable land
    b. Storm sewers to west and south of Wooster Lake discharge to and through ADID wetlands
    c. Wooster Lake has the highest lake water quality and T&E fish species in the watershed
3. Recommendations
    a. No direct discharges from new development into Wooster Lake.
    b. Develop alternatives for some of the existing storm sewer inputs to Wooster Lake.
    c. Vegetation management for stream corridor
    d. Implement Lake County Health Department recommendations for Wooster Lake.

E. Sub-Management Unit 3
1. Description
    a. Molidor Road to Nippersink Road
2. Assessment
    a. Sub-unit 3a has both existing and future development areas
    b. Sub-units 3b, 3c, and 3d have significant depressional storage areas
        - Sub-unit 3b will most likely develop rapidly
        - Sub-unit 3c open space to remain
        - Sub-unit 3d is planned for development
    c. Stream reaches assessed.
        - All reaches have moderate to high bank erosion
    d. Fischer Lake is a shallow, manmade lake with high nutrient and sediment levels
        - Nutrient and sediment sources are:
            (i) Fertilizers from surrounding agricultural and residential developments
            (ii) Bank erosion
            (iii) Internal recycling.
3. Recommendations
    a. Sub-unit 3A
        - Source controls and lot level BMPs
        - Agricultural BMPs
        - Address runoff from nursery
    b. Sub-unit 3B & 3D
        - Utilize conservation development practices
        - Develop runoff volume and discharge rate standards specific to depressional sub-basins.
    c. Sub-unit 3C
        - Rehabilitate and protect wetlands complex.
    d. Restore eroding lake shorelines and create riparian buffers w/ recreational access.
    e. Construct an energy dissipation structure and possibly replace the culvert between "upper" and "lower" Fischer Lake.

F. Sub-management Unit 4 – Fish Lake
1. Description
    a. Illinois Route 120 to Molidor Road
2. Assessment

a. Mostly undeveloped now, but future development pressure.
b. High quality wildlife habitat
c. Primarily needs preventative actions
d. Fish Lake is second highest quality lake in watershed
e. Stream reach assessment performed

3. Recommendations
a. Protect ADID wetlands
b. Source controls and BMPs for property surrounding lake.
c. Sub-units 4A & 4B – Implement agricultural BMPs
d. Sub-unit 4A – address runoff from nursery.
e. Implement preventative measures in developing areas.
f. Sub-unit 4C
- Modify drainage ditches through western ADID wetland.
- Replace regional drain tile from Rte. 120 w/ a naturalized wetland swale.

g. Sub-unit 4D
- Do not increase drainage of existing depressional area.
- Retrofit BMPs in existing development.

G. Sub-management Unit 5
1. Description
a. Gilmer Road to Route 120
2. Assessment
a. Mostly undeveloped
b. Hydric soils, wetlands, and drainage tiles present
c. Contains a lot of "green infrastructure"
d. Potential for significant increase in discharge to the watershed
e. Primarily preventive actions will be needed
3. Recommendations
a. Possible sub-unit runoff volume and rate standards – Volo already has some area-specific standards that apply.
b. Retrofit existing stormwater BMPs
c. Protect existing wetlands with conservation easements
d. Perform vegetation management for existing wetlands

H. Sub-management Unit 6
1. Description
a. South from Route 120 to the southern limit of the watershed on the west side of US-12/IL-59.
2. Assessment
a. Substantial hydric soils an drainage tiles present
b. Potential for wetlands restoration
c. Significant existing stormwater storage
d. Primarily preventative actions will be needed.
3. Recommendations

a. Sub-unit specific runoff volume and rate standards.
b. Implement agricultural BMPs
c. Implement conservation development measures if development occurs to limit runoff volume increases.
d. Protect existing wetlands and potentially restore wetlands.
e. Perform vegetation management

I. Plan Outline
1. Introduction
2. Watershed Inventory and Analysis
3. Watershed Management Tools and Strategies
4. Watershed Assessment and Recommendations
5. Prioritized Action Plan

III. **Questions and Answers**

A. Question 1
1. Q: Algae level for Fischer Lake was only shown as moderate. Why?
2. A: The level shown was only for the stream reaches in the Fischer Lake Sub-management Unit, not for Fischer Lake. The LCHD information was used for Fischer Lake. The stream ratings are the average ratings for the reach.

B. Question 2
1. Q: What about Reach 4C in the Fischer Lake sub-unit? It has a lot of algae now.
2. A: We did our work in July 2002, and "moderate" levels are what we saw at that time.

C. Question 3
1. Q: Can you include other vegetation management techniques than burning?
2. A: Burns are fairly simple and usually work well. They are usually a reasonable cost for larger areas. We will, however, add some other strategies to the list of options.

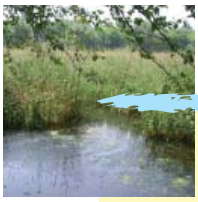
D. Question 4
1. Q: Will we get to comment on the Plan before it becomes final?
2. A: Tom Price - Yes. We need to clean it up and provide it to SMC for their review first. Then it will be able to be commented on by the stakeholders.
3. A: Jason Obergfell – We will make it available to the group for comments prior to finalizing it for official public comment. You will have a second opportunity to comment during the official 60-day public comment period.

E. Question 5
1. Q: What is the relationship between rain gardens and mosquito control?
2. A: The West Nile Virus type of mosquitoes are less frequently found in naturalized areas and are more often found in stagnant water areas without predators (e.g.: bird baths, gutters, standing water areas in mowed lawns, etc.). Also, many rain gardens are designed to drain down rather quickly.

IV. **Next Meeting - All**

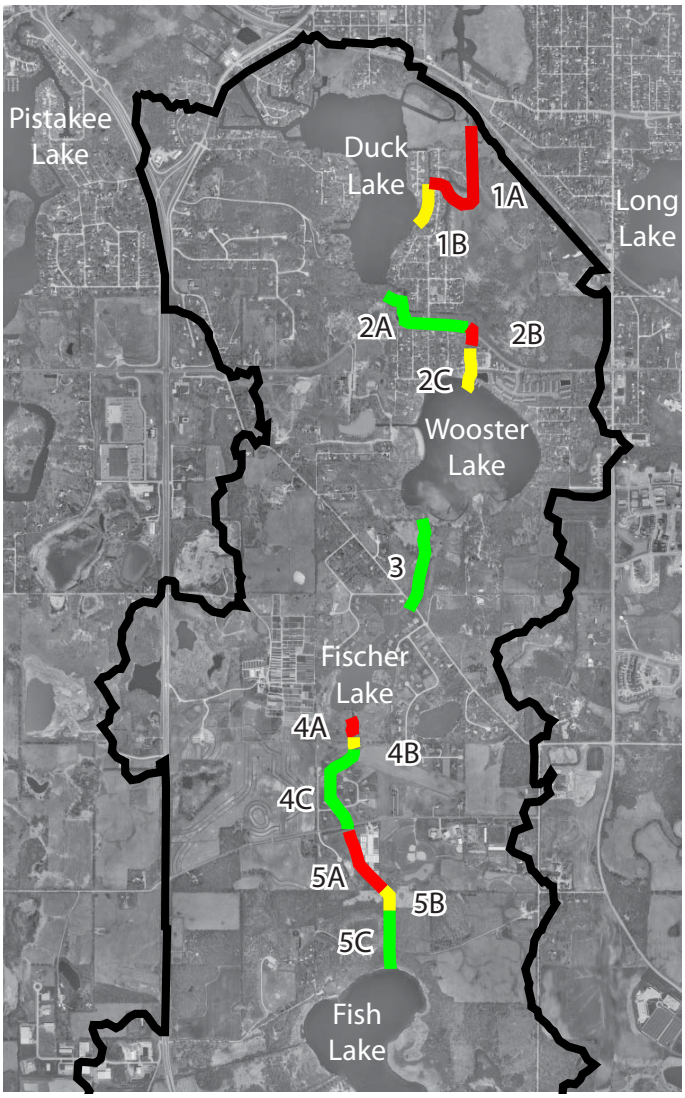
A. Tentatively plan for mid-September meeting.
1. Topics may include nursery operations and Volo's Comprehensive Plan

V. **Adjourn**



Appendix 2 - Stream Inventory Report

The stream inventory played an important role in understanding the watershed and evaluating potential causes of the issues identified by watershed stakeholders. The Drain between Fish Lake and the watershed outlet was divided into five reaches and several of those reaches were divided into sub-reaches. The reaches are divided by the lakes of the watershed. The sub-reaches were divided where significant changes in stream character occured. This appendix describes the findings of the stream inventory.



Stream Reach Map

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FIELD REPORT

DATE OF REPORT:	10 July 2002
DATE OF OBSERVATIONS:	25 June 2002, 1 July 2002
PROJECT NAME/#:	Fish Lake Drain (CDF #02018.00)
REPORT BY:	Sandra Kosek – CDF
TO:	Katherine Maurer, Tom Price, Chingwen Chen – CDF

REPORT

On Tuesday, June 25, Sandra Kosek, Chingwen Cheng, Tom Price, and Katherine Maurer of CDF visited the upstream reaches of Fish Lake Drain (Fish Lake to Fischer Lake), and part of the downstream reach (near Duck Lake). On Monday, July 1, Sandra Kosek and Tom Price visited the remaining stream reaches. The purpose of these field exercises was to perform a stream corridor inventory following the LCSMC procedures, verifying and updating a previous survey conducted by LCSMC. The entire Fish Lake Drain from its outlet at Fish Lake to the Metra railroad culvert was either waded or walked along the banks (in unwadable areas). Field notes were recorded and photographs were taken for each of the stream reaches. LCSMC Stream Inventory data sheets were filled out for each sub-reach section. Site observations and a summary by stream reach and sub-reach are discussed below.

Reach numbering begins with the downstream end of Fish Lake Drain at the Metra railroad culvert, and proceeds upstream. The major reach numbering corresponds to the LCSMC numbering used in the previous survey, although sub-reaches within these major reaches were identified by CDF staff on the basis of differences in geomorphological characteristics.

Reach 1: Duck Lake to Metra Railroad Culvert

This approximately 3,340 foot reach was divided into two sub-reaches: a 2,400 foot segment beginning at the confluence with a small tributary at its upstream end and ending at the Metra railroad culvert (Sub-reach 1A), and a 940 foot segment from the Duck Lake outlet to the tributary confluence (Sub-reach 1B).

Sub-reach 1A consisted of a straight, dredged channel through an area that was primarily wetland, with an average depth of about 3 feet and average width of about 70 feet. Velocity was too low to be observed. The substrate was 100% silt, with low to no substrate stability. Bank erosion severity was low, but observed throughout the reach. Two old beaver dams remained in place near the Metra railroad culvert.

Because of the water depth and soft bottom, this reach was observed from its western bank, which was a 20-30 foot wide strip of made land with an access trail. The wetland area consisted of cattails (*Typha* spp.) and reed canary grass (*Phalaris arundinacea*), while the dry bank was covered with typical invasive woody plants such as boxelder (*Acer negundo*), buckthorn (*Rhamnus cathartica*), and honeysuckle (*Lonicera* spp.) with a few hardwood, willow (*Salix* spp.), and cottonwood (*Populus deltoides*) trees. Wetland and forest comprised 95% of the vegetation within 100 feet of the stream, with the remaining 5% consisting of lawn grass associated with residential development at the upstream end of this reach. The width of the stream and the relatively short height of the riparian vegetation resulted in a canopy cover of no more than 5%. Land uses in this riparian corridor were 80% open space and 20% residential.

The still, sunny, pond-like conditions provide good conditions for the growth of aquatic plants, including water lilies (*Nymphaea* spp.), curly leaf pondweed (*Potamogeton crispus*), sago pondweed (*Potamogeton pectinatus*) and duckweed (*Lemna minor*). These plants provide some habitat cover for fish. Filamentous algae growth was high, and the greenish brown water color also indicated free-floating algal growth was most likely present. This was most noticeable at the upstream end of the reach. Macroinvertebrates were not sampled, although adult damselflies and an invasive eurasian pond snail (*Cipangopaludina japonica*) were observed. Bluegill sunfish (*Lepomis macrochirus*), turtles, and tadpoles (*Rana* spp.) were also seen in the water. All of these species are indicative of slow moving, warm, pondlike waters.

Sub-reach 1B was a straight, dredged channel through a lakeside residential subdivision. Water depth was about 5-6′, suitable for boat passage. Due to the unwadable water depth, substrate conditions were undetermined, but were probably 100% silt. The channel width was slightly narrower than Reach 1A at 60′. Velocity was too low to be observed. Bank armoring was high, with riprap, seawall, and railroad ties lining both banks. Because of the armoring, bank erosion was low. However, in this style of development there is essentially no floodplain; once rising water levels overtop the seawalls, this entire low-lying area is vulnerable to flooding.

The riparian corridor in this reach is 100% residential, with about 20% of the vegetation as trees and shrubs and the remaining 80% as lawn. In nearly all of the yards bordering the drain, lawns were maintained right up to the bank armoring. There was no riparian buffer zone containing vegetation suitable for runoff filtration, erosion protection, habitat, or floodplain development. Mature willows, box elder, silver maples, and various ornamental trees growing in the yards provided about 40% canopy shading.

The combination of water depth, shade, and boat traffic keeps this reach mostly clear of aquatic plants. The olive green color of the water indicates free-floating algae growth. A blue-green algae bloom was noted in a backwater area of the channel, indicating high nutrient concentrations. Although habitat conditions were poor, common carp (*Cyprinus carpio*), bullhead (*Ictalurus* spp.), and bluegill sunfish were observed, most likely coming in from the lake.

Reach 2: Wooster Lake to Duck Lake

Reach 2 was approximately 2,870 feet in length and was divided into three sub-reaches.

Sub-reach 2A, 1,950 feet in length, extended from the confluence with a small tributary just downstream of Rte. 134 downstream to Duck Lake. This channel was also a straight, dredged channel. Average water depth was 3-4′ and channel width was 40′. Velocity was not observable. The substrate was 100% silt with an average depth of 2′, resulting in overall low to no substrate stability.

Land use on one side of the channel consisted of residential development, and the other was primarily open space. The bank on the residential side had a high degree of armoring, while the other bank was not armored and was moderately eroded near Duck Lake. Riparian vegetation was primarily lawn on the residential side and a mix of trees and shrubs on the open space side. Trees present included box elder, silver maple, and occasional oak and hickory. This species mix suggests that some or all of this area may be an overgrown oak savanna remnant. Some floodplain development was apparent on the non-armored, open space side of the stream.

The deep, slow-moving water in this reach also resulted in pondlike conditions. Canopy cover varied from 5-50%. In the sunnier areas there was significant aquatic plant growth, including water lilies, curly leaf pondweed (*Potamogeton crispus*), duckweed (*Lemna minor*), Waterweed (*Elodea* spp.), and coontail (*Ceratophyllum demersum*). Bluegill sunfish and painted turtles (*Chrysemis picta*) were observed in the water.

Sub-reach 2B was a short reach approximately 290 feet in length, extending from the culvert at Rte. 134 to the confluence with a small tributary. Average depth was 1′ and average width was 30′, with no noticeable velocity. The substrate was 100% silt with low to no substrate stability. This was a very wide, very shallow mucky bottom depositional reach with little or no channel variability. Despite the predominance of silt, the water was remarkably clear. No bank erosion was observed.

The riparian corridor land use was 100% open space. This was a very low lying area, with banks as low as 6″, and most likely the floodplain is fairly wide. Bank vegetation consisted of 30% trees (mostly box elder), 10% shrubs, and 60% herbaceous plants. Canopy cover was about 80%.

The straight, shallow nature of this reach meant that there was very little fish or macroinvertebrate habitat available. A small amount of woody debris was present, providing some habitat for tricorythid mayflies, physid snails, sowbugs (isopoda), scuds (amphipoda), and leeches (hirudinea). These organisms are mostly tolerant of warm, low oxygen conditions, although the mayfly represents a relatively less tolerant group. Carp, green sunfish (*Lepomis cyanellus*), and many small minnows (probably creek chubs, *Semotilus atromaculatus*) were observed. These fish species are also tolerant of poor water quality and habitat conditions.

Sub-reach 2C, 630 feet in length, begins at the Wooster Lake outlet and flows downstream to Rte. 134. This reach had a much greater gradient than the downstream reaches, resulting in dramatically different character. Average depth was 8″ and average width was 15′, with a velocity of approximately 1.5 ft/s. The velocity keeps the gravel and sand substrate much more

free of silt than was true of the downstream reaches, with moderate to high substrate stability and low embeddedness present. Bank erosion was noted throughout the reach.

The riparian corridor was mostly forested, although about 50% of the reach consisted of residential land use and 25% commercial, with the remainder as open space. Corridor width was about 50′ even in the developed areas. Trees present were almost exclusively medium sized box elder, with a few mulberry trees. The dominance and uniformity of these pioneer species indicates that this area was cleared, most likely when the residences were constructed. Canopy cover was 90%.

The stream was shallow, but the gradient and velocity have combined to produce some recovery in stream morphology. Pool and riffle structure is beginning to develop in places along this reach, providing habitat for fish and macroinvertebrates. Hydropsychid caddisflies and simuliid blackfly larvae were numerous on the gravel substrate in the riffle zones, along with physid snails, sowbugs (isopoda), leeches (hirudinea), and flatworms (turbellaria). Caddisfly and blackfly larvae require flowing, oxygenated waters, and are intolerant of degraded conditions. Medium sized carp (14″) were also observed in the pools, along with many minnows.

Reach 3: Fischer Lake to Wooster Lake

This reach was approximately 1700 feet in length and was uniform enough that it was evaluated as one reach. Average depth was 1.5′ and average width was 12′, with a very low velocity of 0.2 ft/s. Sediment accumulations were high, and the substrate was 100% silt with low to moderate substrate stability. Two old, broken through beaver dams were found in this reach. Banks were essentially flat, with a wide, low floodplain covered primarily with reed canary grass (an invasive species). Bank erosion was noted along the entire length of the reach, but was most severe at the upstream end. This reach appears to have been dredged through a mostly flat wetland area.

Most of this reach is on Camp Henry Horner property. Land use in the riparian corridor is 95% open space, with a small amount of residential land use near the upstream end of the reach. Bank vegetation was almost entirely reed canary grass with a few scattered willow and box elder trees and an occasional cluster of arrowhead (*Sagittaria latifolia*). Elderberry shrubs (*Sambucus canadensis*) were also present. Sedges (*Carex* spp.) and wild iris (*Iris* sp.) suggestive of a remnant native wetland community were observed on the camp property near the inlet to Wooster Lake. Upland vegetation in this area included a few native wildflowers (*Rudbeckia* sp., *Lobelia* sp.) that also suggest this area may have good potential for restoration.

Instream conditions were fairly uniform, with woody debris and aquatic plants representing the majority of fish and macroinvertebrate habitat. Canopy cover was only 10%, and aquatic plant growth was profuse. Plants observed included Illinois pondweed (*Potamogeton illinoensis*), curly-leaf pondweed (*Potamogeton crispus*), coontail (*Ceratophyllum demersum*), and duckweed (*Lemna minor*). Midges (chironomidae) and physid snails were observed on the woody debris, along with adult dragonflies (aeschnidae). Minnows were observed in the aquatic plant beds.

Reach 4: Molidor Road to Fischer Lake

This reach was approximately 2,660 feet in length and was divided into three sub-reaches.

The upstream reach boundary of Sub-reach 4A was 600 feet upstream of Fischer Lake, extending downstream to the lake. This reach was flatter and wider than Reach 4B immediately upstream. The average width was 45′ and the average depth was 1′. Velocity was 0.1 ft/s. Banks were 4-6′ high, with some erosion noted along the entire reach. This was a straight, dredged channel with 100% silt substrate over a clay hardpan.

Riparian land use was 100% open space, with a vegetated corridor at least 100′ wide. The banks were 80% vegetated, with mostly shrubs and herbaceous plants. Canopy cover was only about 5%, with a few willow and box elder trees. Herbaceous plants on the associated mudflats included water plantain (*Alisma subcordatum*), spike rush (*Eleocharis erythropoda*), arrowhead (*Saggitaria latifolia*), and bulrushes (*Scirpus* spp.). Reed canary grass was also present, although not in as much abundance as in other low-lying reaches. Aquatic plants were also abundant, including curly leaf and sago pondweeds, duckweed, and coontail. A moderate amount of filamentous algae was seen growing on the other aquatic plants.

The straight, uniform channel did not provide much habitat except for aquatic plants. Physid and pleurocerid snails were highly abundant. Whirligig beetles (gyrinidae) and flatworms were also observed. There was little hard substrate for aquatic macroinvertebrate habitat, although the aquatic vegetation provides some habitat for both invertebrates and fish.

Sub-reach 4B extended 260 feet from the culvert at the downstream end of the subdivision, downstream to the upper boundary of Reach 4A. This reach had more gradient than Reach 4A. The average width was 10′, average depth was 10″, and the velocity was 0.5 ft/s. This reach had some pool and run development, although no areas were shallow enough to be considered riffles. Some recovery from dredged conditions was apparent, with a low degree of sinuosity. Banks were still high, 4-10′, with a high degree of bank erosion, especially on the east bank. The stream debris load was rated ‘pass’, but there were a few substantial log jams in the channel. The substrate was 100% silt over a clay hardpan, which provided a moderate degree of substrate stability.

The riparian corridor within 100′ of the stream was 100% open space. Vegetation was a mix of forest (20%), wetland (30%), and shrub/weeds (40%), with the remaining 10% in grass. Willows, box elder, and buckthorn were the dominant woody vegetation. The invasive plant species reed canary grass and purple loosestrife (*Lythrum salicaria*) were also present, along with common reed (*Phragmites australis*) and sandbar willow (*Salix interior*). There were no significant aquatic plants observed.

Woody debris, log jams, and associated pools represented most of the available fish and macroinvertebrate habitat. Macroinvertebrates collected from the woody debris included limnephilid caddisflies, pleurocerid snails, midges (chironomidae), flatworms, and freshwater sponge. The caddisflies and sponge are somewhat intolerant organisms that require good oxygenation, probably provided by the waterfall associated with the culvert at the upper reach boundary. This culvert is several feet above the level of the stream at this point, and provides an overflow for what appears to be a large earthen dam at the downstream end of the nearby subdivision. Large concrete blocks serve as riprap as the water cascades down to the stream. This area appears to receive scouring flows, and while the culvert does not appear to be undermined at this time, it should be monitored in the future.

Sub-reach 4C consisted of the 1,800 foot long impounded area from Molidor Road to the dam and culvert. This section was unwadable, with an average depth of at least 5′. The reach was an average of about 100′ wide, with a predominantly silt substrate of probably low to no substrate stability. Some erosion was noted along the banks of the entire reach, although the banks were only about 6″ high.

Land use in this reach was 70% residential, with lawns down to the edge of the water. Yards were fairly large and sloping, with homes set back and several feet higher than the water level. A few willows and box elder were present, with the remaining vegetation primarily lawn grass or ornamental plantings. At the very edge of the water/lawn interface, a few native wetland plants were identified, including brown fox sedge (*Carex vulpinoides*), spike rush (*Eleocharis erythropoda*), Dudley's rush (*Juncus dudleyi*) and dark green rush (*Scirpus atrovirens*). An undeveloped open grassy area in the riparian zone contained sawtooth sunflower (*Helianthus grosseserratus*). Aquatic plants in the impounded area appeared to be similar to those in other reaches, including water lilies, pondweeds, coontail, and low to moderate amounts of filamentous algae. Macroinvertebrates were not sampled in this sub-reach, although adult damselflies were observed.

Reach 5: Fish Lake to Molidor Road

Reach 5 was approximately 2,690 feet in length and was divided into three sub-reaches.

Sub-reach 5A was 1,200 feet in length and extended from a tree line just upstream (215′) of the plant nursery property downstream to Molidor Road. The average depth of the stream was 1.5′ and the average width was 10′. Velocity was about 0.5 ft/s. Sediment accumulations were moderate, with a substrate of 60% silt, 20% sand, and 20% gravel. Most of the sand and gravel areas were in the lower half of the reach, with the upstream parts being mostly silt. Substrate stability was moderate in the downstream section of the reach, and decreased to low in the upstream section.

Most of this sub-reach consisted of a straight, dredged channel with agricultural cropland and wetland on one side and a commercial plant nursery on the other, with a narrow, 0-10′ riparian corridor. Riparian land uses were varied in this reach, with 40% open space, 20% agriculture, and 40% commercial (the nursery). Vegetation in the riparian corridor consisted of 40% shrub/weeds, 40% wetland, 10% lawn/grass, and 10% crops. Most of the wetland vegetation consisted of reed canary grass, although this sub-reach is included in the Fish Lake ADID wetland complex. Banks were about 4′ high, covered with 45% grass (mostly reed canary grass), 20% barren soil, 15% wetland, 10% shrub, and 5% each trees and lawn. Bank erosion in this reach was low. On the east bank, the nursery has recently cleared the bank vegetation and planted a mix of ornamental and native plants. There were several drainage outfalls from the nursery into the stream.

Most of the available habitat in this reach was aquatic plants, with some larger gravel near the Molidor Road culvert. Aquatic plants observed included curly leaf pondweed, waterweed, duckweed, and coontail. A moderate to high amount of filamentous algae was growing on the plants. Macroinvertebrates present included calopterygid damselflies, physid snails, whirligig beetles (gyrinidae), diving beetles (dytiscidae), flatworms, and leeches. Numerous green frogs (*Rana clamitans*) were also noted, including an egg mass and tadpoles. One or two adult frogs were seen for about every ten feet of stream throughout the reach.

Sub-reach 5B extended another 475′ upstream of the upper Sub-reach 5A boundary. This reach had substantially more canopy cover (80% instead of only 5%), very few aquatic plants, and was wider than the downstream reach. The average width was 10′ (ranging from 5′-20′ instead of being uniform) and the average depth was 1.5′. Velocity was 0.1 ft/s. Substrate was 100% silt, but sediment accumulation, while high, was not as great as the downstream reach. Substrate stability was low. Turbidity was moderate, with a brown color to the water. Bank erosion was moderate, with about 40% barren banks and the remainder mostly trees or herbaceous plants.

The riparian corridor was 100% open space, although part of this area appeared to be past nursery plantings. The vegetative buffer was 100′ wide. The channel was dredged though part of a wetland, with large areas of reed canary grass, along with some forest. This area, near the downstream section of this reach, probably provides some floodplain storage during high water events. Tree species present included willows, box elder, buckthorn, and cottonwood. Herbaceous plants included orange jewelweed (*Impatiens capensis*), bur marigold (*Bidens polylepis*), and tall nettle (*Urtica procera*). Because of the shade, there were no aquatic plants growing in this reach.

Habitat for fish and macroinvertebrates was limited, consisting primarily of woody debris. Tricorythid mayflies, physid snails, bryozoa, and flatworms were collected on the debris. Water striders (mesoveliidae) and diving beetles (dytiscidae) were also seen. While mayflies are intolerant of poor conditions, overall this was a very tolerant macroinvertebrate community. A few green frogs were also observed in this reach, although fewer in number than in the downstream Sub-reach 5A.

Sub-reach 5C was about 1,015 feet in length. This reach extended from the upstream boundary of Sub-reach 5B to the Fish Lake outlet. This sub-reach had the steepest gradient in Reach 5. The average width of the stream was 7′ and the average depth was 9″. Velocity was about 1.5 ft/s. Because of the gradient and velocity, some degree of pool-riffle development (mostly riffle) and a low degree of sinuosity has developed in this reach. The substrate in this reach consisted of 50% gravel, 20% clay pan, 15% silt, 10% sand, and 5% cobble with high substrate stability. Banks were about 6′ high and bank erosion was moderate. A small, 6″ high concrete sill dam was observed about 250′ downstream of Fish Lake, impounding this short section of the reach. This area was more silty and lower gradient than the other sections.

The riparian corridor land use was 100% open space, although about 40% could be considered fallow agricultural fields. The width of the vegetated buffer was 60-100′. Nearly 100% of this was forested. Woody plants present were primarily pioneer invasive species such as box elder, buckthorn, and honeysuckle. Canopy cover was 75%, and due to the shade and the velocity, no aquatic plants were present.

This stream reach was predominantly riffle, which provided little habitat for fish. Macroinvertebrate habitats sampled included cobble and woody debris. Macroinvertebrates present included hydropsychid cadisflies, simuliid blackfly larvae, physid snails, sowbugs (isopoda), leeches, and whirligig beetles (gyrinidae). These caddisfly and blackfly larvae require flowing, oxygenated water and are relatively intolerant of poor conditions.

Summary

Fish Lake Drain at the time of this survey was flowing at a rate of about 7.5-15 cfs. This small stream is not a natural channel but was dredged to create the lake drainage. As a result, it is difficult to evaluate because good to excellent instream conditions are generally not expected from a dredged channel. However, there are clear variations in the degree of siltation, bank erosion, floodplain development, and aquatic habitat in different reaches of the stream.

Siltation was moderate to high throughout the drain. The only exceptions were reaches with high enough gradient that the silt was transported farther downstream before settling. The source of the silt is most likely bank erosion. Heavy silt loads can come from agricultural areas or developed areas where sediment producing construction practices have been used without methods for preventing transport to the stream. However, most of the Fish Lake Drain riparian corridor, which is still significantly wide (over 100′ in places) consists of vegetated open space and very little agriculture or development. The widespread bank erosion is therefore the most likely source of the silt, especially given the clay pan and clay soils noted in some areas.

Bank erosion is caused by severe flow fluctuations in stream levels, especially during large storm events which cause scouring of the unprotected banks. This scouring not only erodes banks, it also undermines trees and culverts and washes away aquatic organisms. It will tend to be worse where there is more gradient, which also increases the velocity of the water. It will also vary depending on the stability and depth of the roots of the bank vegetation. While much of the riparian corridor is wooded, most of the area of the actual stream banks was covered with less stable vegetation such as reed canary grass and other herbaceous plants with relatively shallow root systems. Bank stabilization and flow moderation would help reduce the degree of erosion and also mitigate the degree of sedimentation in the drain. Bank armoring, while effective at controlling erosion, is less desirable as stream habitat. It also requires some ongoing maintenance, and if the entire stream is not armored, it may cause the erosion problem to be displaced to the site where the armoring stops.

Another factor affecting stream flow fluctuation for this type of lake drainage typically would be the management of lake levels. These lakes do not appear to be under active level control at this time. There is a small level control structure, apparently abandoned, just downstream of Fish Lake, and a weir is maintained at Wooster Lake. Level control is probably provided to a limited extent by the culverts at Fischer and Duck Lakes. As the watershed develops and more storm water is redirected to the lakes and streams from additional impervious surfaces, there may be public pressure to build and operate lake level control structures. The tendency to operate such structures in a way that increases high flows by releasing even more water when flows are high would increase the flow fluctuation problem in the drain.

Most of the areas available as floodplain in the drain are low-lying wetland areas that were probably drained in the process of dredging. Nearly all of these areas are now dominated by reed canary grass, although a few places had some associated cattail marsh. The hydrology of these areas has been severely disturbed, but their function as flood storage areas should be maintained if further development occurs. Some of these areas might be suitable for restoration to more stable and diverse vegetative communities.

In-stream habitat for aquatic life was minimal throughout the drain. Excessive siltation, uniform channel structure, and lack of canopy shading or riffle development combined to severely limit the number and type of organisms present. In the few places where gradient kept the substrate

relatively free of silt, the presence of degradation-intolerant caddisflies, blackflies, and mayflies suggest that the water quality of the stream is good enough to support aquatic life use, and that the stream is primarily habitat limited. Since this is a created channel, even if the siltation is reduced or eliminated, it is uncertain whether the substrate will be suitable for high quality fish and macroinvertebrate habitat. However, under improved conditions, it is likely that a greater diversity of both fish and macroinvertebrates could be achieved than exists at present. There may also be opportunities, given the width of the riparian corridor, to create some more natural stream meanders which would contribute to a variation in stream channel morphology and provide additional habitat for fish and macroinvertebrates.

Fish Lake Drain Inventory Report Form

LAKE CO ID (FL): FL01A
DATE: 7/1/2002

PRIMARY WATERSHED: Fish L. Drain
STREAM REACH NAME: Fish Lake Drain
STREAM REACH #: 1

REACH BOUNDARIES UPSTREAM: confluence with Forest Ave.
REACH BOUNDARIES DOWNSTREAM: Metra railroad culvert

UPSTREAM GPS#
DOWNSTREAM GPS#

LENGTH (ft): 2400
TEMP. (F): 90
TIME: 1:00:00 AM
INVESTIG.: TP/SK
STREAM STAGE: None
RECENT RAIN: N/A
RAIN (in):

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☐ No Recov.: ☑ Pilot Channel: ☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY: 0
BASEFLOW SINUOSITY: 0
POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 3
Types/Locations of High Cases: Severity low but all of banks eroded
DEGREE OF ARMORING: 0
Types/Locations of High Cases:

SEDIMENT ACCUMULATIONS: 3

MEAN BANK HT (ft): 1
BANK HT RANGE: from: 6" to: 2'
MEAN BANK SLOPE: 2:1
BANK SLOPE RANGE: from: to:
MEAN WATER DEPTH (ft): 3'
WATER DEPTH RANGE: from: 2 to: 5
TOP MEAN CHAN. WIDTH (ft): 70'
TOP CHANNEL WIDTH RANGE: from 60 to: 90
BOTTOM MEAN CHAN. WIDTH (ft): 70'
BOT. CHAN. WIDTH RANGE: from 60 to: 90
MEAN VELOCITY (ft/s): 0
VELOCITY RANGE: from: 0 to: 0

PREDOMINANT BANK VEG. %
None: 0 Grass: 10 Lawn: 5 Wetland: 50
Trees: 30 Shrub: 15 Rowcrop: 0

PREDOMINANT TREE/SHRUB
Willows ☑ Box Elder ☑ Honeysuckle ☑ Buckthorn ☑ Hardwoods ☑ Other: Cottonwood

CANOPY (% shaded cov. of channel): 5
BEAVER ACTIVITY: ☑
OF DAMS: 2

INSTREAM DEBRIS LOAD: Pass
OVERBANK DEBRIS LOAD: Pass

COMMENTS: Imponded by beavers

IMPOUNDED: ☑
MID-STREAM BARS _ISLANDS: ☑

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

B. HYDRAULIC STRUCTURES:

LAKE CO ID: FL01A
TYPE:
SIZE (ft): W: 0 H: 0 L: 0
MATERIAL: Steel
HSNO: 1
LOCATION/GPS#
NOTES:

B. HYDRAULIC STRUCTURES:

LAKE CO ID: FL01A
TYPE:
SIZE (ft): W: 0 H: 0 L: 0
MATERIAL: Concrete
HSNO: 2
LOCATION/GPS#
NOTES:

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	80
Recreational:	0	Commercial Industrial:	0
Residential:	20	Other	0
Other Description:			

VEGETATION %

Forest:	15	Lawn/Grass:	5	Wetlands:	80
Crops:	0	Shrub/Weeds:	0	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: more than 50 ft avg wooded or cattails

COMMENTS (Riparian Corridor/Floodplain): rVery small stretch near Forest Ave. with narrow vegetated buffer - lawns to edge

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	0	Sand:	0	Cobble:	0	Silt:	100
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Low

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: N/A

FILAMENTOUS ALGAE: High

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Moderate

WATER COLOR: Brown

COMMENTS: More green near Duck Lake - alage

F. INSTREAM COVER FOR FISH

Undercut Banks: ☐	Pools Over 28" Deep: ☑	Macrophytes: ☑	Logs: ☑
Overhanging Veg: ☑	Rootwads: ☐	Boulders: ☐	Backwaters: ☑

COMMENTS (Instream Cover for Fish): Pond-like cover -- mostly vegetation & debris

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: N/A

GEAR/METHODS USED FOR: Invertebrates: ____ Fish: ____

EFFORTS USED FOR: Invertebrates: ____ Fish: ____

INVERTEBRATES:

Mayflies: ☐	Caddisflies: ☐	Dragonfly/Damselfly Nymphs: ☑	Snail ☑	Isopods: ☐	Sowbugs: ☐	Leeches: ☐	Worms: ☐
Water Pennies: ☐	Beetles: ☐	Other:	Very pond like entire reach - probably pond type macroinverts				

FISH:

Carp: ☐	Black Bullheads: ☐	Creek Chubs: ☐	Green Sunfish: ☐	Bluegill: ☑	Largemouth Bass: ☐
Johnny Darters: ☐	Fathead Minnows: ☐	Golden Shiners: ☐	Other:	Turtles & tad poles	

BIRDS:

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	80
Recreational:	0	Commercial Industrial:	0
Residential:	20	Other	0
Other Description:			

VEGETATION %

Forest:	15	Lawn/Grass:	5	Wetlands:	80
Crops:	0	Shrub/Weeds:	0	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: more than 50 ft avg wooded or cattails

COMMENTS (Riparian Corridor/Floodplain): rVery small stretch near Forest Ave. with narrow vegetated buffer - lawns to edge

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	0	Sand:	0	Cobble:	0	Silt	100
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Low

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: N/A

FILAMENTOUS ALGAE: High

GREASE/OIL IN WATER COLUMN: ☐ **GREASE/OIL IN SEDIMENT:** ☐

TURBIDITY: Moderate

WATER COLOR: Brown **COMMENTS:** More green near Duck Lake - alage

F. INSTREAM COVER FOR FISH

Undercut Banks: ☐	Pools Over 28" Deep: ☑	Macrophytes: ☑	Logs: ☑	COMMENTS (Instream Cover for Fish): Pond-like cover -- mostly vegetation & debris
Overhanging Veg: ☑	Rootwads: ☐	Boulders: ☐	Backwaters: ☑	

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: N/A

GEAR/METHODS USED FOR: Invertebrates: Fish:

EFFORTS USED FOR: Invertebrates: Fish:

INVERTEBRATES:

Mayflies: ☐	Caddisflies: ☐	Dragonfly/Damselfly Nymphs: ☑	Snail ☑	Isopods: ☐	Sowbugs: ☐	Leeches: ☐	Worms: ☐
Water Pennies: ☐	Beetles: ☐	Other:	Very pond like entire reach - probably pond type macroinverts				

FISH:

Carp: ☐	Black Bullheads: ☐	Creek Chubs: ☐	Green Sunfish: ☐	Bluegill: ☑	Largemouth Bass: ☐
Johnny Darters: ☐	Fathead Minnows: ☐	Golden Shiners: ☐	Other:	Turtles & tad poles	

BIRDS:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01A	TP	2024	9	Downstream face Forest Ave. bridge

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01A	TP	2025	10	Looking upstream from Forest Ave. bridge

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01A	TP	2026	11	Looking downstream from Forest Ave. bridge

GPS #

Roll#2017 - Photo#2

Roll#2018 - Photo#3

Roll#2019 - Photo#4

Roll#2020 - Photo#5

Roll#2021 - Photo#6

Roll#2023 - Photo#8

Roll#2024 - Photo#9

Roll#2026 - Photo#11

Fish Lake Drain Inventory Report Form

LAKE CO ID (FL):	FL01B	DATE:	6/25/2002
PRIMARY WATERSHED:	Fish L. Drain	STREAM REACH NAME:	Fish Lake Drain
STREAM REACH #:	2		
REACH BOUNDARIES UPSTREAM:	Duck Lake	REACH BOUNDARIES DOWNSTREAM:	Forest Ave. culvert (N)
UPSTREAM GPS#		DOWNSTREAM GPS#	

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
940	90	3:30:00 PM	SK/TP/KM/C	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☐ No Recov.: ☑ Pilot Channel: ☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY:	0	BASEFLOW SINUOSITY:	0	POOL/RIFFLE DEVELOPMENT:	0
DEGREE OF BANK EROSION:	1	Types/Locations of High Cases: Slight erosion on east side at shoreline along open space		DEGREE OF ARMORING:	3
Types/Locations of High Cas riprap, sea wall, railroad tie					
SEDIMENT ACCUMULATIONS:	0				

MEAN BANK HT (ft):	4' (2'below 2'a	BANK HT RANGE:	from:	to:
MEAN BANK SLOPE:	1:1	BANK SLOPE RANGE:	from: 1:1	to: 2:1
MEAN WATER DEPTH (ft):	5.5'	WATER DEPTH RANGE:	from: 5'	to: 6'
TOP MEAN CHAN. WIDTH (ft):	60'	TOP CHANNEL WIDTH RANGE:	from 60'	to: 70'
BOTTOM MEAN CHAN. WIDTH (ft):	60'	BOT. CHAN. WIDTH RANGE:	from 60'	to: 70'
MEAN VELOCITY (ft/s):	~0	VELOCITY RANGE:	from: ~0	to: 0

PREDOMINANT BANK VEG. %				
None: 0	Grass: 0	Lawn: 30	Wetland: 0	
Trees: 30	Shrub: 30	Rowcrop: 0		

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☑	☑	☐	☐	☐	forbs 10%; Sil

CANOPY (% shaded cov. of channel):	40	BEAVER ACTIVITY: ☐	# OF DAMS:
INSTREAM DEBRIS LOAD:	Pass	OVERBANK DEBRIS LOAD:	Pass

COMMENTS: Backed up from lake level

IMPOUNDED: ☐ MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

B. HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
FL01B	Culvert	8	0	0	Steel

HSNO: 3

LOCATION/GPS#: Road

NOTES:

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	0
	Recreational:	0	Commercial Industrial:	0
	Residential:	100	Other	0
	Other Description:			

VEGETATION %						
	Forest:	10	Lawn/Grass:	80	Wetlands:	0
	Crops:	0	Shrub/Weeds:	10	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 0-10'

COMMENTS (Riparian Corridor/Floodplain): All residential, typical lakeshore development, no natural shoreline - all amored or altered

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
	Gravel:	0	Sand:	0	Cobble:	0	Silt 0
	Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan: 0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: N/A

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: N/A

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☐ **GREASE/OIL IN SEDIMENT:** ☐

TURBIDITY: Low

WATER COLOR: Brown

COMMENTS: Algae; substrate stability not tested but probably low to moderate

F. INSTREAM COVER FOR FISH

Undercut Banks: ☐	Pools Over 28" Deep: ☑	Macrophytes: ☑	Logs: ☐	COMMENTS (Instream Cover for Fish): Mostly open boating channel, very little habitat, mostly some macrophytes
Overhanging Veg: ☐	Rootwads: ☐	Boulders: ☐	Backwaters: ☑	

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: Pools

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:		Fish:	

INVERTEBRATES:

Mayflies: ☑	Caddisflies: ☐	Dragonfly/Damselfly Nymphs: ☐	Snail ☑	Isopods: ☐	Sowbugs: ☐	Leeches: ☐	Worms: ☑
Water Pennies: ☐	Beetles: ☐	Other:	heptagenoids; physa; flatworms; lampsilis shell				

FISH:

Carp: ☑	Black Bullheads: ☑	Creek Chubs: ☐	Green Sunfish: ☐	Bluegill: ☑	Largemouth Bass: ☐
Johnny Darters: ☐	Fathead Minnows: ☐	Golden Shiners: ☐	Other:		

BIRDS:

Ducks: ☐	Geese: ☐	Herons: ☐	Kingfishers: ☐	Sandpipers/Plovers: ☐
Gulls/Terns: ☐	Others:	and Coontail in backwaters		

ADDITIONAL COMMENTS:

Aquatic plants: Bluegreen algae (microcystis); Some Nymphaea; This reach was essentially a canal to provide boat access. Virtually entire shore a hudge podge of bank stabilization with mostly seawall.

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1822	1	Duck Lake

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1823	2	co-de-sac end, "prairie-like" vegetation

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1824	3	Docks along the stream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1825	4	Docks along the stream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1826	5	armored stream bank, west side

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1827	6	armored stream bank, east side

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1828	7	Bridge/Tributary

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1829	8	Falling down wood retaining wall

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1830	9	Blue algae eutrophic problem

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1831	10	Stormwater drainage along development
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL01B	CC	1832	11	Stormwater drainage in co-de-sac
		GPS #		

Roll#1822 - Photo#1

Roll#1825 - Photo#4

Roll#1823 - Photo#2

Roll#1826 - Photo#5

Roll#1824 - Photo#3

Roll#1827 - Photo#6

Roll#1828 - Photo#7

Roll#1829 - Photo#8

Roll#1830 - Photo#9

Roll#1831 - Photo#10

Roll#1832 - Photo#11

Fish Lake Drain Inventory Report Form

LAKE CO ID (FL): FL02A
DATE: 7/1/2002

PRIMARY WATERSHED: Fish L. Drain
STREAM REACH NAME: Fish Lake Drain
STREAM REACH #: 3

REACH BOUNDARIES UPSTREAM: confluence downstream of Rount 134
REACH BOUNDARIES DOWNSTREAM: Duck Lake

UPSTREAM GPS#
DOWNSTREAM GPS#

LENGTH (ft): 1950
TEMP. (F): 90
TIME: 1:00:00 AM
INVESTIG.: SK/TP
STREAM STAGE: None
RECENT RAIN: N/A
RAIN (in):

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☐ No Recov.: ☑ Pilot Channel: ☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY: 0
BASEFLOW SINUOSITY: 0
POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 2
Types/Locations of High Cases: as it enter Duck Lake, down stream from Forest Ave.

DEGREE OF ARMORING: 2
Types/Locations of High Cases: Most of residential side rip rap, timbers, sheet pile

SEDIMENT ACCUMULATIONS: 3

MEAN BANK HT (ft): 2
BANK HT RANGE: from: 6" to: 5'

MEAN BANK SLOPE: 0.5:1
BANK SLOPE RANGE: from: 0.5:1 to: 1:1

MEAN WATER DEPTH (ft): 3.5
WATER DEPTH RANGE: from: 3 to: 4

TOP MEAN CHAN. WIDTH (ft): 45
TOP CHANNEL WIDTH RANGE: from 30 to: 60

BOTTOM MEAN CHAN. WIDTH (ft): 40
BOT. CHAN. WIDTH RANGE: from 30 to: 50

MEAN VELOCITY (ft/s): 0
VELOCITY RANGE: from: to:

PREDOMINANT BANK VEG. %
None: 0 Grass: 50 Lawn: 0 Wetland: 0
Trees: 25 Shrub: 25 Rowcrop: 0

PREDOMINANT TREE/SHRUB
Willows ☐ Box Elder ☑ Honeysuckle ☐ Buckthorn ☐ Hardwoods ☑ Other: Oak Hickory;

CANOPY (% shaded cov. of channel): 25
BEAVER ACTIVITY: ☐
OF DAMS:

INSTREAM DEBRIS LOAD: Pass
OVERBANK DEBRIS LOAD: Pass

COMMENTS: No actural dam within reach

IMPOUNDED: ☑
MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

B. HYDRAULIC STRUCTURES:

LAKE CO ID: FL02A
TYPE: Culvert
SIZE (ft): W: 0 H: 0 L: 0
MATERIAL: Steel
HSNO: 4
LOCATION/GPS#: Forest Ave.
NOTES:

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
Agricultural:	0	Vacant/Open Space:	30
Recreational:	0	Commercial Industrial:	0
Residential:	70	Other	0
Other Description:			

VEGETATION %					
Forest:	35	Lawn/Grass:	50	Wetlands:	0
Crops:	0	Shrub/Weeds:	15	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: > 50' where it exists; none at lawns

COMMENTS (Riparian Corridor/Floodplain): One bank is residential, other bank all open

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %								
Gravel:		Sand:	0	Cobble:	0	Silt	100
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Low

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: N/A

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Brown

COMMENTS: algae

F. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:
☑	☑	☑	☐
Overhanging Veg:	**Rootwads:**	**Boulders:**	**Backwaters:**
☐	☑	☐	☑

COMMENTS (Instream Cover for Fish): **Undercut banks in places less than 12"; Pondlike-mostly macrophytes**

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: N/A

GEAR/METHODS USED FOR:	Invertebrates:		Fish:	
EFFORTS USED FOR:	Invertebrates:		Fish:	

INVERTEBRATES:

Mayflies:	Caddisflies:	Dragonfly/Damselfly Nymphs:	Snail	Isopods:	Sowbugs:	Leeches:	Worms:
☐	☐	☐	☐	☐	☐	☐	☐

Water Pennies:	Beetles:	Other:	Pondlike
☐	☐		

FISH:

Carp:	Black Bullheads:	Creek Chubs:	Green Sunfish:	Bluegill:	Largemouth Bass:
☐	☐	☐	☐	☑	☐

Johnny Darters:	Fathead Minnows:	Golden Shiners:	Other:	Painted turtle
☐	☐	☐		

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:
☐	☐	☐	☐	☐

Gulls/Terns:	Others:	
☐		

ADDITIONAL COMMENTS:

Aquatic plants: Nymphaea, Lemna, Elodea, and Curly leaf pondweed in the sun; Coontail

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02A	TP	2027	1	Panorama of foot bridge at upstream end of Duck Lake, over exposed
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02A	TP	2028	2	Panorama of foot bridge at upstream end of Duck Lake, over exposed
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02A	TP	2029	3	Panorama of foot bridge at upstream end of Duck Lake, over exposed
		GPS #		

Roll#2027 - Photo#1

Roll#2029 - Photo#3

Fish Lake Drain Inventory Report Form

LAKE CO ID (FL): FL02B
DATE: 7/1/2002

PRIMARY WATERSHED: Fish L. Drain
STREAM REACH NAME: Fish Lake Drain
STREAM REACH #: 4

REACH BOUNDARIES UPSTREAM: Route 134
REACH BOUNDARIES DOWNSTREAM: confluence downstream of Route 134

UPSTREAM GPS#
DOWNSTREAM GPS#

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
290	90	2:00:00 PM	SK/TP	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☐ No Recov.: ☑ Pilot Channel: ☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY: 0
BASEFLOW SINUOSITY: 0
POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 0
Types/Locations of High Cases:
DEGREE OF ARMORING: 0
Types/Locations of High Cases:

SEDIMENT ACCUMULATIONS: 3

MEAN BANK HT (ft): 18"
BANK HT RANGE: from: 6" to: 2'

MEAN BANK SLOPE: 1:1
BANK SLOPE RANGE: from: 1:1 to: 2:1

MEAN WATER DEPTH (ft): 1'
WATER DEPTH RANGE: from: to:

TOP MEAN CHAN. WIDTH (ft): 35'
TOP CHANNEL WIDTH RANGE: from to:

BOTTOM MEAN CHAN. WIDTH (ft): 30
BOT. CHAN. WIDTH RANGE: from to:

MEAN VELOCITY (ft/s): 0
VELOCITY RANGE: from: to:

PREDOMINANT BANK VEG. %: None: 0 Grass: 0 Lawn: 0 Wetland: 0 Trees: 30 Shrub: 10 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ Box Elder ☑ Honeysuckle ☐ Buckthorn ☐ Hardwoods ☐ Other: Forbs 60%

CANOPY (% shaded cov. of channel): 80
BEAVER ACTIVITY: ☐
OF DAMS:

INSTREAM DEBRIS LOAD: Pass
OVERBANK DEBRIS LOAD: Pass

COMMENTS: No dam but lake conditions

IMPOUNDED: ☑
MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

B. HYDRAULIC STRUCTURES:

LAKE CO ID: FL02B
TYPE:
SIZE (ft): W: 0 H: 0 L: 0
MATERIAL:
HSNO:
LOCATION/GPS#
NOTES:

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	100
Recreational:	0	Commercial Industrial:	0
Residential:	0	Other	0
Other Description:			

VEGETATION %

Forest:	50	Lawn/Grass:	0	Wetlands:	0
Crops:	0	Shrub/Weeds:	50	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: > 50 ft

COMMENTS (Riparian Corridor/Floodplain): All open space both sides, very low lying area probably wide floodplain

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	0	Sand:	0	Cobble:	0	Silt	100
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Low

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: N/A

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: N/A

WATER COLOR: Clear

COMMENTS: Remarkably clear compare to other reaches

F. INSTREAM COVER FOR FISH

Undercut Banks: ☐	Pools Over 28" Deep: ☐	Macrophytes: ☐	Logs: ☑	COMMENTS (Instream Cover for Fish): Wide and shallow no pods, very little habitat
Overhanging Veg: ☑	Rootwads: ☐	Boulders: ☐	Backwaters: ☐	

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: Runs

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:	5 mins	Fish:	

INVERTEBRATES:

Mayflies: ☑	Caddisflies: ☐	Dragonfly/Damselfly Nymphs: ☐	Snail ☑	Isopods: ☑	Sowbugs: ☑	Leeches: ☑	Worms: ☐
Water Pennies: ☐	Beetles: ☐	Other:	Tricory thidae; physa; Bryozoa; Not much habitat to sample - low oxgen, seds anaerobic				

FISH:

Carp: ☑	Black Bullheads: ☐	Creek Chubs: ☐	Green Sunfish: ☑	Bluegill: ☐	Largemouth Bass: ☐
Johnny Darters: ☐	Fathead Minnows: ☑	Golden Shiners: ☐	Other:	many minnows	

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:

Gulls/Terns:	Others:

ADDITIONAL COMMENTS:

Nymphaea, elodea, coontail, but minimal; a very few aquatic macrophytes compare to other reaches.

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02B				

GPS #

Fish Lake Drain Inventory Report Form

LAKE CO ID (FL):	FL02C	DATE:	7/1/2002
PRIMARY WATERSHED:	Fish L. Drain	STREAM REACH NAME:	Fish Lake Drain
STREAM REACH #:	5		
REACH BOUNDARIES UPSTREAM:	Wooster Lake	REACH BOUNDARIES DOWNSTREAM:	Route 134
UPSTREAM GPS#		DOWNSTREAM GPS#	

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
630	90	1:00:00 PM	SK/TP	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☑ No Recov.: ☐ Pilot Channel: ☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY:	0	BASEFLOW SINUOSITY:	1	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: not very high but throughout		DEGREE OF ARMORING:	1
Types/Locations of High Cases: 5.5' high stack concrete wall near Route 134					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	3-4	BANK HT RANGE:	from: 1	to: 5	
MEAN BANK SLOPE:	1:1	BANK SLOPE RANGE:	from: 1:1	to: 3:1	
MEAN WATER DEPTH (ft):	8"	WATER DEPTH RANGE:	from: 4"	to: 1.5'	
TOP MEAN CHAN. WIDTH (ft):	25	TOP CHANNEL WIDTH RANGE:	from	to:	
BOTTOM MEAN CHAN. WIDTH (ft):	15	BOT. CHAN. WIDTH RANGE:	from	to:	
MEAN VELOCITY (ft/s):	1.5-2	VELOCITY RANGE:	from: 1	to: 2.5	

PREDOMINANT BANK VEG. %				
None: 0	Grass: 0	Lawn: 0	Wetland: 10	
Trees: 60	Shrub: 10	Rowcrop: 0		

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☐	☑	☐	☐	☐	Forb 30%; a lo

CANOPY (% shaded cov. of channel):	90	BEAVER ACTIVITY: ☐	# OF DAMS:
INSTREAM DEBRIS LOAD:	Pass	OVERBANK DEBRIS LOAD:	Pass

COMMENTS: Lots of debris but probably still passes

IMPOUNDED: ☐ MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

B. HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W: 8 H: 6 L: 0	MATERIAL:
FL02C	Culvert	HSNO: 5	Concrete

LOCATION/GPS#: Route 134

NOTES:

B. HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W: 8 H: 6 L: 0	MATERIAL:
FL02C	Culvert	HSNO: 6	Steel

LOCATION/GPS#: Lake outlet (road crossing)

NOTES: at road in subdivision

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	25
Recreational:	0	Commercial Industrial:	25
Residential:	50	Other	0
Other Description:			

VEGETATION %

Forest:	50	Lawn/Grass:	20	Wetlands:	0
Crops:	0	Shrub/Weeds:	30	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: > 50' on west bank; 0-40' on east bank

COMMENTS (Riparian Corridor/Floodplain): Development on both sides but corridor mostly preserved (except near commercial area)

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	35	Sand:	35	Cobble:	0	Silt	30
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Moderate

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: N/A

WATER COLOR: Clear

COMMENTS: good water quality in Wooster Lake

F. INSTREAM COVER FOR FISH

Undercut Banks: ☐	Pools Over 28" Deep: ☑	Macrophytes: ☐	Logs: ☑
Overhanging Veg: ☑	Rootwads: ☑	Boulders: ☐	Backwaters: ☑

COMMENTS (Instream Cover for Fish): Many med (14") carp, some yoy; Good gradient this reach - some pool-riffle development especially near debris jams

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: Riffles

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:	5 mins	Fish:	

INVERTEBRATES:

Mayflies: ☐	Caddisflies: ☑	Dragonfly/Damselfly Nymphs: ☑	Snail ☑	Isopods: ☐	Sowbugs: ☑	Leeches: ☑	Worms: ☐
Water Pennies: ☐	Beetles: ☐	Other:	hydropsyche; damselfly adults; physa; blackfly flatworms				

FISH:

Carp: ☑	Black Bullheads: ☐	Creek Chubs: ☑	Green Sunfish: ☐	Bluegill: ☑	Largemouth Bass: ☑
Johnny Darters: ☐	Fathead Minnows: ☑	Golden Shiners: ☐	Other:	many minnows (carp yoy or clubs); bass observed	

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:

Gulls/Terns:	Others:

ADDITIONAL COMMENTS:

Auatic plants: Lemna, Nymphaea, Coontail - only a few

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2038	1	Route 134 culvert upstream face
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2039	2	Water clarity upstream from route 134
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2040	3	Water clarity upstream from route 134
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2041	4	corridor
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2041	5	Panorama of log jam
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2043	6	Panorama of log jam
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2044	7	Panorama of log jam
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2045	8	balk erosion at log jam by garage on east bank
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2046	9	balk erosion at log jam by garage on east bank

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2047	10	Corridor upstream of concrete wall

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2048	11	Stacked concrete wall

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2049	12	Stacked concrete wall

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2051	13	Several of culvert Wooster Lake outlet

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL02C	TP	2052	14	Lake outlet channel

GPS #

Roll#2038 - Photo#1

Roll#2040 - Photo#3

Roll#2041 - Photo#4

Roll#2042 - Photo#5

Roll#2045 - Photo#8

Roll#2051 - Photo#13

Roll#2052 - Photo#14

Fish Lake Drain Inventory Report Form

LAKE CO ID (FL):	FL03	DATE:	7/1/2002
PRIMARY WATERSHED:	Fish L. Drain	STREAM REACH NAME:	Fish Lake Drain
STREAM REACH #:	6		
REACH BOUNDARIES UPSTREAM:	Fischer Lake	REACH BOUNDARIES DOWNSTREAM:	Wooster Lake at Camp Henry Horver
UPSTREAM GPS#		DOWNSTREAM GPS#	

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
1700	90	2:00:00 PM	SK/TP	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☐ No Recov.: ☑ Pilot Channel: ☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY:	0	BASEFLOW SINUOSITY:	0	POOL/RIFFLE DEVELOPMENT:	0
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: All of length, most not severe, worst at upstream		DEGREE OF ARMORING:	0
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	3				

MEAN BANK HT (ft):	2	BANK HT RANGE:	from: 0	to: 3.5	
MEAN BANK SLOPE:		BANK SLOPE RANGE:	from:	to: 20:1	
MEAN WATER DEPTH (ft):	1.5	WATER DEPTH RANGE:	from: 1	to: 2.5	
TOP MEAN CHAN. WIDTH (ft):	15	TOP CHANNEL WIDTH RANGE:	from	to:	
BOTTOM MEAN CHAN. WIDTH (ft):	12	BOT. CHAN. WIDTH RANGE:	from 10	to: 15	
MEAN VELOCITY (ft/s):	0.2	VELOCITY RANGE:	from: 0.1	to: 1	

PREDOMINANT BANK VEG. %				
None: 0	Grass: 90	Lawn: 0	Wetland: 0	
Trees: 5	Shrub: 5	Rowcrop: 0		

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☑	☑	☑	☐	☐	Elderberry; m

CANOPY (% shaded cov. of channel):	10	BEAVER ACTIVITY: ☐	# OF DAMS: 2
INSTREAM DEBRIS LOAD:	Pass	OVERBANK DEBRIS LOAD:	Pass

COMMENTS: 2 old dams broken through; couple old beaver dams

IMPOUNDED: ☑ MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	95
	Recreational:	0	Commercial Industrial:	0
	Residential:	5	Other	0
	Other Description:			

VEGETATION %						
	Forest:	15	Lawn/Grass:	0	Wetlands:	0
	Crops:	0	Shrub/Weeds:	85	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: > 50 ft

COMMENTS (Riparian Corridor/Floodplain): Where open, lots of reed cnary grass. Closed has mesic woods structure (sod seal, false sol seal, jewelweed)

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %								
	Gravel:	0	Sand:	0	Cobble:	0	Silt:	100
	Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Moderate

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:

FILAMENTOUS ALGAE: High

GREASE/OIL IN WATER COLUMN: ☐ **GREASE/OIL IN SEDIMENT:** ☐

TURBIDITY: Low

WATER COLOR: Brown **COMMENTS:** Fairly clear, but some color

F. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☐	☐	☑	☑	uniform channel

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☐	☑	☐	☐

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: Runs

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:	5 mins	Fish:	

INVERTEBRATES:

Mayflies:	Caddisflies:	Dragonfly/Damselfly Nymphs:	Snail	Isopods:	Sowbugs:	Leeches:	Worms:
☐	☐	☑	☑	☐	☐	☐	☐

Water Pennies:	Beetles:	Other:
☐	☐	dragonfly adults; Chironomids; very warm and pond-like

FISH:

Carp:	Black Bullheads:	Creek Chubs:	Green Sunfish:	Bluegill:	Largemouth Bass:
☐	☐	☐	☐	☐	☐

Johnny Darters:	Fathead Minnows:	Golden Shiners:	Other:
☐	☑	☐	

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:
☑	☐	☐	☐	☐

Gulls/Terns:	Others:
☐	mallard hen and ducklings

ADDITIONAL COMMENTS:

Auqatic plants: fris, Lamna, Sagittaria, Fili algae near lake; also wrly leaf pot, lemna, lots of RCG, Coon tail, Log leaf potamogeton; Area at comp near Wooster Lake, some signs of remnant prairie-rudbeckia, Iskelia, and sedges

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2053	1	Duck Lake
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2054	2	Looking upstream from 200 feet upstream of Duck Lake
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2055	3	Looking downstream toward Wooster Lake
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2056	4	Typical corridor looking upstream
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2057	5	Stream with algae and pond weed
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	RB		238	open channel
		GPS #		
		508		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2059	7	Pond weed mass
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2060	8	close up of pond weed
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2061	9	Looking downstream Nippersink Road
		GPS #		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2062	10	Looking downstream Nippersink Road

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2063	11	Looking downstream Nippersink Road

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL03	TP	2064	12	Fischer Lake outlet

GPS #

Roll#2053 - Photo#1

Roll#2055 - Photo#3

Roll#2054 - Photo#2

Roll#2056 - Photo#4

Roll#2057 - Photo#5

Roll#2058 - Photo#6

Roll#2059 - Photo#7

Roll#2060 - Photo#8

Roll#2061-3 - Photo#9-11

Roll#2064 - Photo#12

Fish Lake Drain Inventory Report Form

LAKE CO ID (FL): FL04A
DATE: 6/25/2002

PRIMARY WATERSHED: Fish L. Drain
STREAM REACH NAME: Fish Lake Drain
STREAM REACH #: 7

REACH BOUNDARIES UPSTREAM: culvert at downstream end of subdivision
REACH BOUNDARIES DOWNSTREAM: Fischer Lake

UPSTREAM GPS#
DOWNSTREAM GPS#

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
600	90	2:00:00 PM	SK/TP/KM/C	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☐ No Recov.: ☑ Pilot Channel: ☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY: 0
BASEFLOW SINUOSITY: 0
POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 3
Types/Locations of High Cases: not terrible but 100% of reach
DEGREE OF ARMORING: 0
Types/Locations of High Cases:

SEDIMENT ACCUMULATIONS: 2

MEAN BANK HT (ft):
BANK HT RANGE: from: 6(W)-4(E) to: 2(W)-5(E)
MEAN BANK SLOPE:
BANK SLOPE RANGE: from: :1(W)-2:1(E to: :1(W)-1:1(
MEAN WATER DEPTH (ft): 8"-1
WATER DEPTH RANGE: from: 4" to: 2.5
TOP MEAN CHAN. WIDTH (ft): 55
TOP CHANNEL WIDTH RANGE: from 50 to: 70
BOTTOM MEAN CHAN. WIDTH (ft): 45
BOT. CHAN. WIDTH RANGE: from 40 to: 50
MEAN VELOCITY (ft/s): 0.1
VELOCITY RANGE: from: 0 to: 0.5

PREDOMINANT BANK VEG. %: None: 20 Grass: 10 Lawn: 0 Wetland: 15 Trees: 0 Shrub: 25 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ Box Elder ☑ Honeysuckle ☐ Buckthorn ☐ Hardwoods ☐ Other: forbs 30%

CANOPY (% shaded cov. of channel): 5
BEAVER ACTIVITY: ☐
OF DAMS:

INSTREAM DEBRIS LOAD: Pass
OVERBANK DEBRIS LOAD: Pass

COMMENTS:

IMPOUNDED: ☑
MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
Agricultural:		Vacant/Open Space:	100
Recreational:	0	Commercial Industrial:	0
Residential:	0	Other	0
Other Description:			

VEGETATION %					
Forest:	10	Lawn/Grass:	10	Wetlands:	0
Crops:	0	Shrub/Weeds:	30	Other:	50
Other Description:	forbs				

WIDTH OF VEGETATED BUFFER: 100ft

COMMENTS (Riparian Corridor/Floodplain):

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
Gravel:	0	Sand:	0	Cobble:	0	Silt	100
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Moderate

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: N/A

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Clear

COMMENTS: algae

F. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:
☐	☑	☑	☑
Overhanging Veg:	**Rootwads:**	**Boulders:**	**Backwaters:**
☐	☐	☐	☑

COMMENTS (Instream Cover for Fish): **Mostly macrophytes; Uniform channel except near culvert, where flashy hydro has created some pods**

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: Pools

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:	5 mins	Fish:	

INVERTEBRATES:

Mayflies:	Caddisflies:	Dragonfly/Damselfly Nymphs:	Snail	Isopods:	Sowbugs:	Leeches:	Worms:
☐	☐	☐	☑	☐	☐	☐	☑
Water Pennies:	**Beetles:**	**Other:**					
☐	☑						

lots of Elimia physa; flatworms; gynnids; Anodonta mussel shell; Very low oxygen,

FISH:

Carp:	Black Bullheads:	Creek Chubs:	Green Sunfish:	Bluegill:	Largemouth Bass:
☐	☐	☐	☐	☐	☐
Johnny Darters:	**Fathead Minnows:**	**Golden Shiners:**	**Other:**		
☐	☐	☐			

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:
☐	☐	☐	☐	☐
Gulls/Terns:	**Others:**			
☐				

ADDITIONAL COMMENTS:

Aquatic plants: Potamogeton (thin leaf) and Crispus, Lemna, Saggitania, Coontail; Eastern slope was very disturbed

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1779	1	culvert, looking downstream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1780	2	culvert, looking uptream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1781	3	stream condition, looking downstream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1782	4	stream condition, looking uptream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1783	5	stream condition, looking downstream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1784	6	stream condition, looking downstream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1785	7	Eutrophic condition (algae), looking downstream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1786	6	east side bank erosion

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1787	9	west side bank erosion

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1788	10	eutrophic condition (algae)

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1789	11	stream condition upstream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1790	12	look upstream, east bank

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1791	13	stream condition, middle part, looking uptream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1792	14	stream condition, west bank, looking upstream

GPS #

Roll#1779 - Photo#1

Roll#1780 - Photo#2

Roll#1781 - Photo#3

Roll#1782 - Photo#4

Roll#1783 - Photo#5

Roll#1784 - Photo#6

Roll#1785 - Photo#7

Roll#1786 - Photo#8

Roll#1787 - Photo#9

Roll#1788 - Photo#10

Roll#1789 - Photo#11

Roll#1790 - Photo#12

Roll#1791 - Photo#13

Roll#1792 - Photo#14

Fish Lake Drain Inventory Report Form

LAKE CO ID (FL): FL04B
DATE: 6/25/2002

PRIMARY WATERSHED: Fish L. Drain
STREAM REACH NAME: Fish Lake Drain
STREAM REACH #: 8

REACH BOUNDARIES UPSTREAM: Culvery downstream of subdivision
REACH BOUNDARIES DOWNSTREAM: 260 ft downstream of culvert (woods)

UPSTREAM GPS#
DOWNSTREAM GPS#

LENGTH (ft): 260
TEMP. (F): 90
TIME:
INVESTIG.: SK/TP/KM/C
STREAM STAGE: None
RECENT RAIN: N/A
RAIN (in):

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☑ No Recov.: ☐ Pilot Channel: ☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY: 1
BASEFLOW SINUOSITY: 1
POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 3
Types/Locations of High Cases: Very severe on east slope
DEGREE OF ARMORING: 0
Types/Locations of High Cases

SEDIMENT ACCUMULATIONS: 1

MEAN BANK HT (ft):
BANK HT RANGE: from: 4(W)-10(E) to: 4-12
MEAN BANK SLOPE: 1:1
BANK SLOPE RANGE: from: to:
MEAN WATER DEPTH (ft): 10"
WATER DEPTH RANGE: from: 8" to: 1
TOP MEAN CHAN. WIDTH (ft): 20
TOP CHANNEL WIDTH RANGE: from 15 to: 30
BOTTOM MEAN CHAN. WIDTH (ft): 10
BOT. CHAN. WIDTH RANGE: from 8 to: 12
MEAN VELOCITY (ft/s): 0.5
VELOCITY RANGE: from: to:

PREDOMINANT BANK VEG. %: None: 30 Grass: 10 Lawn: 0 Wetland: 15 Trees: 10 Shrub: 20 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ Box Elder ☑ Honeysuckle ☐ Buckthorn ☑ Hardwoods ☐ Other: Forbs 15%

CANOPY (% shaded cov. of channel): 10
BEAVER ACTIVITY: ☐
OF DAMS:

INSTREAM DEBRIS LOAD: Pass
OVERBANK DEBRIS LOAD: Pass

COMMENTS: significant debris in channel

IMPOUNDED: ☐
MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

B. HYDRAULIC STRUCTURES:

LAKE CO ID: FL04B
TYPE: Culvert
SIZE (ft): W: 8 H: 6 L: 0
MATERIAL: Steel
HSNO: 7
LOCATION/GPS#: south end of the reach
NOTES:

C. POINT DISCHARGE:

N/A

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	100
	Recreational:	0	Commercial Industrial:	0
	Residential:	0	Other	0
	Other Description:			

VEGETATION %						
	Forest:	20	Lawn/Grass:	10	Wetlands:	30
	Crops:	0	Shrub/Weeds:	40	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 100ft

COMMENTS (Riparian Corridor/Floodplain):

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
	Gravel:	0	Sand:	0	Cobble:	0	Silt: 100
	Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan: 0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Moderate

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Moderate

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Clear

COMMENTS: Waterfall from culvert

F. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☐	☑	☑	☑	log jams created pools; few macrophytes and rootwads
Overhanging Veg:	**Rootwads:**	**Boulders:**	**Backwaters:**	
☐	☑	☐	☐	

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: Runs

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:	5mins	Fish:	

INVERTEBRATES:

Mayflies:	Caddisflies:	Dragonfly/Damselfly Nymphs:	Snail	Isopods:	Sowbugs:	Leeches:	Worms:
☐	☑	☑	☑	☐	☐	☐	☑

Water Pennies:	Beetles:	Other:
☐	☑	Only habitat is woody debris; Limneplulids; adults of dragon/damselfly; Many Elimia snails;

FISH:

Carp:	Black Bullheads:	Creek Chubs:	Green Sunfish:	Bluegill:	Largemouth Bass:
☑	☐	☐	☐	☐	☐

Johnny Darters:	Fathead Minnows:	Golden Shiners:	Other:
☐	☐	☐	

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:
☐	☐	☐	☐	☐

Gulls/Terns:	Others:
☐	

ADDITIONAL COMMENTS:
No significant aquatic plants

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1793	1	East side floodplain

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1794	2	West bank

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1795	3	West bank floodplain

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1796	4	Serious erosion on west bank

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1797	5	Serious erosion on west bank

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1798	6	Serious erosion on west bank

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1799	7	Serious erosion on west bank

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1800	8	Wood debris dam

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04B	CC	1801	9	Wood debris dam

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1788	10	eutrophic condition (algae)

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1789	11	stream condition upstream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1790	12	look upstream, east bank

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1791	13	stream condition, middle part, looking uptream

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04A	CC	1792	14	stream condition, west bank, looking upstream

GPS #

Roll#1793 - Photo#1

Roll#1795 - Photo#3

Roll#1794 - Photo#2

Roll#1798 - Photo#6

Roll#1799 - Photo#7

Roll#1804 - Photo#12

Roll#1801 - Photo#9

Roll#1805 - Photo#13

Roll#1802 - Photo#10

Roll#1806 - Photo#14

Roll#1803 - Photo#11

Fish Lake Drain - Main Table

LAKE CO ID (FL):	FL04C	DATE:	6/25/2002
PRIMARY WATERSHED:	Fish L. Drain	STREAM REACH NAME:	Fish Lake Drain
STREAM REACH #:	9		
REACH BOUNDARIES UPSTREAM:	Molidor Road	REACH BOUNDARIES DOWNSTREAM:	Culvert at downstream of subdivision
UPSTREAM GPS#		DOWNSTREAM GPS#	

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
1800	90		SK/TP/KM/C	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION: None: ☐ Recovering ☐ No Recov.: ☐ Pilot Channel: ☑

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY:	0	BASEFLOW SINUOSITY:	0	POOL/RIFFLE DEVELOPMENT:	0
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: Slight erosion but over 100% of reach (0.5-1ft)		DEGREE OF ARMORING:	2
Types/Locations of High Cases					
SEDIMENT ACCUMULATIONS:	0				

MEAN BANK HT (ft):	2	BANK HT RANGE:	from: 1	to: 3	
MEAN BANK SLOPE:	3:1	BANK SLOPE RANGE:	from: 3:1	to: 4:1	
MEAN WATER DEPTH (ft):	5	WATER DEPTH RANGE:	from:	to:	
TOP MEAN CHAN. WIDTH (ft):	110	TOP CHANNEL WIDTH RANGE:	from	to:	
BOTTOM MEAN CHAN. WIDTH (ft):	100	BOT. CHAN. WIDTH RANGE:	from	to:	
MEAN VELOCITY (ft/s):	~0	VELOCITY RANGE:	from:	to:	

PREDOMINANT BANK VEG. %					
None: 0	Grass: 0	Lawn: 70	Wetland: 0		
Trees: 10	Shrub: 10	Rowcrop: 0			

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☑	☑	☐	☐	☐	Forb 10%

CANOPY (% shaded cov. of channel):	1	BEAVER ACTIVITY: ☐	# OF DAMS:
INSTREAM DEBRIS LOAD:	Pass	OVERBANK DEBRIS LOAD:	Pass

COMMENTS:

IMPOUNDED: ☑ MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

B. HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W: 0	H: 0	L: 0	MATERIAL:
FL04C	Culvert	HSNO:	8			Steel

LOCATION/GPS#: Downstream

NOTES:

B. HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W: 0	H: 6.5	L: 0	MATERIAL:
FL04C	Culvert	HSNO:	9			Steel

LOCATION/GPS#: Subdivision downstream from Molidor Road

NOTES: 4" flow depth

B. HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
FL04C	Culvert	0	6.5	0	Steel

HSNO: 10

LOCATION/GPS#: Molidor Road culvert

NOTES: 6" flow depth

C. POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (in): Top:	Bottom	Deep:
FL04C	Concrete Pipe	10		0

PDNO: 0

LOCATION/GPS #:

NOTES: not sure of source

C. POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (in): Top:	Bottom	Deep:
FL04C	Steel Pipe	8		0

PDNO: 20

LOCATION/GPS #:

NOTES: Drains road swale

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	30
Recreational:	0	Commercial Industrial:	0
Residential:	70	Other	0

Other Description:

VEGETATION %

Forest:	10	Lawn/Grass:	80	Wetlands:	0
Crops:	0	Shrub/Weeds:	10	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 10 (0-100)

COMMENTS (Riparian Corridor/Floodplain): Area of mowed grass (undeveloped lots) and small wooded riparian zone at downstream end of reach; all else is lawns

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel: 0	Sand: 0	Cobble: 0	Silt 100	
Concrete: 0	Organic Matter 0	Boulder: 0	Claypan: 0	

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	Low
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	N/A
FILAMENTOUS ALGAE:	Moderate

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Clear

COMMENTS: some algae

F. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:
☐	☑	☑	☐
Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☐	☐	☐	☐

COMMENTS (Instream Cover for Fish): Impounded-very pond like habitat, all macrophytes

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: N/A

GEAR/METHODS USED FOR: Invertebrates: Fish:

EFFORTS USED FOR: Invertebrates: Fish:

INVERTEBRATES:

Mayflies: ☐ Caddisflies ☐ Dragonfly/Damselfly Nymphs ☐ Snail ☐ Isopods: ☐ Sowbugs: ☐ Leeches: ☐ Worms: ☐

Water Pennies: ☐ Beetles: ☐ Other:

FISH:

Carp: ☐ Black Bullheads: ☐ Creek Chubs: ☐ Green Sunfish: ☐ Bluegill: ☐ Largemouth Bass: ☐

Johnny Darters: ☐ Fathead Minnows: ☐ Golden Shiners: ☐ Other:

BIRDS:

Ducks: ☐ Geese: ☐ Herons: ☐ Kingfishers: ☐ Sandpipers/Plovers: ☐

Gulls/Terns: ☐ Others:

ADDITIONAL COMMENTS:

Aquatic plants: Coontail, ful algae, Lemna, Nymphaea

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:	GPS #
FL04C	CC	1807	1	stand on the culvert and look upstream	

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:	GPS #
FL04C	CC	1808	2	east bank	

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:	GPS #
FL04C	CC	1809	3	stream condition	

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:	GPS #
FL04C	CC	1810	4	west side subdivision development	

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:	GPS #
FL04C	CC	1811	5	development along the stream (lawn area)	

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1812	6	sewer outlet from residential house on the east side

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1813	7	drainage and tile on the west side of development (8" culvert)

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1814	8	drainage and tile on the west side of development (8" culvert)

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1815	9	4' sewer pipe upstream

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1816	10	suspicious device

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1817	11	culvert at Molidor Road

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1818	12	suspicious erosion control material

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1819	13	suspicious erosion control material

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1820	14	suspicious erosion control material

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL04C	CC	1821	15	culvert underneath the Molidor road (Same as Roll#1817)

GPS #

Roll#1807 - Photo#1

Roll#1808 - Photo#2

Roll#1809 - Photo#3

Roll#1810 - Photo#4

Roll#1811 - Photo#5

Roll#1812 - Photo#6

Roll#1813 - Photo#7

Roll#1814 - Photo#8

Roll#1815 - Photo#9

Roll#1816 - Photo#10

Roll#1817 - Photo#11

Roll#1818 - Photo#12

Roll#1819 - Photo#13

Roll#1820 - Photo#14

Roll#1821 - Photo#15

Fish Lake Drain - Main Table

LAKE CO ID (FL):	FL05A	DATE:	6/25/2002
PRIMARY WATERSHED:	Fish L. Drain	STREAM REACH NAME:	Fish Lake Drain
STREAM REACH #:	10		
REACH BOUNDARIES UPSTREAM:	To tree line upstream of nursery	REACH BOUNDARIES DOWNSTREAM:	Molidor Road bridge
UPSTREAM GPS#		DOWNSTREAM GPS#	

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
1200	90	0:00:00 AM	SK/TP/KM/C	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION:	None:	Recovering	No Recov.:	Pilot Channel:
	☐	☐	☑	☑

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY:	0	BASEFLOW SINUOSITY:	0	POOL/RIFFLE DEVELOPMENT:	0
DEGREE OF BANK EROSION:	1	Types/Locations of High Cases		DEGREE OF ARMORING:	0
Types/Locations of High Cases					
SEDIMENT ACCUMULATIONS:	2				

MEAN BANK HT (ft):	4	BANK HT RANGE:	from: 1	to: 10	
MEAN BANK SLOPE:	2:1	BANK SLOPE RANGE:	from: 1:1	to: 3:1	
MEAN WATER DEPTH (ft):	1.5	WATER DEPTH RANGE:	from: 0.5	to: 2	
TOP MEAN CHAN. WIDTH (ft):	30	TOP CHANNEL WIDTH RANGE:	from 25	to: 50	
BOTTOM MEAN CHAN. WIDTH (ft):	10	BOT. CHAN. WIDTH RANGE:	from 6	to: 15	
MEAN VELOCITY (ft/s):	2	VELOCITY RANGE:	from: 0.5	to: 1.5	

PREDOMINANT BANK VEG. %					
None:	20	Grass:	45	Lawn:	5
Wetland:	15	Trees:	5	Shrub:	10
Rowcrop:	0				

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☐	☑	☐	☑	☐	Elderberry

CANOPY (% shaded cov. of channel):	5	BEAVER ACTIVITY:	☐	# OF DAMS:	
INSTREAM DEBRIS LOAD:	Pass	OVERBANK DEBRIS LOAD:	Pass		
COMMENTS:					
IMPOUNDED:	☐	MID-STREAM BARS _ISLANDS:	☐		
EST. MANNINGS n:	Right Overbank:	Instream:	Left Overbank:		

C. POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (in):			
FL05A	Steel Pipe	Top: 8	Bottom	Deep: 0	
PDNO: 30	LOCATION/GPS # 20' u.s. of Molidor Rd.				

NOTES: Flowing

C. POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (in):			
FL05A	Clay Pipe	Top: 8	Bottom	Deep: 0	
PDNO: 40	LOCATION/GPS # 40' us.s of Molidor Rd.				

NOTES: Very slow traffic

C. POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (in):			
FL05A	Steel Pipe	Top: 4	Bottom 2	Deep: 0	
PDNO: 50	LOCATION/GPS # 80' u.s. of Molidor Rd.				

NOTES: No flow, from nursery

C. POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (in):			
FL05A	Steel Pipe	Top: 5	Bottom	Deep: 0	
PDNO: 60	LOCATION/GPS # 200' u.s. of Molidor Rd.				

NOTES: Multiple CPP (7), No flow. 6" 2-6pp. From nursery.

SUSPICIOUS ACTIVITIES: One of the sources is the Nursery

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
Agricultural:	20	Vacant/Open Space:	40
Recreational:	0	Commercial Industrial:	40
Residential:	0	Other	0
Other Description:			

VEGETATION %					
Forest:	0	Lawn/Grass:	10	Wetlands:	40
Crops:	10	Shrub/Weeds:	40	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 10ft

COMMENTS (Riparian Corridor/Floodplain): A lot of variation near the stream: ag., wetland, and nursery.

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
Gravel:	0	Sand:	0	Cobble:	0	Silt	100
Concrete:	0	Organic Matter	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	Moderate
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	High
FILAMENTOUS ALGAE:	Low

GREASE/OIL IN WATER COLUMN: GREASE/OIL IN SEDIMENT:

TURBIDITY:	
WATER COLOR:	Brown
COMMENTS:	silty bottom, vegetative; first half of substrate 60% silt, 20% gravel, and 20% sand

F. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☐	☐	☑	☐	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☐	☐	☐	☑

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH:	N/A
HABITATS SAMPLED FOR INVERTEBRATES:	Runs

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:	5 mins	Fish:	

INVERTEBRATES:

Mayflies:	Caddisflies	Dragonfly/Damselfly Nymphs	Snail	Isopods:	Sowbugs:	Leeches:	Worms:
☐	☐	☑	☑	☐	☐	☑	☑

Water Pennies:	Beetles:	Other:
☐	☑	Many dragon/damselfly, mostly Calopteryglidae coenagnonidae; Many Elimia snails; Gyrinids

FISH:

Carp:	Black Bullheads:	Creek Chubs:	Green Sunfish:	Bluegill:	Largemouth Bass:
☐	☐	☐	☐	☐	☐

Johnny Darters:	Fathead Minnows:	Golden Shiners:	Other:
☐	☑	☐	

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:
☑	☐	☐	☐	☐

Gulls/Terns:	Others:
☑	RW Blackbird

ADDITIONAL COMMENTS:

Aquatic plant: Pot. Crispus, Elodea, Coontail, Saggitaria cat., Lemna; Many green frogs as well as tad poles and egg mass.; First couple hundred feet was higher gradient and somewhat mere incised. The rest was very flat, lower floodplain, siltier bottom.

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1732	1	Drainage pipe

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1733	2	sewage outlet (right close to #1732)

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1734	3	sewage outlet, close to #1733, about 3 yards

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1735	4	sewage outlet, about 5 yards to #1734

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1736	5	sewage outlet, about 3 yards to #1735

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1737	6	upstream bank condition, some vegetation

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1738	7	sewage outlet

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1739	8	new planting on east bank

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1740	9	uniform channel condition

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1741	10	erodable bank condition

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1742	11	look downstream

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1743	12	look upstream

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1744	13	look upstream, eutrophic condition

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1745	14	look upstream, picnic lawn

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1746	15	obscure arbitrary

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1747	16	wetlands, reed canadian grass on west side

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05A	CC	1748	17	look upstream

GPS #

Roll#1732 - Photo#1

Roll#1734 - Photo#3

Roll#1733 - Photo#2

Roll#1735 - Photo#4

Roll#1736 - Photo#5

Roll#1737 - Photo#6

Roll#1738 - Photo#7

Roll#1739 - Photo#8

Roll#1740 - Photo#9

Roll#1741 - Photo#10

Roll#1742 - Photo#11

Roll#1743 - Photo#12

Roll#1744 - Photo#13

Roll#1748 - Photo#17

Roll#1745 - Photo#14

Roll#1746 - Photo#15

Roll#1747 - Photo#16

Fish Lake Drain - Main Table

LAKE CO ID (FL):	FL05B	DATE:	6/25/2002
PRIMARY WATERSHED:	Fish L. Drain	STREAM REACH NAME:	Fish Lake Drain
STREAM REACH #:	11		

REACH BOUNDARIES UPSTREAM: 690 ft upstream of edge of nursery

REACH BOUNDARIES DOWNSTREAM: Tree line just upstream of nursery (215 ft u/s of nursery)

UPSTREAM GPS#

DOWNSTREAM GPS#

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
475	90	1:00:00 AM	SK/TP/KM/C	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION:	None:	Recovering	No Recov.:	Pilot Channel:
	☐	☐	☑	☑

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY:	0	BASEFLOW SINUOSITY:	0	POOL/RIFFLE DEVELOPMENT:	0
DEGREE OF BANK EROSION:	2	Types/Locations of High Cases		DEGREE OF ARMORING:	0
Types/Locations of High Case					
SEDIMENT ACCUMULATIONS:	3				

MEAN BANK HT (ft):		BANK HT RANGE:	from:	to:	
MEAN BANK SLOPE:	2:1	BANK SLOPE RANGE:	from: 3:1	to: 10:1	
MEAN WATER DEPTH (ft):	1.5	WATER DEPTH RANGE:	from: 1	to: 2	
TOP MEAN CHAN. WIDTH (ft):	20	TOP CHANNEL WIDTH RANGE:	from	to:	
BOTTOM MEAN CHAN. WIDTH (ft):	10	BOT. CHAN. WIDTH RANGE:	from 5	to: 20	
MEAN VELOCITY (ft/s):	0.1	VELOCITY RANGE:	from:	to:	

PREDOMINANT BANK VEG. %					
None: 40	Grass: 10	Lawn: 0	Wetland: 0		
Trees: 20	Shrub: 10	Rowcrop: 0			

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☑	☑	☐	☑	☐	Forbs 20%; C

CANOPY (% shaded cov. of channel):	80	BEAVER ACTIVITY:	☐	# OF DAMS:	
INSTREAM DEBRIS LOAD:	Pass	OVERBANK DEBRIS LOAD:	Pass		

COMMENTS: one debris dam about 1 ft high

IMPOUNDED: ☑ MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	100
Recreational:	0	Commercial Industrial:	0
Residential:	0	Other	0
Other Description:			

VEGETATION %

Forest:	80	Lawn/Grass:	15	Wetlands:	5
Crops:	0	Shrub/Weeds:	0	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 100ft

COMMENTS (Riparian Corridor/Floodplain): Large areas of reed canary grass mixed with willow/cottonwood forested area (dredged channel through former wetland), large area of hydric soils

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	0	Sand:	0	Cobble:	0	Silt	100
Concrete:	0	Organic Matter	0	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Low

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: N/A

FILAMENTOUS ALGAE: N/A

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Moderate

WATER COLOR: Brown

COMMENTS: bare banks

F. INSTREAM COVER FOR FISH

Undercut Banks: ☑	Pools Over 28" Deep: ☐	Macrophytes: ☐	Logs: ☑	COMMENTS (Instream Cover for Fish): only inches of undercut banks; few logs; Not much habitat, mostly uniform channel
Overhanging Veg: ☐	Rootwads: ☑	Boulders: ☐	Backwaters: ☐	

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: Pools

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:	5mins	Fish:	

INVERTEBRATES:

Mayflies: ☑	Caddisflies ☐	Dragonfly/Damselfly Nymphs ☑	Snail ☑	Isopods: ☐	Sowbugs: ☑	Leeches: ☑	Worms: ☑
Water Pennies: ☐	Beetles: ☑	Other: Caenids; gerrids and mesoveliids; elimia; flatworms; bryozoa; gyrinids; Slow water low					

FISH:

Carp: ☐	Black Bullheads: ☐	Creek Chubs: ☐	Green Sunfish: ☐	Bluegill: ☐	Largemouth Bass: ☐
Johnny Darters: ☐	Fathead Minnows: ☐	Golden Shiners: ☐	Other: tad poles		

BIRDS:

Ducks: ☐	Geese: ☐	Herons: ☐	Kingfishers: ☐	Sandpipers/Plovers: ☐

Gulls/Terns: Others:

ADDITIONAL COMMENTS:

No significant aquatic plants growth; Down stream end had much lower and flatter banks. After 100-200 ft upstream of debris jams, became much more incised.

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1749	1	significant tributary

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1750	2	look to the tributary

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1751	3	floodplain

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1752	4	riparian habitat

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1753	5	east stream bank

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1754	6	west stream bank

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1756	7	wood debris/dam upstream, suspicious beavers activity

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1757	8	dam upstream

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1758	9	dam upstream

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05B	CC	1759	10	east streambank

GPS #

Roll#1749 - Photo#1

Roll#1752 - Photo#4

Roll#1750 - Photo#2

Roll#1753 - Photo#5

Roll#1751 - Photo#3

Roll#1754 - Photo#6

Roll#1756 - Photo#7

Roll#1757 - Photo#8

Roll#1759 - Photo#10

Fish Lake Drain - Main Table

LAKE CO ID (FL):	FL05C	DATE:	6/25/2002
PRIMARY WATERSHED:	Fish L. Drain	STREAM REACH NAME:	Fish Lake Drain
STREAM REACH #:	12		
REACH BOUNDARIES UPSTREAM:	Fish Lake	REACH BOUNDARIES DOWNSTREAM:	690 ft upstream of nursery
UPSTREAM GPS#		DOWNSTREAM GPS#	

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
1015	90		SK/TP/Km/C	None	N/A	

A. CHANNEL CONDITIONS:

CHANNELIZATION:	None:	Recovering	No Recov.:	Pilot Channel:
	☐	☐	☑	☐

NOTE: For the next six fields: 0=None; 1=Low; 2=Moderate; 3=High

BANKFULL SINUOSITY:	0	BASEFLOW SINUOSITY:	1	POOL/RIFFLE DEVELOPMENT:	2
DEGREE OF BANK EROSION:	2	Types/Locations of High Cases		DEGREE OF ARMORING:	0
Types/Locations of High Case	Sediment low d.s. mod u.s.				
SEDIMENT ACCUMULATIONS:	2				

MEAN BANK HT (ft):	6	BANK HT RANGE:	from: 4	to: 10	
MEAN BANK SLOPE:	1:1	BANK SLOPE RANGE:	from:	to:	
MEAN WATER DEPTH (ft):	9"	WATER DEPTH RANGE:	from: 0.5	to: 1	
TOP MEAN CHAN. WIDTH (ft):	30	TOP CHANNEL WIDTH RANGE:	from 20	to: 50	
BOTTOM MEAN CHAN. WIDTH (ft):	6-8	BOT. CHAN. WIDTH RANGE:	from 4	to: 12	
MEAN VELOCITY (ft/s):	1.5	VELOCITY RANGE:	from: 1	to: 2.5	

PREDOMINANT BANK VEG. %				
None: 25	Grass: 10	Lawn: 0	Wetland: 0	
Trees: 35	Shrub: 15	Rowcrop: 0		

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☐	☑	☑	☑	☐	Forbs 15%

CANOPY (% shaded cov. of channel):	75	BEAVER ACTIVITY:	☐	# OF DAMS:	
INSTREAM DEBRIS LOAD:	Pass	OVERBANK DEBRIS LOAD:	Pass		
COMMENTS:	impounded just u.s. end				
IMPOUNDED:	☑	MID-STREAM BARS _ISLANDS:	☐		
EST. MANNINGS n:	Right Overbank:	Instream:	Left Overbank:		

C. POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (in):
FL05C	Concrete Pipe	Top: 6 Bottom Deep: 138
PDNO: 70	LOCATION/GPS # 250' d.s. of Fish Lake	

NOTES:

SUSPICIOUS ACTIVITIES:

D. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
Agricultural:	0	Vacant/Open Space:	100
Recreational:	0	Commercial Industrial:	0
Residential:	0	Other	0
Other Description:			

VEGETATION %					
Forest:	100	Lawn/Grass:	0	Wetlands:	0
Crops:	0	Shrub/Weeds:	0	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 100 (on east bank, 60 ft wooded then grass)

COMMENTS (Riparian Corridor/Floodplain): All open currently, but about 40% follow ag. Field (nursery with willows-mowed)

E. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
Gravel:	50	Sand:	10	Cobble:	5	Silt	15
Concrete:	0	Organic Matter	0	Boulder:	0	Claypan:	20

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Moderate

FILAMENTOUS ALGAE:

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY:

WATER COLOR: Green

COMMENTS: clear and green downstream, brown at upstream of dam

F. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:
☐	☐	☐	☑

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☐	☑	☐	☐

COMMENTS (Instream Cover for Fish): Very narrow with high banks - occasional log or roots - some cobble. Not much habitat.

G. AQUATIC AND TERRESTRIAL ORGANISMS

HABITATS SAMPLED FOR FISH: N/A

HABITATS SAMPLED FOR INVERTEBRATES: Riffles

GEAR/METHODS USED FOR:	Invertebrates:	hand	Fish:	
EFFORTS USED FOR:	Invertebrates:	5mins	Fish:	

INVERTEBRATES:

Mayflies:	Caddisflies	Dragonfly/Damselfly Nymphs	Snail	Isopods:	Sowbugs:	Leeches:	Worms:
☐	☑	☑	☑	☑	☐	☑	☐

Water Pennies:	Beetles:	Other:
☐	☑	hydropsyche, gyrinids, blackfly

FISH:

Carp:	Black Bullheads:	Creek Chubs:	Green Sunfish:	Bluegill:	Largemouth Bass:
☐	☐	☐	☐	☐	☐

Johnny Darters:	Fathead Minnows:	Golden Shiners:	Other:
☐	☐	☐	

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:
☐	☐	☐	☐	☐

Gulls/Terns:	Others:
☐	

ADDITIONAL COMMENTS:

No aquatic plants. This reach had strectches of quite high gradient with riffle like conditions upstream of low dam was very flat and silty

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05C	CC	1766	1	stream bank condition

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05C	CC	1767	2	look upstream

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05C	CC	1768	3	small concrete dam on west side

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05C	CC	1769	4	same concrete dam as #1768, east side

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05C	CC	1770	5	middle part of dam condition, look downstream

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05C	CC	1771	6	look downstream

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05C	CC	1772	7	look upstream to Fish Lake

GPS #

H. PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
FL05C	CC	1773	8	look upstream to Fish Lake

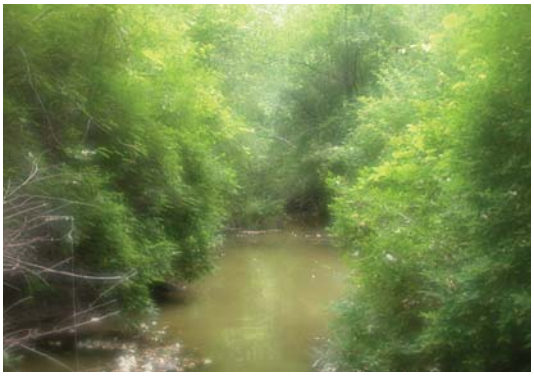
GPS #

Roll#1768 - Photo#3

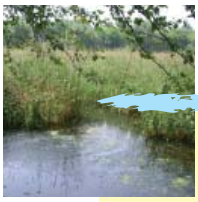
Roll#1772 - Photo#7

Roll#1769 - Photo#4

Roll#1770 - Photo#5



Roll#1771 - Photo#6



Appendix 3 - Wetlands Field Report

CONSERVATION DESIGN FORUM

Landscape Architecture · Community Planning · Ecological Restoration · Resource Management

375 West First Street
Elmhurst, Illinois 60126
630.559.2000 *phone*
630.559.2030 *fax*
www.cdfinc.com

FIELD REPORT

DATE OF REPORT:	9 July 2002
DATE OF OBSERVATION:	14 June 2002
PROJECT NAME/#:	Fish Lake Drain (CDF #02018.00)
REPORT BY:	Katherine Maurer– CDF
TO:	Sandra Kosek, Tom Price, Chingwen Cheng – CDF

REPORT

On Friday, June 14th, Sandra Kosek and Katherine Maurer of CDF visited the wetland areas (and several natural areas) within the Fish Lake Drain Watershed. The purpose of this field exercise was to compile existing ecological data on natural habitats and/or species within the project area, present a summary of these data in narrative form, and confirm or determine the quality (both hydrologically and biologically) or existence of those wetlands previously identified.

Prior to the site visit, we reviewed Lake County ADID (Advanced Identification) wetland maps and Natural Features Inventories (provided by the IDNR) and highlighted those areas that should be field investigated. The USFWS and IDNR also verified the presence of endangered and threatened species known from within the project area. In general, state-endangered species include any species that is in danger of extinction as a breeding species in Illinois; and, state-threatened species include any breeding species that is likely to become a state-endangered species within the foreseeable future in Illinois. Federally-endangered species include any federally-threatened species include any species that is likely to become an endangered species within foreseeable future throughout all or a significant portion of its range.

Each of the target areas was either viewed from the vehicle or was traversed (when easily accessible). Field notes were recorded and photographs were taken for each of the target areas. Site observations and a summary of the available data (mostly from the ADID studies) for the higher quality wetland areas are addressed below. Two adjacent ADID wetlands have also been discussed.

Attached are photographs, a summary table, site ADID wetlands map, and a map of each of the wetlands/natural areas identified (including those areas not identified as ADID).

ADID Wetland 72 – Molidor Road Marsh

This approximately 18-acre wetland is primarily comprised of an open water deep marsh community dominated by cattails. The wetland is a cycling/hemi-marsh (open water with interspersed vegetation), which provides good waterfowl habitat. In general, this wetland exhibits high biological values for the presence of a high quality wildlife habitat; however, it also provides high water quality values for stormwater storage and sediment/toxicant retention. Management problems include salt run-off from Route 12, agricultural runoff, and sedimentation.

ADID Wetland 73 – Fish Lake

This approximately 230-acre wetland complex is primarily comprised of three plant community types: a degraded aquatic bed/open water habitat (dominated by Coontail) in the center of the wetland, a high quality sedge meadow/calcareous wet prairie (dominated by sedges, Prairie Cordgrass, Little Bluestem, and Indian Grass) to the east, and an oak hickory savanna amongst the campground infrastructure to the west. In general, this wetland exhibits high biological values for the presence of a high quality plant community and wildlife habitat; however, it also exhibits high water qualities for significant stormwater storage, shoreline/bank stabilization, sediment/toxicant retention, and nutrient removal/transformation. Management problems include shrub invasion and non-native herbaceous species.

ADID Wetland 81

This wetland is primarily comprised of an open water community dominated by cattails. In general, this wetland exhibits high water qualities for stormwater storage, sediment/toxicant retention, and nutrient removal/transformation. Management problems include low water levels, dominant Reed Canary Grass, salt run-off from Route 12. This wetland is connected to the Fish Lake complex.

ADID Wetland 101 - Singing Hills Forest Preserve/Monahan Lake

This approximately 648-acre wetland is primarily comprised of two plant community types: shallow marsh (dominated by cattails, Common Bur Reed, and Common Arrowhead) and sedge meadow (dominated by Common Tussock Sedge and Bottlebrush Sedge). There is also a floating mat component to this area (dominated by Steeple Bush, Marsh Shield Fern, and Common Water Plantain). The wetland is surrounded by an overgrown oak hickory savanna community. In general, this wetland exhibits high biological values for the presence of a high quality plant community; however, it also exhibits high water qualities for stormwater storage volume and sediment/toxicant retention. In addition, this site has been identified as rookery. Management problems include low water levels and areas dominated by Reed Canary Grass.

ADID Wetland 189 – Wooster Lake

This approximately 117-acre wetland is primarily comprised of an open water community with very little natural shoreline. In general, this wetland exhibits high biological values for the

presence of high quality (and endangered or threatened) wildlife; however, it also exhibits high water qualities for sediment/toxicant retention and nutrient removal/transformation. Management problems include high-density residential development to the east and west shoreline edges, siltation from the campground and residential development, and shoreline erosion. Threatened and endangered species have been identified within this area.

Adjacent High Quality Wetlands

ADID Wetland 66 – Stanley Road Bog
This approximately 17-acre wetland is primarily comprised of a low shrub bog. In general, this wetland exhibits high biological values for the presence of high quality (and endangered or threatened) wildlife; however, it also exhibits high water qualities for stormwater storage and sediment/toxicant retention. Management problems include presence of invasive species (Purple Loosestrife, Reed Canary Grass, Common Buckthorn, and Glossy Buckthorn) due to the alteration of water levels.

ADID Wetland 85 - Sargent marsh
This approximately 43-acre wetland is primarily comprised of an emergent marsh. This marsh has been described as a cycling marsh, which provides good hemi-marsh (open water with interspersed vegetation) habitat conditions. In general, this wetland exhibits high biological values for the presence of high quality (and endangered or threatened) wildlife; however, it also exhibits high water qualities for stormwater storage and sediment/toxicant retention. Management problems include presence of invasive species (Purple Loosestrife).

Summary of Findings

As would be expected form the large amounts of hydric soils found through the project area, many wetland habitats of varying qualities have been identified. All of these wetlands are associated with hydric soils, and they vary from high quality, remnant habitats such as wet prairie and sedge meadow to degraded areas such as farmed wetlands. Many remnant oak savanna areas were also identified within the project limits. Although varying in size, once combined, these areas do provide significant wildlife habitat and stormwater storage within the watershed.

A total of 9 state-listed species (both plants and animals) have been identified within or adjacent to the project area (mostly within the ADID wetland sites). These species include the following:

Chamaedaphne calucylata – Leatherleaf
Chlidonias niger – Black Tern
Etheostoma exile – Iowa Darter
Ixobrychus exilis – Least Bittern
Larix laricina – American Larch
Notropis heterodon – Blackchin Shiner
Notropis heterolepis – Blacknose Shiner
Podilymbus podiceps – Pied-billed Grebe
Xanthocephalus xanthocephalus – Yellow-headed Blackbird

No federally-endangered or threatened species occur in the vicinity of the project area.

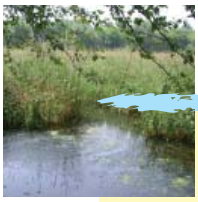
Recommendations

The key threats and cause for the degradation of these wetland and natural areas are sedimentation/siltation (affecting the water quality), salt runoff, agricultural runoff, alternating water levels, and invasion of non-native species (Purple Loosestrife, Reed Canary Grass, Common Buckthorn, and Glossy Buckthorn). In general, most of these problems are due to lack of management and stewardship of the native landscapes. A well-maintained stable native landscape provides significant groundcover (free of dense tree and shrub thickets), and absorption and infiltration of stormwater, thereby reducing run-off and soil erosion. It is our understanding that many of these areas are under private ownership. Education is critical to the health and longevity of these natural areas.

Significant efforts should be made to preserve and maintain the identified ADID sites as well as the additional wetlands and natural areas. Fire is the most critical stewardship item to maintain a native landscape in perpetuity. Continuous stewardship of the native landscape will enhance water quality, reduce soil erosion and the hydrologic effects of surface water run-off, improve wildlife habitat, and increase the aesthetic quality of the area. When properly restored, the existing habitat diversity contained throughout these areas will afford a marvelous resource that offers a setting of rare, natural beauty, as well as cultural significance.

In spite of the pressures imposed upon the landscape from residential and commercial development, conservation-oriented land planning on the part of the local communities can enhance the quality of the watershed. Planning should include not only the protection and buffering of all remnant habitats, but also incorporate greenway corridors to link these areas. Additionally, all off-site impacts to natural areas should be avoided, which would include increasing required buffer zones around all natural areas, minimizing soil erosion (particularly from construction sites), incorporating silt fencing, routine site inspections, etc.

Ecological monitoring should be implemented throughout the project area in order to assess impacts that occur as a result of land use changes, and ultimately, to better understand and protect the entire watershed.



Appendix 4-
Stormwater Management Toolbox

Expanded Stormwater Management Toolbox

FISH LAKE DRAIN WATERSHED MANAGEMENT PLAN
APPENDIX 4

EXPANDED STORMWATER MANAGEMENT TOOLBOX

INTRODUCTION

The watershed restoration and management techniques described in this appendix are broadly organized to reflect the watershed planning goals of:

- minimizing flood damages,
- improving water quality,
- protecting and restoring natural resources, and
- improving watershed stewardship.

Within each of the "goals" sections, the watershed measures are categorized as being either "preventative" or "remedial" in nature.

Preventative measures reduce the likelihood that new watershed problems such as flooding or pollution will arise, or that existing problems will worsen. Preventative techniques generally target new development in the watershed and are geared toward protecting existing resources and preventing degradation. Planning, regulatory and administrative programs and alternative site designs are examples of preventative measures. Prevention also includes measures that protect the natural drainage system through land acquisition and conservation management.

Remedial measures are used to solve known watershed problems or to improve current watershed conditions. Remedial measures include retrofitting drainage system infrastructure such as detention basins and stormsewer outfalls to improve water quality, adjust release rates, or reduce erosion. Both water quality and water quantity problems can be addressed by installing measures that improve infiltration and reduce runoff. Examples include disconnecting downspouts from stormsewers, installing biofilters and re-landscaping with deep-rooted native vegetation. Other remedial techniques range from stabilizing eroding streambanks and restoring wetlands, to floodproofing and constructing reservoirs for flood mitigation.

Maintenance programs for both the natural and created drainage infrastructure could be categorized as either remedial or preventative depending on the circumstances. For instance removing a load of debris that is blocking channel flow may remedy some localized backwater flooding, but a regular maintenance program would remove the debris before it causes a flooding problem. Under these circumstances, maintenance would be considered a preventative measure. For purposes of this plan, maintenance programs are placed in the preventative category since under almost all circumstances, timely maintenance will serve to prevent future problems.

Successful application of management techniques to improve or protect watershed conditions will depend on how well information about the techniques and their benefits is disseminated to the appropriate watershed stakeholders (and residents). Therefore, the importance of having active education and public outreach programs that inform the public and promote good watershed management cannot be over-emphasized.

1.0 MINIMIZING FLOOD DAMAGES

1A. PREVENTATIVE MEASURES: DON'T INCREASE FLOOD DAMAGE POTENTIAL

Flood prevention techniques seek to prevent flooding problems before they occur. Techniques such as zoning and floodplain regulations seek to prevent flood damages by limiting development in areas

where flooding is most likely to occur. Land acquisition maintains open space, preserving rainfall infiltration and natural storage areas. Several categories of flood prevention techniques involve runoff reduction. Runoff reduction techniques reduce flood damage potential at the source by decreasing the amount of runoff from a developed site. One category looks at improved infiltration on-site, the other uses alternative development techniques that include natural drainage measures and minimization of impervious surfaces.

1A.1 Floodplain Zoning

A zoning ordinance regulates development by dividing the community into zones or districts and setting development criteria for each district. Zoning can be used to control where new development or redevelopment occurs, so that new flood problems are not created and existing flood problems are not worsened. Two zoning approaches can be used to prevent inappropriate development in floodprone areas. They involve establishing separate zoning districts or using overlay zoning. Separate districts designate floodplain as a special zoning district that only allows development that is not susceptible to flood damage, such as some recreational uses, or conservation or agriculture. Overlay zoning adds special development limitations to the underlying zoning (i.e. residential, commercial, industrial etc.) in areas subject to flooding.

1A.2 Floodplain Regulations

In addition to zoning ordinances, regulations that restrict construction in floodplains are usually found in one or more of the following documents: subdivision ordinances, building codes, and/or separate "stand alone" floodplain ordinances such as the WDO in Lake County. If the zoning for a site allows a structure to be built, then the applicable subdivision and building regulations will impose construction standards to protect buildings from flood damage, and will require compensatory storage to prevent the development from aggravating the flooding problem. Subdivision ordinances specifically govern how land will be subdivided into lots, and set standards for infrastructure provided by the developer including roads, sidewalks, utilities, stormwater detention, stormsewers and drainage ways. Building codes should establish flood protection standards for all structures.

The IDNR regulates development in the floodplain through a permit program. For Lake County, IDNR has delegated floodplain permitting authority to the SMC subject to concurrence by the IDNR. All development in floodplains requires a WDO permit. The WDO restricts development in mapped floodways and limits development in the 100-year floodplain. Lowest floor elevations (including basements) must be a minimum of 2 feet above the base flood elevation (BFE) for residential structures constructed in the floodplain. Non-residential structures must also meet these lowest floor elevation requirements, or be dry-floodproofed to 2 feet above the BFE. In addition to elevating the structures, compensatory storage must be provided for water storage lost due to floodplain fill at a ratio of 1.2:1 for riverine floodplain and 1:1 for depressional floodplain.

All Lake County communities must adhere to the standards required in the WDO as minimum development requirements for their community. Depending on flood risk, individual communities can adopt floodplain regulations that are more restrictive than the minimum requirements of the WDO.

A significant amount of the development in Lake County occurred before the WDO became effective; therefore WDO requirements for detention and water quality treatment did not apply to these areas. However, the WDO applies to both new developments and redevelopment projects, the WDO flood prevention and water quality provisions have the potential to improve conditions in redeveloped areas or areas where homeowners desire significant improvements to their structures.

Tailoring the Lake County WDO to the specific conditions that exist in a particular subwatershed can be an effective tool to prevent further flood damage (and water quality degradation). The main provisions of the WDO that affect runoff are the maximum allowable release rates and the runoff volume reduction hierarchy. The release rate requirement applies to the maximum runoff rate that can occur from a

parcel after it has been developed. Currently, the maximum release rate is 0.04 cfs/acre for the 2-year 24-hour storm event and 0.15 cfs/acre for the 100 year, 24 hour storm event. An effective way to lower or maintain peak flows and to prevent new flooding problems is by establishing more stringent release rates specific to a subwatershed.

1A.3 Floodplain Acquisition

Floodplain acquisition can be an effective tool for reducing future flooding because it prevents developments in the floodplain. In addition to eliminating floodplain development and the resulting flooding damage, floodplain acquisition provides multiple benefits with the addition of amenities such as greenways, recreational trails, river access points and wildlife habitat corridors.

1A.4 Runoff Reduction

Runoff reduction is divided into two broad categories. One category of techniques improves infiltration of precipitation at newly developed sites or existing developments. The other involves implementing alternative site designs that incorporate nonstructural practices like preserving the natural drainage system and reducing the amount of impervious surface in newly developed or redeveloped areas.

1A.4.1 Infiltration Techniques

Natural Landscaping
One technique for reducing runoff (and thereby preventing new flooding problems) is the use of natural landscaping. Natural landscaping utilizes deep-rooted native vegetation such as grasses, wildflowers and wetland plants rather than turf grass in both new and existing developments. Natural landscaping has a number of benefits:

- It promotes increased infiltration of stormwater thereby reducing runoff.
- It filters runoff and improves water quality.
- Native vegetation and natural landscaping provides habitat for plants and animals.
- It costs less to install and maintain than conventional landscaping.

Some larger sites where native vegetation could be used include: institutional sites such as schools, churches and hospitals; office and industrial parks; housing developments; community parks; and golf courses. In addition to larger sites, native vegetation also is an appropriate replacement for traditional lawns and gardens on individual residential and commercial lots and can be very effective at infiltrating runoff from rooftops, decks, driveways and parking lots. Local landscaping and weed ordinances may need to be revised to allow for - and promote - the use of native vegetation. (Northeastern Illinois Planning Commission 1997; NRCS 1997a; Buslaff 1997; Highland Park Environmental Commission 1998).

Permeable Paving Blocks and Porous Pavement
Another way to reduce runoff from a site is to use permeable paving blocks or porous pavement. Permeable paving blocks contain openings that are filled with soil and planted with vegetation. Porous pavement uses large size aggregate material so that precipitation can rapidly infiltrate into the ground. Permeable paving blocks and porous pavement are effective techniques when used in low traffic areas such as emergency drives, overflow or seasonal parking lots and residential driveways. Using permeable paving blocks and porous pavement can reduce runoff volumes and pollutant loadings (Dreher and Price 1997).

Infiltration Devices
Infiltration trenches and basins are two similar runoff reduction devices. Infiltration trenches and basins are generally excavated depressional areas where stormwater runoff is directed. Infiltration areas are planted with appropriate vegetation (also referred to as bio-infiltration or bioretention practices) or covered with decorative rock. Both infiltration trenches and basins reduce runoff and recharge groundwater, thereby decreasing the need for stormwater storage. Bioretention/infiltration practices not only provide water quantity control benefits, but also improve water quality. These types of practices are especially appropriate as designed "rain gardens" that have the added advantage of being aesthetically pleasing. Individual yards and business sites can be designed or retrofitted to include bioretention practices.

Infiltration devices do have a few limitations. First, they may freeze up in winter making them temporarily ineffective. Designs should include a backup system for this circumstance. They may also require a sediment trap to reduce the frequency of clogging. More importantly though, infiltration trenches and basins require permeable soils (hydrologic soil groups A and B). When properly installed on sites with permeable soils, infiltration devices can be an effective tool for reducing the runoff rate, volume and pollutant loads (Dreher and Price 1997, Department of Environmental Resources Prince George's County 1997).

Alternative Site Designs
Alternative site design techniques are approaches that can be used for new developments and some redeveloped sites. Alternative site designs use a series of best management practices to:

- Reduce the amount of impervious surface area on the development site thereby reducing the amount of stormwater runoff and the risk of new flooding.
- Preserve the natural infiltration and storage characteristics of a site.
- Improve the water quality of runoff from a site by using the landscape to filter and infiltrate runoff.

Alternative site designs incorporate runoff reduction strategies, water quality enhancements, and protect more open space for infiltration and recreational opportunities. Alternative site designs use the following techniques: maintain the natural drainage system; use vegetated swales rather than traditional curb and gutter with a stormsewer system; reduce the percent of impervious surface; and cluster buildings (Dreher and Price 1997; Price, Dreher and Schaal 1994; Terrene Institute 1994; Schueler 1995; Arendt 1996).

When the techniques described in this section are used together on a development site to reduce runoff, this is referred to as a runoff reduction hierarchy. The goal of this hierarchy is to maintain runoff volumes and rates from the developed site as close as possible to pre-development conditions. When these techniques are combined with an integrated on-site system to also improve water quality, this system is called a treatment train. The goal of the treatment train is to reduce pollutants in urban stormwater runoff to the maximum extent possible through the use of multiple stormwater management techniques.

Natural Drainage Measures
A series of features that can be used in new development sites (and larger redevelopment sites) throughout the watershed are 'natural' drainage measures. Rather than using stormsewers, concrete-lined channels, or curbs and gutters, natural drainage measures use vegetated swales, filter strips and other techniques that absorb, filter and

convey runoff. Natural drainage measures can significantly reduce runoff volumes by allowing infiltration of stormwater, while conventional drainage systems such as stormsewers accelerate the delivery of runoff to the river or other receiving water body. In addition to infiltration benefits, natural drainage measures can remove pollutants from runoff by using vegetation to filter and absorb pollutants. Natural drainage measures often cost less to build than conventional drainage systems, and the use of native vegetation with natural drainage practices requires less maintenance and also provides wildlife habitat.

Impervious Area Reduction

The greater the amount of impervious surface, the greater the runoff volume will be from a site. In fact, NIPC estimates that, on an annual basis, stormwater runoff volumes from impervious surfaces such as parking lots are four times as great as the volume off of lawns (Dreher and Price 1997). Along with the increased amounts of runoff, there are also greater amounts of nonpoint source pollutants carried in the runoff.

TABLE J-1
RELATIONSHIP BETWEEN IMPERVIOUS COVER AND STREAM QUALITY

Impervious cover	Stream quality
0 -10 percent	good (stressed)
11 - 25 percent	fair (impacted)
>25 percent	low (degraded)

From: *Impervious Cover as an Urban Stream Indicator and a Watershed Management Tool*, Schueler & Claytor, The Center for Watershed Protection

Studies indicate that there is a direct relationship between the amount of impervious surface in a watershed and the quality of the receiving stream (Table J-1). There are several ways to reduce imperviousness through the use of alternative site design techniques. The two techniques that are often the easiest to implement are the use of alternative streetscapes and alternative parking lot designs.

Alternative Streetscapes

Alternative streetscapes are most often recommended and used in residential developments. Designing the development to include smaller turnarounds, narrower streets, narrower sidewalks and shorter setbacks are examples of impervious reduction practices in alternative streetscapes.

Residential streets should be designed for the minimum required pavement width needed to support travel lanes, parking and emergency and service vehicles, and should be based on the volume of traffic. Excessive pavement widths make streets the largest single component of impervious cover in a subdivision, therefore, narrowing streets can significantly reduce the amount of impervious surface. For example, reducing lower density residential street widths from 32 to 20 feet will result in an approximate 18 percent reduction in impervious surface for a typical ¼ acre lot subdivision, and a 6 percent reduction in impervious area over an entire watershed (Table J-2).

TABLE J-2
INNOVATIVE SITE PLANNING TECHNIQUES AND THEIR EFFECT ON IMPERVIOUS COVER*

	Strategy	Impervious Reduction (%)
1	Reduce residential sidewalks by 50 percent by installing sidewalks on only 1 side of the street	1.3
2	Reduce residential sidewalks from 5 feet to 4 feet width	0.5
3	Reduce local access street widths from 32 feet to 27 feet Reduce local access street widths from 32 feet to 25 feet	2.5 3.5

	Reduce local access street widths from 32 feet to 20 feet	6.0
4	Reduce commercial parking by 5 percent Reduce commercial parking by 10 percent Reduce commercial parking by 20 percent	2.7 5.3 10.7
5	Reduce multifamily parking by 5 percent Reduce multifamily parking by 10 percent Reduce multifamily parking by 20 percent	0.7 1.5 3.0
6	Reduce commercial, industrial and multifamily roof areas by 10 percent Reduce commercial, industrial and multifamily roof areas by 20 percent	4.3 8.5

* From: Center For Watershed Protection, *Estimating Current and Future Impervious Cover (draft), 1998.*

Examples of narrow residential street widths range from 16-20 feet with no parking, to 26-28 feet with parking. "Several national engineering organizations have recommended that residential streets can be as narrow as 22 feet in width (AASHTO, 1994; ASCE, 1990) if they serve neighborhoods that produce low traffic volumes (less than 500 daily trips, or 50 homes)."[1] Narrower streets also tend to discourage cut-through traffic and speeding. Turnarounds offer another opportunity to reduce unnecessary street pavement. A hammerhead design requires the least amount of pavement. Additionally, cul-de-sacs can be constructed with a smaller radius and the center can be recessed, left open and landscaped for runoff infiltration and snow storage in the winter.

Another significant reduction in impervious area can be achieved by reducing building setbacks. Reduced setbacks result in shorter driveways and less impervious surface. For example a 30 foot setback decreased to 20 feet still allows sufficient length for parking in the driveway. However, it eliminates 10 feet of wasted driveway space (and impervious surface) that was too short for another car length. This design practice adds the benefit of more back yard, which tends to be utilized for "living space" more than front yard areas.

Sidewalk area can also be decreased to reduce imperviousness without losing functionality. For example, sidewalks can be narrowed from 5 feet to 4 feet in residential areas, and/or only installed on one side of the street. Another option for reducing paved area is to design pervious paths located away from the streetscape as an alternative to traditional sidewalks. Overall, combining the above reductions in impervious area from narrower streets, smaller turnarounds, shorter setbacks and narrower sidewalks will result in a significant reduction in imperviousness within a development (Dreher and Price 1997).

Alternative Parking Lot Designs

Alternative parking lot designs that reduce impervious surface can be used in most types of non-residential developments and some multi-family developments. Techniques used to reduce parking lot runoff include either reducing the size of the paved parking lot, or designing the parking lot to catch and infiltrate runoff.

Several techniques used to reduce the size of parking lots include:

[1] Better Site Design: A Handbook for Changing Development Rules in Your Community, Pg. 29, Center for Watershed Protection, 1998.

- reviewing and updating peak parking demand assumptions to make sure that allocated parking is actually needed and being used;
- banking parking for new developments rather than constructing a parking lot that will initially be oversized;
- reducing the size of some of the parking stalls for smaller vehicles;
- sharing parking lots between users.

Parking lot designs that increase infiltration usually incorporate excavated islands or swales between rows of cars where runoff is directed through curb cuts. The vegetated swales infiltrate and filter the runoff, thereby reducing the volume of stormwater directed to stormsewers. Alternative parking lot designs frequently cost less to build and maintain than traditional lots. For example, bio-swales used in a parking lot at the Oregon Museum of Science and Industry resulted in a $78,000 savings compared to a conventional lot design (NRCS 1997a).

1A.4.2 Stormwater Regulations

Runoff Reduction Hierarchy

A matter of policy debate is whether some or all of the runoff reduction techniques presented in the preceding section should be implemented on a voluntary basis, or be required as a part of a stormwater management regulatory program. In Lake County, the WDO includes a runoff reduction hierarchy that is intended for use when designing and permitting new developments. The hierarchy is found in Table J-3. The runoff volume reduction hierarchy specifies that sites should choose a strategy that minimizes the increase in runoff volumes and rates from development, but the WDO does not provide explicit incentives for developers to use the hierarchy. Therefore, the runoff reduction hierarchy is not given as much consideration in designs as it should, and is frequently overlooked during review.

Experience has shown that permit reviewers from certified communities have interpreted the requirements of the hierarchy in different ways, therefore the hierarchy has not been consistently applied throughout the county. The runoff volume reduction hierarchy language in the WDO was amended in 1999 to provide more clarity. Individual communities have the greatest authority to improve the use and effectiveness of the hierarchy by attaching density or other incentives to its use.

TABLE J-3
WDO RUNOFF VOLUME REDUCTION HIERARCHY

1. Preservation of natural resource features of the development site (e.g. floodplains, wetlands, isolated Waters of Lake County, prairies and woodlands).
2. Preservation of the existing natural streams, channels, and drainageways.
3. Minimizing impervious surfaces created at the site (e.g. narrowing road width, minimizing driveway length and width, clustering homes, and shared driveways).
4. The use of open vegetated channels to convey stormwater runoff.
5. Preservation of the natural infiltration and storage characteristics of the site (e.g. disconnection of impervious cover and on-lot bioretention facilities).
6. Structural measures that provide water quality and quantity control
7. Structural measures that provide only quantity control and conveyance

Stormwater Detention

The WDO emphasizes the use of detention as the primary stormwater management control measure for Lake County. Detention is used to prevent an increase in the rate of runoff from a site after it is developed, and is the designated measure to achieve the post-development release rates required by the WDO. The release rate requirements apply to all development where the total land area in an ownership parcel results in: 1) more than one acre of impervious surface; or 2) has more that 3 acres of hydrologically-disturbed area (unless the new impervious surface is less than one-half acre); or 3) has an impervious surface area ratio of 50 percent or greater (unless the new impervious surface is less than one-half acre). The additional volume of runoff generated by new impervious surface is not directly addressed in WDO requirements, although the runoff reduction hierarchy (presented in the previous section) is designed to mitigate the effects of increased runoff.

1B. REMEDIAL MEASURES: REDUCE FLOOD DAMAGE POTENTIAL

Flooding and other water quantity problems can be reduced by both structural and non-structural means. Structural flood control measures require the building of structures such as reservoirs, levees and floodwalls to control the flow of floodwaters and to reduce flood damages. Non-structural measures include practices such as acquisition or relocation of floodprone buildings, floodproofing and use of runoff reduction techniques such as native landscaping.

1B.1 Structural Flood Control

Structural measures control or contain water and are generally designed to prevent floodwaters from reaching buildings. Structural alternatives generally include reservoirs, levees and floodwalls, diversions, stream channel conveyance improvements and drainage and stormsewer improvements. Because of their size and cost, structural projects are often implemented with help from state or federal flood control agencies such as the Illinois Department of Natural Resources - Office of Water Resources, USACE, and the NRCS.

Since structural flood control is generally the most expensive type of mitigation measure in terms of installation time and costs, maintenance requirements and environmental impacts, a thorough assessment of alternatives should be conducted before choosing a structural flood control measure. The advantages and disadvantages of structural flood control techniques are discussed in Table J-4 (Association of State Floodplain Managers 1996).

TABLE J-4
BENEFITS AND DRAWBACKS TO STRUCTURAL FLOOD CONTROL MEASURES

Advantages	Shortcomings
♦ May provide the greatest amount of protection for land area used. ♦ Because of land limitations, may be the only practical solution in some circumstances. ♦ Can incorporate other benefits into structural project design such as water supply and recreational uses. ♦ Regional detention may be more cost-efficient and effective than requiring numerous small detention basins.	♦ They disturb the land and disrupt natural water flows, often destroying wildlife habitat. ♦ They require regular maintenance, which if neglected, can have disastrous consequences. ♦ They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage. ♦ They can create a false sense of security, as people protected by a project often believe that no flood can ever reach them. ♦ Although it may be unintended, in many circumstances they promote more intensive land use

	and development in the floodplain. ♦ They can create new flooding problems if improperly designed or built. ♦ Levees and reservoirs can significantly degrade riparian and aquatic habitat and water quality.

1B.1.1 Reservoirs/Regional Detention

Reservoirs and regional detention are large structures that control flooding by holding high flows behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that is equal to or less than the capacity of the downstream channel. Reservoirs that maintain a normal water level may be used for water supply and/or to provide water-based recreational benefits. In addition, wet or dry detention basins can serve multiple uses by doubling as parks or providing other open space uses.

The amount of land needed, coupled with the expense of construction, management and maintenance limit the use of reservoirs. Additionally, reservoirs may fail to prevent floods that exceed their design levels; may eliminate the natural and beneficial functions of the floodplain; and may negatively impact water quality and aquatic habitat. Impoundments are also known to affect temperature, pH, dissolved oxygen and nutrient transport. In addition, reservoirs frequently act as giant sediment basins accumulating sediment over a period of years that reduces stormwater storage capacity.

1B.1.2 Detention Basins

Some localized flooding problems can be remedied by enlarging or adjusting flows through existing detention basins, or by constructing new basins. Detention basins are considered to be effective at flood reduction in watersheds of up to 30 square miles. While regional detention is generally more cost-effective than constructing numerous small detention facilities, in some cases there may not be sufficient land available for regional detention. Also, for very localized flood problems, a smaller detention basin may be the most economical solution. In addition, slowing release rates from new and existing detention basins can reduce the downstream flood risk and some of the impacts of flashy hydrology on the stream channel.

Sometimes many of the known flood problem areas in a subwatershed suffer flood damage primarily caused by poor local drainage or a depressional location rather than flood damage from overbank flooding. Retrofitting older detention basins with restrictors that regulate the 2-year event, expanding detention basin capacity where feasible and installing new detention in localized flood problems areas are three types of retrofit opportunities available to reduce flood damage potential at these types of flood problem sites.

1B.1.3 Levees and Floodwalls

Earthen levees or concrete floodwalls are erected between the river or lakes and the properties to be protected. Levees and floodwalls confine water to the stream channel by artificially raising the banks. Levees must be well designed to account for large floods, underground seepage, pumping of internal drainage and erosion and scour. A serious concern with levees is that they frequently offer a false sense of security. In some cases land use behind a levee can change to high intensity, high-value occupation under the false assumption that all future floods will be controlled by the levee, when in

reality, large floods may overtop or breach the levee creating more flood damage than would have occurred. Problems also arise when the present runoff volume in the channel exceeds the design capacity of older levees that were constructed for lower flow conditions.

Levees and floodwalls have other limitations. Placed along the lake, river, or stream edge, they degrade riparian and aquatic habitat. Levees are expensive to construct, require considerable land and maintenance and are more likely to push floodwater onto other properties upstream or downstream. In some cases, it may be necessary to include expensive and noisy pumping operations for internal drainage. Levees also act as barriers to river access, block views and disrupt local drainage patterns.

1B.1.4 Barriers

Constructing barriers such as low floodwalls and berms around an individual property can keep floodwaters from reaching the building. Berms are commonly used in areas subject to shallow flooding. Not considered engineered structures, berms are made by re-grading or filling an area. Low floodwalls may be built around stairwells to protect the basement and lower floor of a split-level home. By keeping water away from the building walls, the problems of seepage and hydrostatic pressure are reduced.

As with levees, the use of floodwalls and berms must also include a plan to install drainpipes and/or sump pumps to handle leaks and water seepage through or under the barrier, and to get rid of water that may collect inside. Care must be taken in the design, location and installation of berms or floodwalls to insure that floodwaters are not inadvertently pushed onto adjacent properties.

1B.1.5 Improved Channel Conveyance

Channel conveyance improvements alter the channel so that more water is carried away at a faster rate. Improvements generally include making the channel wider, deeper, smoother and/or straighter. Some channels in urban areas have also been lined with concrete or put in underground pipes.

Straightening, deepening and/or widening a stream or river channel, commonly referred to as ‘channelization’, has traditionally been the common remedy for local drainage or flooding problems. Channelized rivers and streams drain water faster from area adjacent to and upstream of the channel, but can create or worsen flooding problems downstream as larger volumes of water are transported at a faster rate. Channelized waterways tend to be unstable and experience more streambank erosion. Therefore, the need for periodic reconstruction, streambank stabilization and silt removal becomes cyclic in these circumstances making stream and channel maintenance very expensive.

Dredging is another type of conveyance improvement. It is frequently cost prohibitive due to the expense of disposing of the dredged material. In addition, unless instream and/or upstream tributary erosion are corrected, the dredged areas usually fill back in within a few years, and the process and expense have to be repeated. Channel conveyance improvements such as channelization and dredging are considered to be environmentally destructive. Pool/riffle and riparian habitat are lost negatively impacting both aquatic and terrestrial plants and animals. Increased water temperature and higher turbidity are two types of water quality impacts associated with improved channel conveyance.

1B.1.6 Drainage Improvements

Drainage improvements can be in the form of open ditches, swales or stormsewers. Man-made ditches and stormsewers help drain areas where the surface drainage system is inadequate, or where underground drainageways may be safer or more practical. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and stormsewer improvements usually are designed to carry the runoff from smaller, more frequent storms. Stormsewer improvements include installing new sewers, modifications of sewer inlets, installing larger pipes and using measures such as flap gates to prevent back flows.

Because drainage ditches and stormsewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving stream or river has sufficient capacity to handle the additional volume and flow of water. To reduce the cumulative downstream flood impacts of numerous small drainage projects, additional detention and/or runoff reduction practices should be undertaken in conjunction with drainage system improvements.

In some areas, streets, parking lots or athletic fields can be modified to store water from larger, less frequent storms to relieve and reduce overloading of the local drainage system. Although street modifications for stormwater storage are not appropriate in all areas, in many circumstances, they can be more effective and less expensive than increasing the size of receiving stormsewer systems.

1B.2. Non-Structural Flood Control

In addition to structural controls for flood remediation, flooding problems can also be addressed using non-structural means. Some of the non-structural flood control techniques include floodproofing, acquisition of floodplain buildings, building elevation and building relocation. More communities and county-wide agencies could get involved in non-structural programs such as acquisition by helping to identify repetitively flooded properties.

In addition to being used for prevention, runoff reduction techniques may also be used by individual homeowners or neighborhood associations in retrofit projects to lessen flooding problems.

1B.2.1 Building Relocation

Moving a building to higher ground is an extremely effective way to protect it from flooding. While almost any building can be moved, the cost goes up for heavier structures, such as those made of brick, and for large or irregularly shaped buildings. Building relocation is generally cost-effective where flooding is relatively severe and/or frequent. Buildings that have suffered structural damage or contamination from frequent or long duration flooding should not be considered for relocation.

While relocation is typically the responsibility of the building owner, government-sponsored loans or grants may be available for cost-share. Communities and county-wide agencies could play a greater role in building relocation by improving public and local official awareness of this option, and by identifying buildings or properties well-suited for relocation and seeking potential cost-share funds to assist individual property owners.

1B.2.2 Buyouts/Acquisition

Like relocation, acquisition ensures that buildings in a floodprone area will cease to be subject to damage. The major difference is that acquisition is undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to an appropriate public use such as a park. Acquiring and clearing buildings

from the floodplain is not only the best long-term flood protection measure; it also is a way to convert a problem area into a community asset that can provide environmental and recreational benefits.

More communities and countywide agencies could get involved in acquisition by:

1. improving public awareness of this option;
2. budgeting the 25 percent matching funds necessary for state and federal funding;
3. establishing guidelines for determining when acquisition is preferable to flood control or flood proofing; and
4. prioritizing properties for purchase.

To achieve maximum benefits from this type of public investment, acquisition and land reuse should be a component of a community's redevelopment plan, and be incorporated as a strategy in park, greenways and capital improvement plans.

1B.2.3 Building Elevation

Raising a house above the flood level is the best way to protect a structure that cannot be removed from the floodplain. The structure is elevated on a foundation or piers so that the lowest floor is above the base flood elevation. When flooding occurs, water levels stay below the main floor, causing no damage to the structure or its contents. Raising a building above the flood level is cheaper than moving it, and can be less disruptive to a neighborhood. Commonly practiced in floodprone areas nationwide, this protection technique is required by law for new and substantially damaged residences located in a 100-year floodplain.

Although flood damages can be reduced significantly or eliminated through building elevation, there are some limitations to remaining in a flood prone location. While the building itself is sufficiently elevated to be protected from flood damage, flooding may isolate the building and make it inaccessible. Flood waters surrounding the building can also result in a loss of utility service or septic use, making the building uninhabitable. Additionally, pollutant contamination in floodwaters may present health and safety concerns.

1B.2.4 Floodproofing

Floodproofing measures can provide either wet floodproofing or dry floodproofing. In areas where there is shallow flooding, dry floodproofing measures can be used to prevent water from entering some buildings. A wet floodproofing strategy allows water to enter the building, but moves damageable belongings, appliances and utilities out of harm's way. Wet floodproofing includes some of the least expensive and easiest mitigation practices to install. Although floodwaters are not controlled, with wet floodproofing damage can be greatly reduced.

Dry Floodproofing
Dry floodproofing is a combination of practices that are used to seal a building against floodwaters. The building must be waterproofed; that is, walls, floors and all openings must be sealed and made watertight. Buildings with crawlspaces generally cannot be dry floodproofed because water can seep under walls into the crawlspace. However, buildings on slabs and buildings with basements can benefit from dry floodproofing.

Because of the need to address hydrostatic pressure, a structural engineer should be consulted when designing the dry floodproofing measures. If a dry floodproofed

structure is not sufficiently reinforced, basement walls and floors can become cracked, buckled or broken by the pressure of floodwater.

Wet Floodproofing

Wet floodproofing protects from damage when floodwaters cannot be kept out of a building. It is a relatively simple means of making sure that nothing gets damaged or ruined when floodwaters get in. Wet floodproofing techniques range from moving a few valuable items to a higher floor, to totally rebuilding the area that floods. At the very least, several low-cost steps can be taken to wet floodproof a structure. Simply moving furniture and electrical appliances out of the floodprone portions of the building can prevent thousands of dollars in damages. One strong advantage is that no matter how little is done; flood damage will be reduced.

Wet floodproofing measures work in cases where there is a level above the flood zone to which items can be relocated. It generally does not work for one-story houses where living areas get flooded. An advantage of using wet floodproofing vs. dry floodproofing is that by allowing water in the structure, the danger of wall collapsing due to uneven pressure is alleviated.

1B.2.5 Runoff Reduction

Examples of runoff reduction techniques that can be installed as retrofits in developed areas include the use of natural landscaping, permeable pavement, infiltration trenches, basins or swales, and disconnection of downspouts from impervious areas. Descriptions of natural landscaping, permeable pavement and infiltration techniques were provided in the flood prevention section. Disconnecting downspouts is relatively simple and inexpensive. In these cases, runoff from rooftops is collected in rainbarrels or diverted directly to lawns or rain gardens (bioretention areas) for infiltration.

Implementing these runoff reduction retrofits is generally the responsibility of individual property owners. While these techniques may not have a significant impact when applied individually on a single site, the cumulative effect when used at numerous sites throughout the watershed can result in significant flood reduction benefits. For example, a 1989 engineering report by Baxter & Woodman for the City of Highland indicates an average-sized home in Highland Park can contribute 3,000 gallons to sewers during a one-hour duration, 2-year frequency storm (1.45 inches).[2] Since public participation is necessary for watershed effectiveness, an aggressive public information and outreach effort should be used for implementation of these techniques.

1B.2.6 Insurance

Insurance does not prevent flooding or flood damage; it helps owners protect their property investments by paying for repairs and replacement of items damaged in a flood. While a typical homeowner's insurance policy does not cover flood damages to property, flood insurance coverage is available through the NFIP, as is additional basement backup insurance.

Federal law demands that all federally insured lending institutions require that buildings located in the 100-year floodplain have flood insurance. Flood insurance is available to anyone located within a community that participates in the NFIP regardless of their location respective to the mapped floodplain. Both Antioch and Lake Villa are members of the NFIP. However, neither participates in the Community Rating System (CRS), which is a program that credits a community for exceeding the minimum requirements of

[2] Pages 3-5, Baxter & Woodman, City of Highland Park Stormwater Master Plan, Nov. 1989.

the NFIP. Residents of CRS communities pay reduced flood insurance rates as a result of their community's flood mitigation activities. Lake County SMC provides technical and planning assistance to municipalities regarding NFIP compliance and to a limited extent for the CRS program.

2.0 IMPROVING WATER QUALITY

Pollutant sources affecting water quality can be place into one of two categories:

- point sources (such as pipe outlets to a stream) or
- non-point sources (such as overland runoff).

Each pollutant source presents a special set of problems. Point sources typically have produce higher flows at a given location and may require more expensive pollutant removal techniques. The diverse and diffuse nature of non-point pollutant sources present a challenge by requiring various techniques to be applied at numerous sites throughout the watershed, but the techniques can sometimes be as simple as providing vegetative buffers.

It is notable that the causes and sources of impairment may be considerably different for streams and lakes. For instance, lakes may act as natural sinks for many non-point source pollutants and may be more susceptible than flowing streams to problems such as nutrient-induced eutrophication.

2A. PREVENTATIVE MEASURES: PRESERVE EXISTING WATER QUALITY

Preventative measures will address how land needs to be developed and maintained to reduce future increases in nonpoint pollutant loads. Traditionally, as land has been developed in a watershed, water quality has declined. If land continues to be developed in a traditional manner, it is anticipated that water quality will continue to degrade. The Lake County WDO provisions help protect water quality, but improvements will need to be made in development designs and in land management practices in order to further protect water quality.

Development design features are addressed in the water quality measures described below. Individual property owners play a significant role in implementing these measures, and in reducing the use of products and practices that contribute to water pollution. Maintaining streams and riparian buffers can also go a long way to preventing water pollution.

Several preventative techniques for protecting water quality include:

- Regulatory requirements.
- BMPs such as vegetative filter strips, waterway buffers, swales, wetland detention basins and stormwater filters.
- Preservation of riparian buffers along streams.
- Stream maintenance program.
- Nonpoint source pollution prevention program.

2A.1. Regulatory Requirements

Regulatory requirements for water quality protection can be incorporated into state and federal statutes and administrative rules, or in local ordinances. Nonpoint pollution from new developments can be most effectively addressed at the local level since local units of government are responsible for land use planning and development approvals. As a result of past problems, many local municipalities and counties have water quality provisions in development ordinances or in separate soil erosion and sediment control ordinances. In addition to local controls, the federal Clean Water Act includes several requirements directed at nonpoint pollution. Water quality impacts are considered in stormwater

permits for large municipalities, wetland permitting (Section 404) and with soil erosion and sediment control requirements for new developments (Rule 5).

2A.1.1. Lake County WDO Requirements

The Lake County WDO contains three primary requirements that address water quality:

- treatment with Best Management Practices (BMPs),
- soil erosion and sediment control measures during construction, and
- buffers for water bodies.

Water Quality Treatment with Best Management Practices (BMPs)
The WDO requires the use BMPs to treat at least 0.01 inches of runoff for every one percent of impervious surface for developments that will create more than 0.5 acres of impervious area. For example, the minimum treatment volume for a 2-acre site with 1.0 acres of impervious area would be: (50% impervious) x (0.01 inches) x (2 acres of tributary area) = 1 acre-inch = 3,630 cubic feet. A volume of 3,630 cubic feet is approximately equivalent to a 35-foot square filled 3 feet deep.

The ordinance does not dictate how water quality treatment should be done, it only requires that these runoff quantities be treated. The WDO generally references the Lake County Stormwater Management Commission's Technical Reference Manual for design guidance on water quality treatment BMPs.

The WDO does not include performance standards for the required BMPs. Therefore, while the effectiveness of various BMPs has been documented, variability in the application, maintenance and monitoring of the BMPs leads to variable results for preventing water quality impacts from development. The 1999 WDO amendments improved the clarity of what level of water quality treatment is required by the WDO. The 1999 water quality amendments have resulted in more consistent implementation of BMP requirements for water quality protection by all of the watershed communities; however, the WDO does not contain numerical effluent standards.

Soil Erosion and Sediment Control Measures
The second WDO requirement is the installation of soil erosion and sediment control measures on building sites to prevent erosion, or at minimum, to prevent sediment from leaving the site. Soil erosion/sediment control requirements include the use of filter barriers, sediment traps, settling basins, side slope stabilization, filters on stormsewer inlets, and temporary and permanent vegetative stabilization. Filter barriers (such as silt fence) are required for disturbed areas that drain less than 1 acre. Sediment traps are required for disturbed areas that drain from 1-5 acres, and sediment basins are required for disturbed areas greater than 5 acres. The soil erosion and sediment control provisions require an on-site pre-construction meetings prior to the commencement of earthmoving.

Buffers for Waterbodies
The third WDO water quality requirement is to provide buffers for waterbodies to filter sheet flow runoff before it drains into the waterbody. This requirement applies to streams, rivers, wetlands and lakes, and the buffer requirements vary depending on the type and quality of the water body.

2A.2. Water Quality Best Management Practices

A number of BMPs such as vegetative filter strips, buffers, swales, wetland detention basins and stormwater filters can be incorporated into new developments or redevelopment projects to reduce

water quality impacts. These practices will be described later in this section. To choose an appropriate BMP, it is essential to determine in advance the objectives to be met by the BMP and to calculate the cost and related effectiveness of alternative BMPs. Once a BMP has been selected, expertise is needed to insure the BMP is properly installed, monitored and maintained over time. BMPs to consider for the watershed and their potential effectiveness in meeting water quality objectives are presented in Table J-5.

Tables J-6 and J-7 depict percentage pollutant removal rates for different BMPs from data collected and reported by the Center for Watershed Protection (Center) in June 1997. These removal efficiencies are based on one hundred twenty-three performance monitoring studies that the Center compiled into a database. Because performance can be extremely variable within a group of BMPs, estimates of BMP performance should be considered as a long-run average, not as a fixed or constant value. (Schueler 1995, Claytor & Schueler 1996, Schueler 1997, Center for Watershed Protection 1998, Price & Dreher 2000).

Table J-8 shows the design factors and information on removal of various types of pollutants. The removal efficiencies were determined by case studies, published scientific papers and journal articles. For more information about design, construction costs, and performance parameters for each of these BMPs, please see the American Society of Civil Engineers "Guide for Best Management Practice Selection in Urban Developed Areas" (See American Society of Civil Engineers 2000 in the reference list.

2A.2.1. Riparian Buffers

Maintaining riparian buffers along stream and river channels can reduce some of the water quality and habitat degradation effects associated with increased imperviousness (and runoff) in the watershed. Riparian buffers provide hydrologic, wildlife habitat, recreational and aesthetic benefits as well as water quality functions. Sediment, phosphorus and nitrogen are at least partly removed from water passing through a naturally vegetated buffer (see Table J-9). The percentage of pollutants removed depends on the pollutant load, the type of vegetation, the amount of runoff and the character of the buffer area. The most effective buffer width can vary along the length of a channel. Adjacent land uses, topography, runoff velocity and soil and vegetation types are all factors used to determine the optimum buffer width. Where a standard width is needed for regulatory purposes, 100 feet is considered a minimum buffer width for typical surface water requirements. Wider buffers are recommended for more sensitive areas such as high quality streams and wetlands (Mitchell 1996).

The WDO requires the designation of linear buffers along all stream channels. When the channel has a watershed greater than 20 acres but less than one square mile, the required buffer width is 50 feet on each side of the channel. When the channel has a watershed greater than one square mile, a 30-foot buffer is required. Streams with and Index of Biotic Integrity (IBI) rating greater than 40 require a 100 foot buffer. These are the minimum requirements in the county.

TABLE J-5
BMP EFFECTIVENESS TOWARD MEETING BMP OBJECTIVES

BEST MANAGEMENT PRACTICE	BMP OBJECTIVE						
	Runoff Rate Control	Runoff Volume Control	Physical Habitat Preservation	Sediment Pollution Control	Nutrient Control	BOD Control	Other* Pollutant Control

Impervious Area Reduction	2	2	2	2	2	2	2
Impervious Area Disconnection	2	2	1	2	2	2	2
Filter Strips	2	2	2	2	2	2	2
Swales	2	2	1	2	2	2	2
Infiltration Devices	2	3	1	3	3	3	3
Porous Pavement	2	2	1	3	3	3	3
Wet Detention	3	1	2	3	2	3	2
Wetland Detention	3	1	2	3	2	3	2
Dry Detention	2	1	1	2	1	1	1
Settling Basins	2	1	1	2	2	2	2
Water Quality Inlets	1	1	1	2	1	1	1
Sand Filters	1	1	1	3	2	2	2
Rock Outlet Protection	1	1	2	2	1	1	1
Storage Area Cover	1	1	1	2	2	1	2-3
Street Sweeping	1	1	1	1-2	1	1-2	1-2
Source Controls	1	1	1	1	2	2	2
Stream Protection/ Restoration	2	1	3	2	2	2	1
Wetland Protection/ Restoration	2-3	2-3	3	2-3	2	2-3	2

Effectiveness Key:
3 = Fully achieves objective
2 = Partially achieves objective
1 = Does not achieve objective

* Other pollutants include toxic compounds such as heavy metals and pesticides, fecal bacteria, petroleum based hydrocarbons and deicing materials such as salt. A "2" in this column indicates that the BMP controls some of these pollutants but not others.

Source: Dreher 1994

TABLE J-6
COMPARISON OF MEDIAN POLLUTANT REMOVAL EFFICIENCIES AMONG SELECTED BMP GROUPS: CONVENTIONAL POLLUTANTS

		Median Stormwater Pollutant Removal Rate (Percent)					
Best Management Practice	**No. of studies[1]**	**Total Suspended Solids**	**Total P[2]**	**Soluble P[3]**	**Total N[4]**	**Nitrate**	**Carbon[5]**
Detention pond	2	7	10	2	5	3	(-1)
Dry ED* pond	6	61	19	(-9)	31	9	25
Wet pond	30	77	47	51	30	24	45
Wet ED* pond	6	60	58	58	35	42	27
PONDS [A]	36	67	48	52	31	24	41
Shallow marsh	14	84	38	37	24	78	21
ED* wetland	5	63	24	32	36	29	ND
Pond/wetland	11	72	54	39	13	15	4
WETLANDS	35	78	51	39	21	67	28
Surface sand filters	6	83	60	-37	32	(-9)	67
FILTERS [B]	11	87	51	-31	44	(-13)	66
CHANNELS	9	0	(-14)	(-15)	0	2	18
SWALES [C]	9	81	29	34	ND	38	67

* ED = extended detention
[1] Number of performance monitoring studies
[2] Total P = total phosphorus
[3] Soluble phosphorus as measured as ortho-P, soluble reactive phosphorus or biologically available phosphorus.
[4] Total N = total nitrogen
[5] Carbon = measure of organic carbon (BOD, COD or TOC)
[A] Excludes conventional and dry ED ponds.
[B] Excludes vertical sand filters and vegetated filter strips
[C] Includes biofilters, wet swales and dry swales

TABLE J-7
MEDIAN POLLUTANT REMOVAL REPORTED FOR SELECTED BMP GROUPS: FECAL COLIFORM, HYDROCARBONS AND SELECTED TRACE METALS

	Median Stormwater Pollutant Removal Rate (Percent)

Best Management Practice	Bacteria [E]	Hydro-Carbons [F]	Cadmium	Copper	Lead	Zinc
Detention and Dry ED* Ponds	ND	ND	54	26	43	26
Ponds [A]	65	83	24	57	73	51
Wetlands	77	90	69	39	63	54
Filters [B]	55	81	--	34	71	80
Channels	0	ND	55	14	30	29
Swales [C]	(-50)	62	42	51	67	71

* ED = extended detention
[A] Excludes conventional and dry ED ponds.
[B] Excludes vertical sand filters and vegetated filter strips
[C] Includes biofilters, wet swales and dry swales
[D] The number of studies is less than 5 for some BMP groups for bacteria, TPH, Cd and medians should be considered provisional.
[E] Bacteria values represent mean removal rates.
[F] Hydrocarbons measured as total petroleum hydrocarbons or oil/grease.

TABLE J-8
A GUIDE FOR BMP SELECTION IN URBAN DEVELOPED AREAS

Area	BMP									
	Land Area Needed	Distance Above Groundwater	Soil Type Needed	Cost	Maintenance	Total Nitrogen Percent Removal	Total Phosphorus Percent Removal	Suspended Solids Percent Removal	Heavy Metals Percent Removal	Floating Trash Removal
Ponds										
Dry Retention Online	High	2 ft.	A or B	High	Medium	60-98	60-98	60-98	60-98	High
Dry Offline Retention or Detention	High	2 ft.	A or B	High	Medium	60	85	90	65-85	High
Wet Detention	High	NA	Any	High	Low	40	50	85	25-70	High
Wet Detention with	High	NA	Any	High	High	25	65	85	60-85	High

Filtration										
Dry Detention	High	1 ft.	A or B	High	Medium	15	25	70	35-70	High
Alum System		NA	NA	High	Very High	50	90	90	80-90	0
Wetlands	High	0 ft.	C or D	High	High	Varies Widely	Varies Widely	High	High	High
Sand Filters	Range from Medium to High	Range from 2-7 ft.	NA		High	31-47	40-70	57-95	20-84	NA
Baffle Boxes	Low	NA	NA	Medium	Medium	0	30	20-90	Unknown	Low
Vegetated Swales	Medium	Low	A,B,C	Medium	Low	0-25	29-45	60-83	35	Low
Buffer Strips	Low	1-2 ft.	A,B,C	Medium	Low	20-60	20-60	20-80	20-80	Low
Infiltration Trenches	Low	2-4 ft.	A or B	Medium	High	45-70	50-75	75-99	75-99	High
Inlet Devices	None	NA	NA	Low	High	****	****	Low-Medium	Low	High

Note:

**** Traps particulate phosphorus and nitrogen in the form of leaves and grass – not effective for dissolved nutrients.

TABLE J-9
POTENTIAL POLLUTANT REMOVAL CAPABILITY OF URBAN STREAM BUFFERS*

Pollutant	Potential ** Removal Rate
Sediment	75 percent
Total nitrogen	40 percent
Total phosphorus	50 percent
Trace metals	60-70 percent
Hydrocarbons	75 percent

* From: Center For Watershed Protection, Site Planning for Urban Stream Protection, 1995.
**Potential removal rate based on combined 25-foot grass strip in outer zone and 75 foot forested buffer in middle and streamside zone.

Several state and federal programs exist to provide incentives for maintaining riparian buffers. The Wetlands Reserve Program makes funding available for the purchase and restoration of wetlands and riparian buffer connections between wetlands. The Illinois Buffer Partnership promotes and supports the voluntary efforts of farmers and landowners in the planting, maintenance and enhancement of streamside buffers. Property tax incentives for conservation also include reduced assessments for land dedicated to open space, conservation easements on natural areas and common areas in developments through the Real Property Conservation Rights Act and the Natural Areas Preservation Act.

2A.3. Stream Maintenance

Stream maintenance includes an ongoing program to remove blockages caused by accumulated sediment and overgrown weedy, non-native vegetation or debris, along with the repair of eroded streambanks. “Debris” refers to a wide range of materials that may include tree limbs and branches that accumulate naturally and large items of trash or lawn waste accidentally or intentionally dumped into channels or drainage swales. Routine clearing of debris from streams is a cost effective measure to prevent flooding. In addition to sediment and debris removal, stream maintenance can also involve using BMPs to stabilize eroding streambanks. However, stream maintenance activities normally do not alter the shape of the channel (Dreher and Heringa 1998; Stowe and DuPage County 1991; Wildlife Society 1983; Illinois Department of Natural Resources 1983).

In Lake County, parks, public works or highway departments, the Forest Preserve District and/or drainage districts (where rights-of-way are established or easements have been granted) generally are responsible for channel maintenance. Many subwatersheds in Lake County do not have a drainage district. For streams located on private property in subwatersheds without a drainage district, stream maintenance is the responsibility of the private property owner.

Channel maintenance and restoration have been a component of several river and stream projects in other parts of Lake County. These projects include an extensive restoration in the headwaters of the West Fork of the North Branch Chicago River undertaken by the Village of Lincolnshire. The restoration project included streambank stabilization (using bioengineering techniques), natural area and wetland restoration and re-connection of the stream to its floodplain. The Lake County Forest Preserve District also worked on a project to stabilize the Middle Fork of the North Branch Chicago River at it Middle Fork Savanna property using bioengineering and pool/riffle complexes.

The Lake County SMC has developed “A Citizen’s Guide for Riparian Area Management”, which educates landowners about debris removal and riparian landscaping. There is currently no coordinated program or maintenance standards established at the county-level for on going stream maintenance.

Maintenance is typically done as needed in response to problems or complaints about blockages or erosion. SMC anticipates adopting environmentally friendly stream maintenance standards in the future to provide guidance and consistency for projects throughout Lake County. In the interim it is recommended that the guidelines adopted by DuPage County[3] or the American Fisheries Society[4] be used.

2A.4. Nonpoint Source Pollution Prevention Program

Pollution prevention or source reduction programs reduce the generation and exposure to the elements of pollutants that collect on streets, parking lots and other surfaces and eventually wash into streams, rivers and lakes. Because nonpoint pollution is generated in relatively small amounts from numerous sites (including homeowner's lawns and driveways, schools, construction sites and businesses), the most effective source reduction programs are community programs that include a combination of regulation, guidance and education.

Source controls keep pollutants from entering the stormwater in the first place. In most cases, source controls are more cost effective than structural water quality BMPs to reduce pollutant loading. However, a combination of source reduction and structural BMPs are usually the most effective method to control pollution from runoff.

Source reduction is simply changing everyday practices to reduce the quantity of pollutants that end up on the land and in the water. In addition to reducing pollutant inputs, pollution prevention programs also recommend using environmentally friendly products and changing the timing of some activities to minimize the amount of materials that wash off. Opportunities to reduce pollutant loads are numerous and range from recycling and reducing applications of lawn chemicals to driving less and minimizing road salt usage. Some common source reduction opportunities are listed in Table J-10.

TABLE J-10
SOURCE REDUCTION ACTIVITIES

Source Reduction Activity	Who's Responsible
1. Collect and recycle crankcase oil	homeowners, business, government
2. Reduce pesticide and fertilizer applications to lawns	homeowners, business, government
3. Don't litter	everyone
4. Clean up and properly dispose of pet wastes	homeowners, businesses (kennels)
5. Properly store and dispose of household chemicals	homeowners
6. Remove illegal and improper connections to storm drains	homeowners, business, government
7. Landscape yards and business grounds to reduce runoff	homeowners, business, government
8. Maintain septic tank properly	homeowners

[3] See DuPage County's "Streambank Stabilization Program Streamlined Permit Packet," prepared by Rust Environment & Infrastructure, June 1996 and "Stream Maintenance Program Report," prepared by Randolph Stowe and the Environmental Concerns Department, July 1991.
[4] See AFS's "Stream Obstruction Removal Guidelines," prepared by the Wildlife Society and American Fisheries Society, 1983.

9. Direct downspouts from paved surfaces	homeowners, business, government
10. Install rain barrels	homeowners
11. Sweep up rather than hose off to clean	homeowners, business, government
12. Sweep street gutters and keep stormsewer inlets clean of leaves and trash	homeowners, business, government
13. Prevent erosion	homeowners, business, government
14. Minimize quantity of road salt used	businesses, government

2A.5. Implementing Agricultural Practices

The NRCS publishes guidelines for farmers to prevent soil erosion and to improve or protect water quality and water resources. The following information was taken from the NRCS Field Office Technical Guide (FOTG). Several of these practices described below are similar to best management practices for riparian sites (such as filter strips and buffers), but specific suggestions are given for agricultural sites.

2A.5.1. Residue Management, No Till/Strip Till

This practice manages the amount, orientation, and distribution of crop and other plant residues on the soil surface year-round, while growing crops planted in narrow slots, or tilled, residue free strips previously untilled by full-width inversion implements. The purpose of this conservation practice is to reduce sheet and rill erosion, which leads to improved water quality. Additional benefits of this practice are to reduce wind erosion, to maintain or improve soil organic matter content and tilth (tillage), to conserve soil moisture, to manage snow, to increase plant available moisture or reduce plant damage from freezing or dessication, and to provide food and escape cover for wildlife. This technique includes tillage and planting methods commonly referred to as no till, zero till, slot plant, row till, direct seeding, or strip till.

Residue management is when loose residues are retained on the field, and then uniformly distributed on the soil surface to minimize variability in planting depth, seed germination, and emergence of subsequently planted crops. When combines or similar machines are used for harvesting, they are equipped with spreaders capable of distributing residue over at least 80 percent of the working width. No till or strip till may be practiced continuously throughout the crop sequence, or may be managed as part of a system which includes other tillage and planting methods such as mulch till (see below). Production of adequate amounts of crop residues is necessary for the proper functioning of this conservation practice and can be enhanced by selection of high residue producing crops and crop varieties in the rotation, use of cover crops, and adjustment of plant populations and row spacings.

Maintaining a continuous no till system will maximize the improvement of soil organic matter content. Also, when no till is practiced continuously, soil reconsolidation provides additional resistance to sheet and rill erosion. The effectiveness of stubble to trap snow or reduce plant damage from freezing or dessication increases with stubble height. Variable height stubble patterns may be created to further increase snow storage.

2A.5.2. Residue Management, Mulch Till

This practice manages the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round, while growing crops where the entire field surface is tilled prior to planting. The purpose of this conservation practice is to reduce sheet and rill erosion, which leads to improved water quality. Additional benefits of this practice are to reduce wind erosion, to maintain or improve soil organic matter content and tilth (tillage), to conserve soil moisture, to manage snow to increase plant available moisture or reduce plant damage from freezing or dessication, and to provide food and escape cover for wildlife. This practice is also commonly referred to as mulch tillage or chiseling and disking. It applies to stubble mulching on summer fallowed land, to tillage for annually planted crops, and to tillage for planting perennial crops.

Mulch till may be practiced continuously throughout the crop sequence, or may be managed as part of a residue management system that includes other tillage methods such as no till. Production of adequate amounts of crop residue for the proper functioning of this practice can be enhanced by selection of high residue producing crops and crop varieties in the rotation, use of cover crops, and adjustment of plant populations and row spacing.

2A.5.3. Nutrient Management

Nutrient management is the management of the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments. The purposes of this practice is to minimize the transport of applied nutrients into surface water or ground water while supplying adequate nutrients for optimum crop yield and quantity. This management practice also helps sustain the physical, biological, and chemical properties of the soil.

Nutrient management plans are developed with assistance from the NRCS. A nutrient budget for nitrogen, phosphorus, and potassium is developed considering all potential sources of nutrients including, but not limited to animal manure, commercial fertilizer, crop residue, and legume credits. Realistic yields are based on soil productivity information, potential yield, or historical yield data based on a 5-year average. A procedure for calculating 5-year average yields is found in the *Illinois Agronomy Handbook*. Nutrient management plans will specify the form, source, amount, timing, and method of application of nutrients on each field in order to achieve realistic production levels while minimizing transport of nutrients to surface and/or groundwater.

2A.5.4. Filter Strip

A filter strip is an area of permanent herbaceous vegetation situated between cropland, grazing land, or disturbed land and environmentally sensitive areas. The purpose of this conservation practice is to reduce sediment, particulate organic matter, and sediment adsorbed contaminant loading in runoff, and to reduce dissolved contaminant loadings in runoff which improves water quality. This practice also restores or maintains sheet flow in support of a riparian forest buffer, and restores, creates, and enhances herbaceous habitat for wildlife and beneficial insects. This practice applies only when used in conjunction with other conservation practices as part of a conservation management system. This practice does not apply where runoff or subsurface water does not interact with planted vegetation.

The filter strip flow length is determined based on the field slope percent and length, filter strip slope percent, erosion rate, amount and particle size distribution of sediment delivered to the filter strip, density and height of filter strip vegetation, and runoff volume associated with erosion producing events.

Filter strips should be permanently designated plantings to treat runoff and should not be part of the adjacent cropland's rotation. Overland flow entering the filter strip should be primarily sheet flow. Concentrated flow shall be dispersed. Filter strips cannot be installed on unstable channel banks that are eroding due to undercutting of the toe bank. Permanent herbaceous vegetation should consist of a single species or a mixture of grasses, legumes, and/or other forbs (a herbaceous plant other than a grass) adapted to the soil, climate, and farm chemicals used in adjacent cropland. Filter strips must be properly maintained so that they function properly.

Filter strips should be strategically located to reduce runoff and increase infiltration and ground water recharge throughout the watershed. Filter strips should also be strategically placed to intercept contaminants, thereby enhancing the water quality of the watershed. To avoid damage to the filter strip, consider using plant species that are tolerant to herbicides used in the upslope crop rotation. Filter strip sizes should be adjusted to accommodate planting, harvesting, and maintenance equipment. Filter strip widths greater than that needed to achieve a 30 minute flow-through time at ½-inch depth will not likely improve the effectiveness of the strip in addressing water quality concerns created by sediment, particulate organics, and sediment adsorbed contaminants.

2A.5.5. Contour Buffer Strip

Contour buffer strips are narrow strips of permanent, herbaceous vegetative cover established across the slope and alternated down the slope with parallel, wider cropped strips. Crop strips are alternated with buffer strips down the hill slope. Normally a crop strip will occupy the area at the top of the hill. The purposes of this practice are to reduce sheet and rill erosion, to reduce transport of sediment and other water-borne contaminants, and to enhance wildlife habitat. This practice applies to cropland and is most suitable on uniform slopes ranging from 4 to 8 percent with slopes less than the Critical Slope Length (the length of slope above which contouring loses its effectiveness).

This practice is more difficult to establish on undulating to rolling topography because of the difficulty of maintaining parallel strip boundaries across the hill slope or staying within row grade limits. The narrow strips of permanent vegetative cover are not part of the normal crop rotation. When used in combination with terraces with underground outlets, diversions, or water and sediment control basins, the layout of buffer strips shall be coordinated with the grade and spacing of the terraces so that strip boundaries will parallel terraces wherever possible. The buffer strip shall occupy the terrace or diversion channel, a channel leading to a water and sediment control basin, or lie immediately up-slope of the terrace or diversion channel. Surface flow from contoured crop rows must go to a stable outlet. Stable outlets include grassed waterways, underground outlets for terraces or diversions, water and sediment control basins, field borders, headlands or end rows, or similarly stabilized areas.

The buffer strips shall be of equal width, except when a varying width buffer strip is needed to keep either a cropped strip adjacent to it of uniform width or to maintain the strip boundary grades within NRCS criteria (Illinois Field Office Technical Guide). Width of buffer strips at their narrowest point shall be no less than 15 feet for grasses or grass legume mixtures and no less than 30 feet when legumes are used alone. In no case shall a contoured buffer strip be as wide or wider than the cropped strip.

Additional criteria are available to enhance wildlife habitat (see Section 3.0)

2A.5.6 Contour Farming

Contour farming is the tillage, planting, and other farming operations performed on or near the contour of the field slope. The purpose is to reduce sheet and rill erosion and to reduce the transport of sediment and other water-borne contaminants. Contour farming is most effective on slopes between 2 and 10 percent. This practice will be less effective on slopes exceeding 10 percent and has almost no effect on erosion on slopes exceeding 25 percent. This practice calls for performing all tillage and planting operations parallel to contour baselines or terraces, diversions, or contour buffer strip boundaries where these practices are used. All runoff from contouring should be delivered to stable outlets, such as grassed waterways, field borders, water and sediment control basins, or underground outlets for terraces and diversions.

Since most watersheds in Lake County are relatively flat (i.e. slopes are generally less than 1 percent), contour buffer strip and contour farming can be used to a limited extent in the County.

2B. REMEDIAL MEASURES: IMPROVE WATER QUALITY

Water quality in urbanized watersheds can typically be improved using a number of retrofitting techniques. Retrofitting refers to modification of existing stormwater control structures such as detention basins and conveyance systems such as ditches and stormsewers. These structures were originally designed to improve drainage and reduce flood risk, but they can also be retrofitted to improve water quality. This section will focus on enacting a lakes management plan, properly maintaining septic tanks and fields to improve water quality, retrofitting existing detention basins and stormwater outfalls, and stabilizing streambanks.

2B.1. Lakes Management

Increased lakeshore development, failing septic systems, polluted stormwater runoff, and other improper land use practices can degrade water quality. With increased nutrients and fertilizers, lakes can become choked with plants and the water can become green and murky. If water quality deteriorates, recreational activities such as fishing, boating, and swimming can become impaired; the local economy could suffer, and the general health of Lake County residents could be threatened. Therefore, protecting the quality of our lakes is an important concern of Lake County residents.

Each lake is a valuable resource that must be properly managed if it is to be enjoyed by present and future generations. To assist with this endeavor, the Lake County Health Department has an LMU that provides technical expertise essential to the management and protection of Lake County surface waters. The following information on lakes management and on the specific objectives to achieve the

goals was prepared and written by the LMU. The information below is a summary of issues relevant to achieving water quality goals.

Please contact the LMU for additional information including: the pros and cons of the practices described below, your suggestions and recommendations, and cost estimates for the practices. The contact information for the LMU is as follows:

Lake County Health Department
Lakes Management Unit
3010 Grand Avenue
Waukegan, IL 60085
Phone: 847 377-8020
Fax: 847 249-4972
Internet: http://www.co.lake.il.us/health/ehs/lakes.htm

2B.1.1 Shoreline Erosion Control

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

- Option 1: No Action
- Option 2: Install a Steel or Vinyl Seawall
- Option 3: Install Rock Rip-Rap or Gabions.

  Rip-rap is the term for using rocks to stabilize shorelines. Gabions are wire cages or baskets filled with rock.
- Option 4: Create a Buffer Strip
- Option 5: Install A-Jacks®.

  A-Jacks® are made of two pieces of pre-cast concrete that, when fitted together, resemble a child's playing jacks. These structures are installed along the shoreline and covered with soil and/or an erosion control product. Native vegetation is then planted on the backfilled area. They can be used in areas where severe erosion does not justify a buffer strip alone.
- Option 6: Install Biolog, Fiber Roll, or Straw Blanket with Plantings.

  These products are long cylinders of compacted synthetic or natural fibers wrapped in mesh. The rolls are staked into shallow water. Once established, a buffer strip of native plants can be planted along side or on top of the roll (depending if rolls are made of synthetic or natural fibers).

- Option 7: Establish a “No Wake” Zone or No Motor Area

  In most cases a combination of these options is optimal for shoreline stabilization. Each specific site has its own characteristics and needs a specially designed set of treatments. The effectiveness and durability of these shoreline measures are critically dependent on how they are installed in the field. The choice of a Contractor with experience is very important.

2B.1.2. The Volunteer Lake Monitoring Program

In 1981, the VLMP was established by the IEPA to gather fundamental information on Illinois inland lakes, and to provide an educational program for citizens. Annually, 150-200 lakes (out of 3,041 lakes in Illinois) are sampled by approximately 250 citizen volunteers. The volunteers are primarily lake shore residents, lake owners/managers, members of environmental groups, public water supply personnel, and citizens with interest in a particular lake.

The VLMP relies on volunteers to gather a variety of information on their chosen lake. The primary measurement is Secchi disk transparency or Secchi depth. Analysis of the Secchi disk measurement provides an indication of the general water quality condition of the lake, as well as the amount of usable habitat available for fish and other aquatic life.

Microscopic plants and animals, water color, and suspended sediments are factors that interfere with light penetration through the water column and lessen the Secchi disk depth. As a rule, one to three times the Secchi depth is considered the lighted or euphotic zone of the lake. In this region of the lake there is enough light to allow plants to survive and produce oxygen. Water below the lighted zone can be expected to have little or no dissolved oxygen. Other observations such as water color, suspended algae and sediment, aquatic plants, and odor are also recorded. The sampling season is May through October with volunteer measurements taken twice a month.
After volunteers have completed one year of the basic monitoring program, they are qualified to participate in the Expanded Monitoring Program. In the expanded program, selected volunteers are trained to collect water samples that are shipped to the IEPA laboratory for analysis of total and volatile suspended solids, total phosphorus, nitrate-nitrite nitrogen, and ammonia nitrogen. Other parameters that are part of the expanded program include dissolved oxygen, temperature, and zebra mussel monitoring. Additionally, chlorophyll *a* monitoring has been added to the regiment of selected lakes. These water quality parameters are routinely measured by lake scientists to help determine the general health of the lake ecosystem.

For more information about the VLMP contact the VLMP Regional Coordinator:
Holly Hudson
Northeast Illinois Planning Commission
222 S. Riverside Plaza, Suite 1800
Chicago, IL 60606
(312) 454-0400
Internet: http://www.nipc.cog.il.us/

2B.1.3. Options for Lakes with Low Dissolved Oxygen Concentrations

Fish and other aquatic organisms need oxygen to live. As water moves past their gills (or other breathing apparatus), microscopic bubbles of oxygen gas in the water, called dissolved oxygen (DO), are transferred from the water to their blood. Oxygen can be present in the water, but sometimes the concentration is too low to sustain some or all aquatic life. When DO concentrations drop below 5 mg/L at 100 percent saturation, aquatic life becomes moderately impaired.

Oxygen also is needed by virtually all algae and all aquatic plants, and for many chemical reactions that are important to lake functioning. Lake DO concentrations naturally vary and are controlled by several biological, chemical and physical processes.

Dissolved oxygen concentrations in a lake can vary greatly depending on the time of day. This is mainly due to oxygen being produced during photosynthesis and consumed during respiration and decomposition. Because it requires light, photosynthesis occurs only during the daylight hours. Respiration and decomposition, on the other hand, occurs 24 hours a day. This difference alone can account for large daily variations in DO concentrations. During the night, when photosynthesis cannot counter balance the loss of oxygen through respiration and decomposition, DO concentration may steadily decline. DO concentrations are generally lowest just before dawn, when photosynthesis resumes.

More oxygen dissolves into water when wind stirs the water; as the waves create more surface area, more diffusion can occur. Another physical process that affects lake DO concentrations is the relationship between water temperature and gas saturation. Cold water can hold more of any gas, in this case oxygen, than warmer water. As water becomes warmer it can hold less and less DO. During the summer months in the warmer top portion of a lake, the total amount of oxygen present may be limited by temperature. Generally this is not an issue for lakes in Lake County. Temperature effects can also cause reduced DO in deeper lakes (usually greater than 10 feet deep) as thermal stratification may cut off all oxygen sources from reaching the lower depths.

DO concentrations drop as organisms continue to respire and consume oxygen. The bottom layer of a lake may eventually become anoxic, that is, totally devoid of oxygen. Oxygen losses can also occur in summer if large amounts of plants or algae quickly die, either naturally or as a result of an application of fast acting aquatic herbicides or algicides. Decomposition is more rapid in the summer due to warmer water temperature, which uses a large amount of DO very quickly, causing a DO crash.

Ice-covered, nutrient-enriched lakes may also develop variations of DO dependent on depth. If there is little or no snow cover to block sunlight, algae and some plants may continue to photosynthesize, resulting in a small increase in DO just below the ice. But as microorganisms continue to decompose material in the lower water column and in the sediment, they consume oxygen, and the DO is depleted. No oxygen input from the air occurs because of the ice cover, and, if snow covers the ice, it becomes too dark for photosynthesis. This condition can cause high fish mortality during the winter, known as “winter kill.” Lakes in this area that do not have at least 25 percent of their surface area with a depth of at least 10 feet are prone to winter kill.

Options to increase DO in a lake include:

- Option 1: No action
- Option 2: Aeration via Artificial Circulation

- Option 3. Reduce Lake Phosphorus Concentrations
- Option 4. Snow Removal from Ice-Covered Lakes
- Option 5. Increasing Lake Depth
- Option 6. Aquatic Plant Management
- Option 7. Reduce Organic Matter.

2B.1.4. Nuisance Aquatic Plant Management

All nuisance aquatic plant management techniques have both positive and negative characteristics. If used properly, they can all be beneficial to a lake's well being. If misused or abused, they all share similar outcomes - negative impacts to the lake.

Putting together a good aquatic plant management plan should not be rushed. Plans should consist of a realistic set of goals well thought out before implementation. The plan should be based on the management goals of the lake and involve usage issues, habitat maintenance and/or restoration, and limitations of the lake.

For an aquatic plant management plan to achieve long term success, follow up is critical. A good aquatic plant management plan considers both the short and long-term needs of the lake. The management of the lake's vegetation does not end once the nuisance vegetation has been reduced/eliminated. It is critical to continually monitor problematic areas for regrowth and remove as necessary. An association or property owner should not always expect immediate results. A quick fix of the vegetation problems may not always be in the best interest of the lake. Sometimes the best solutions take several seasons to properly solve the problem.

The management options covered below are commonly used techniques that are coming into wider acceptance and have been used in Lake County. There are other plant management options that are not covered below as they are relatively ineffective, unreliable, or are too experimental to be widely recommended.

Options to manage aquatic plants include:

- Option 1: No action
- Option 2: Aquatic Herbicides
- Option 3: Mechanical Harvesting
- Option 4: Grass Carp
- Option 5: Hand Removal
- Option 6: Water Milfoil Weevil
- Option 7: Reestablishing Native Aquatic Vegetation.

2B.1.5. Nuisance Algae Management

The growth of nuisance or excessive algae can cause a number of problems. Excessive algal growth can cause decreases in water clarity and light penetration. This can lead to several major problems such as loss of aquatic plants, decline in fishery health, and interference with recreational activities. Health hazards, such as swimmer's itch and other skin irritations, have been linked to nuisance algae growth. Normally, excessive/nuisance algae growth is a sign of larger problems such as excessive nutrients and/or lack of aquatic plants.

Some treatment methods, such as copper sulfate, are only quick remedies to the problem. Solving the problem of nuisance algal growth involves treating the factors that cause the growth, not the algae itself. Long-term solutions typically include an integrated approach such as alum treatments, revegetation with aquatic plants, and limiting external sources of nutrients. Interestingly enough, these long-term management strategies are seldom used, typically because of their high initial costs. Instead, the cheap, quick fix of using copper sulfate, though temporary, is much more widely used. However, the costs of continually applying copper sulfate over years, even decades, can eventually far exceed the costs of a slower acting, eventually more effective, integrated approach.

As with aquatic plant management techniques, algae management practices have both positive and negative characteristics. If used properly, they can be beneficial to a lake's well being. If misused or abused, they all share similar outcomes - negative impacts to the lake. For an algae management plan to achieve long term success, follow up is critical.

Options to manage nuisance algae include:

- Option 1: No action
- Option 2: Algicides
- Option 3: Alum Treatment
- Option 4: Revegetation With Native Aquatic Plants.

2B.1.6. Eliminate or Control Exotic Species

Numerous exotic plant species have been introduced into our local ecosystems. Some of these plants are aggressive, quickly out-competing native vegetation and flourishing in an environment where few natural predators exist. Plants such as purple loosestrife (*Lythrum salicaria*), buckthorn (*Rhamnus cathartica*), and reed canary grass (*Phalaris arundinacea*) are three examples. The outcome is a loss of plant and animal diversity and degradation of habitat. This section will address terrestrial shoreline exotic species.

Purple loosestrife is responsible for the "sea of purple" seen along roadsides and in wetlands during summer. It can quickly dominate a wetland or shoreline. Due in part to an extensive root system, large seed production (estimates range from 100,000 to 2.7 million seeds per plant), and high seed germination rate, purple loosestrife spreads quickly. Buckthorn is an aggressive shrub species that grows along lake shorelines as well as most upland habitats. It shades out other plants and is quick to become established on disturbed soils. Reed canary grass is an aggressive plant species that was introduced as a shoreline stabilizer. It is found on lakeshores, streambanks, marshes and exposed moist ground. Although it does serve to stabilize shorelines to some extent, it has low food value and does not provide winter habitat for wildlife. It is very successful in taking over disturbed areas and, if left unchecked, will dominate an area, particularly a wetland or shoreline, in a short period of time. Since it begins growing early in the spring, it quickly out-competes native vegetation that begins growth later in the year. Control of purple loosestrife, buckthorn, and reed canary grass are discussed below. However, these control measures can be similarly applied to other exotic species such as garlic mustard (*Allilaria officianalis*) or honeysuckle (*Lonicera* spp.) as well as some aggressive native species, such as box elder (*Acer negundo*).

Presence of exotic species along a lakeshore is by no means a death sentence for the lake or plant and animal life. If controlled, many exotic species can perform many of the original functions that they were brought here for. For example, reed canary grass was imported for its erosion control properties. It still contributes to this objective (offering better erosion control than commercial turfgrass), but needs to be isolated and kept in control. Many exotics are the result of garden or ornamental plants escaping into the wild. One isolated plant along a shoreline will probably not create a problem by itself. However, problems arise when plants are left to spread, many times to the point where treatment is difficult or cost prohibitive. A monitoring program should be established, problem areas identified, and control measures taken when appropriate. This is particularly important in remote areas of lake shorelines where the spread of exotic species may go unnoticed for some time.

Options to eliminate or control exotic species include:

- Option 1: No action
- Option 2: Biological Control
- Option 3: Control by Hand
- Option 4: Herbicide Treatment.

2B.1.7. Enhance Wildlife Habitat Conditions

The key to increasing wildlife species in and around a lake can be summed up in one word: habitat. Wildlife need the same four things all living creatures need: food, water, shelter, and a place to raise their young. Since each wildlife species has specific habitat requirements, which fulfill these four basic needs, providing a variety of habitats will increase the chance that wildlife species may use an area. Groups of wildlife are often associated with the types of habitats they use. For example, grassland habitats may attract wildlife such as northern harriers, bobolinks, meadowlarks, meadow voles, and leopard frogs. Marsh habitats may attract yellow-headed blackbirds and sora rails, while manicured residential lawns attract house sparrows and gray squirrels. Thus, in order to attract a variety of wildlife, a mix of habitats are needed. In most cases, quality is more important than quantity (i.e., five 0.1-acre plots of different habitats may not attract as many wildlife species as one 0.5 acre plot of one habitat type).

It is important to understand that the natural world is constantly changing. Habitats change or naturally succeed to other types of habitats. For example, grasses may be succeeded by shrub or shade intolerant tree species (e.g., willows, locust, and cottonwood). The point at which one habitat changes to another is rarely clear, since these changes usually occur over long periods of time, except in the case of dramatic events such as fire or flood.

In all cases, the best wildlife habitats are ones consisting of native plants. Unfortunately, non-native plants dominate many of our lake shorelines. Many of them escaped from gardens and landscaped yards (i.e., purple loosestrife) while others were introduced at some point to solve a problem (i.e., reed canary grass for erosion control). Wildlife species prefer native plants for food, shelter, and raising their young. In fact, one study showed that plant and animal diversity was 500 percent higher along naturalized shorelines compared to shorelines with conventional lawns (University of Wisconsin – Extension, 1999).

Options to enhance wildlife habitat include:

- Option 1: No action
- Option 2: Increase Habitat Cover
- Option 3: Increase Natural Food Supply
- Option 4: Increase Nest Availability
- Option 5: Limit Disturbance.

2B.1.8. Conduct a Fisheries Assessment

Many lakes in Lake County have a fish stocking program in which fish are stocked every year or two to supplement fish species already occurring in the lake or to introduce additional fish species into the system. However, very few lakes that participate in stocking check the progress or success of these programs with regular fish surveys. Lake managers should have information about whether or not funds delegated to fish stocking are being well spent, and it is very difficult to determine whether stocked fish species are surviving and reproducing or how they are affecting the rest of the fish community without a comprehensive fish assessment.

A simple, inexpensive way to derive direct information on the status of a fishery is to sample anglers and evaluate the types, numbers and sizes of fish caught by anglers actively involved in recreational fishing on the lake. Such information provides insight on the status of fish populations in the lake, as well as a direct measure of the quality of fishing and the fishing experience. However, the numbers and types of fish sampled by anglers are limited, focusing on game and large, catchable-sized fish. Thus, in order to obtain a comprehensive assessment of the fish community status, including non-game fish species, more quantitative methods must be employed. These include gill netting, trap netting, seining, trawling, angling (hook and line fishing) and electroshocking. Each method has its advantages and limitations, and frequently multiple gear and approaches are employed. The best gear and sampling methods depend on the target fish species and life stage, the types of information desired and the environment to be sampled.

Typically, fish populations are monitored at least annually. The best time of year depends on the sampling method, the target fish species and the types of data to be collected. In many lakes and regions, the best time to sample fish is during the fall turnover period after thermal stratification breaks down and the lake is completely mixed because (1) the young of the year (YOY) and age 1+ (one year or older) fish of most target species should be present and vulnerable to most standard collection gear, including seines, trap nets and electroshockers; (2) species that dwell in the hypolimnion during the summer may be more vulnerable to capture during fall overturn; and (3) lower water temperatures in the fall can help reduce sampling-related mortality. Sampling locations are also species-, life stage-, and gear-dependent. As with sampling methods and time, locations should be selected to maximize capture efficiency for the target species of interest and provide the greatest gain in information for the least amount of sampling effort.

The IDNR will perform a fish survey at no charge on most public and some private water bodies. In order to determine if your lake is eligible for a survey by the IDNR, contact Frank Jakubecik, Fisheries Biologist at (815) 675-2319. If a lake is not eligible for an IDNR fish survey, or if a more comprehensive survey is desired, two known consulting

firms have previously conducted fish surveys in Lake County: EA Engineering, Deerfield, IL, (847) 945-8010 and Richmond Fisheries, Richmond, IL, (815) 675-6545.

2B.1.9. Alleviate Excessive Numbers of Canada Geese (Branta canadensis)

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

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

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

Options to alleviate excessive numbers of geese include:

- Option 1: No action
- Option 2: Removal
- Option 3: Dispersal/Repellent Techniques
- Option 4: Exclusion
- Option 5: Habitat Alteration
- Option 6: Do Not Feed Waterfowl!

2B.1.10 Beaver Management

The beaver (*Castor canadensis)* is the largest rodent in North America. Adults typically weigh 40-50 pounds, but may weigh over 90 pounds. Beavers make their homes in lodges or dens along a lake or streambank. They can live in a small group of two or in larger colonies of five or more. Beavers generally confine their activities to an area within 1/2 mile of their lodge or den.

Beavers were common in Illinois prior to the 1900's. Extensive hunting and trapping in the late 1800's and early 1900's nearly extirpated the beaver from the state. However, conservation efforts, including hunting and trapping laws and reintroduction programs, in the middle 1900's successfully brought the populations back. Currently, beavers are found throughout Illinois.

Beavers are frequently blamed for destroying valuable shrubs and trees and flooding yards and farm fields. In a lake, beavers may dam a culvert or a stream causing lake water levels to rise or fall depending on the directional flow of the culvert or stream. On many lakes, beavers do not build dams since the water level is deep enough. In these cases they build lodges along the shoreline.

Beavers provide many benefits as well. Their engineering skills benefit natural environments by creating wetlands, pools, and other habitats favored by many other wildlife species including waterfowl, other mammals, amphibians, and fish. Several endangered species also benefit from habitats created by beaver.

Options for beaver management include:

- Option 1: No action
- Option 2: Exclusion
- Option 3: Removal
- Option 4: Habitat Alteration.

2B.1.11. Controlling Excessive Number of Carp

A frequent problem that plagues many of the lakes in the County is the presence of common carp (*Cyprinus carpio*). Common carp were first introduced into the United States from Europe in the early 1870's, and were first introduced into Illinois river systems in 1885 to improve commercial fishing. The carp eventually made their way into many inland lakes and are now so wide spread that many people do not realize that they are not native to the U.S.

Carp prefer warm waters in lakes, streams, ponds, and sloughs that contain high levels of organic matter. This is indicative of many lakes in Lake County. Carp feed on insect larvae, crustaceans, mollusks, and even small fish by rooting through the sediment. Immature carp feed mainly on small crustaceans. Because their feeding habits cause a variety of water quality problems, carp are very undesirable in lakes. Rooting around for food causes resuspension of sediment and nutrients, which can both lead to increased turbidity. Additionally, spawning, which occurs near shore in shallow water, can occur from late April until June. The spawning activities of carp can be violent, further contributing to turbidity problems. Adult carp can lay between 100,000 –500,000 eggs, which hatch in 5-8 days. Initial growth is rapid with young growing 4 ¾" to 5" in the first year. Adults normally range in size from 1-10 lbs., with some as large as 60 lbs. Average carp lifespan is 7-10 years, but they may live up to 15 years.

There are several techniques to remove carp from a lake. However, rarely does any technique completely eradicate carp from a lake. Commonly, once a lake has carp, it has carp forever. However, it is up to the management entity to dictate how big the problem is allowed to become. Rotenone is the only reliable piscicide (fish poison) on the market at this time, but it kills all fish that is comes into contact with. Currently, there

is a rotenone laced baiting system that can selectively remove carp. While the process is a step in the right direction, several factors still need to be worked out in order for it to be a viable alternative to the whole lake treatment. Until this baiting technique is further developed and produces consistent results, it is not being recommended by the LMU at this time.

Options for controlling excessive numbers of carp include:

- Option 1: No action
- Option 2: Rotenone (Rotenone is a piscicide)

2B.1.12. Lakes Summary

All lake management techniques have both positive and negative characteristics. If used properly, they can all be beneficial to a lake's well being. If misused or abused, they all share similar outcomes - negative impacts to the lake. Putting together a good lake management plan should not be rushed. Plans should consist of a realistic set of goals well thought out before implementation. The plan should be based on the management goals of the lake and involve usage issues, habitat maintenance/restoration, and limitations of the lake. For a lake management plan to achieve long term success, follow up is critical. An association or property owner should not always expect immediate results. A quick fix of the problems may not always be in the best interest of the lake. Sometimes the best solutions take several seasons to properly solve the problem. Please contact the Lake County Lakes Management Unit at (847) 377-8020 for information and recommendations specific to your lake.

2B.2. Septic Tank Maintenance and Repair

Septic, or on-site waste disposal systems are the primary means of sanitary flow treatment in the unincorporated parts of the watershed in Lake County. Because of the prohibitive cost of providing centralized sewer systems to many areas, septic tank systems will remain the primary means of treatment into the future. Annual maintenance of septic sewer systems is crucial for their operation, particularly the annual removal of accumulated sludge. The cost of replacing failed septic tanks is very high, about $15,000 per unit. Property owners are responsible for their septic sewer systems and all septic systems require new permits from the LCHD every three years. When septic systems fail, untreated sanitary flows are discharged into open watercourses which pollute the water and pose a potential public health risk. Septic systems discharging to the ground surface are a risk to the public health directly through body contact or contamination of drinking water sources, provide conditions favorable to insect vectors such as flies and mosquitoes, and contribute significant amounts of nitrogen and phosphorus to the watershed.

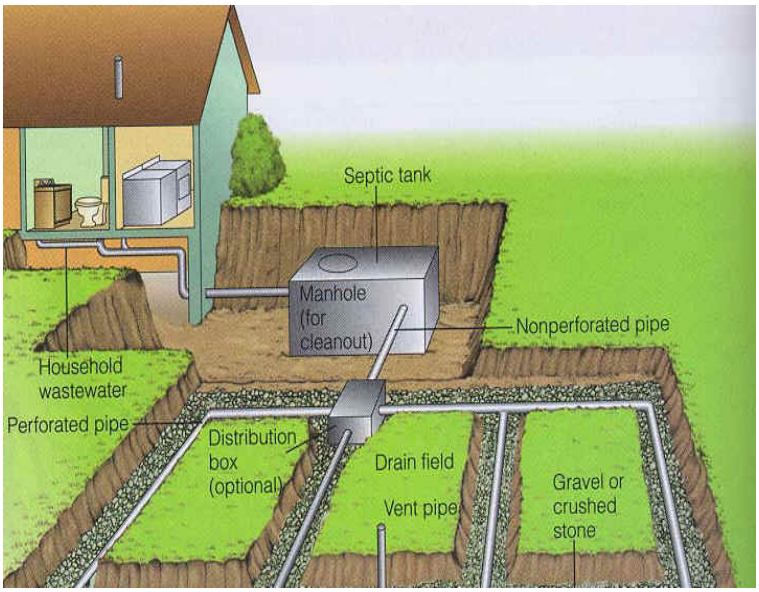
The following information on individual sewage disposal and septic inspections has been provided by the Lake County Health Department.

2B.2.1. Individual Sewage Disposal Program (ISD)

The Individual Sewage Disposal Program (ISD) through the Health Department regulates the use of septic systems in Lake County for both residential and commercial properties. The Health Department must review plans for new septic systems and/or additions or alterations to homes that affect on-site wastewater systems in unincorporated or incorporated areas of Lake County where sanitary sewer is not yet available. This review process is required by County Ordinance Article V and is

intended to protect public health from nuisances and hazards associated with sewage disposal.

The ISD program offers a wide array of services used in siting, planning, and installing septic systems. The Health department trained staff of sanitarians, soil scientists, plan reviewers, and administrators facilitates the communication process in the regulation of ISD permits between the homeowner, design engineers, and septic contractors.



Typical Septic System Layout

2.B.2.2. Well and Septic Evaluations

The LCHD offers the service of performing well and septic evaluations at existing properties. These services are most often requested when a property transaction (either a sale or a refinancing) is taking place, and in many cases is required by a lender and/or buyer. A fee for this service is charged, per Lake County Board of Health Ordinance Article XIII.

The evaluation begins with a thorough search of all LCHD records to determine if a plan of the septic system is available, and if there were any past requests for service regarding the property. Requests for service include previous septic evaluations, property additions/alterations, and any complaints that may have been referred to the LCHD. A summary of any relevant information that LCHD finds in their records will be included in the report.

An on-site evaluation is then made during which LCHD staff visually inspect the components of the septic system for any signs of past or present failures (where sewage reaches the ground surface). If the condition of the septic system is questionable, LCHD staff may dye the system to better assess its function, or collect samples from the ground surface if liquid is present. They may also, in the report of the evaluation, recommend that a licensed septic contractor further evaluate the septic system.

If requested, LCHD staff will also inspect the condition of the water well, and if it is sound, will collect a water sample for laboratory analysis. The sample will be analyzed for coliform bacteria and nitrates, indicators of contamination of the water supply.

A report of the evaluation will then be generated, stating the Department's findings at the time of the evaluation. It is not, however, a guarantee that the septic system and/or well will continue to function properly in the future.

ISD Inspections

Inspections are completed by LCHD staff sanitarians working with Lake County's Licensed Septic Contractors, to ensure the property owners that installations are completed in accordance with the Lake County Board of Health Ordinance Article V, governing Individual Sewage Disposal systems. To help inform LCHD clients and contractors, a schedule of work to be completed for an inspection has been developed (Table J-11). An effort is made to inspect as much as possible during each stage of the construction of a septic system serving a residence or commercial establishment.

2B.2.3. Maintenance Tips for Homeowners

The best and most general tip for septic system maintenance is to routinely pump solids from the septic tank. Frequency is related to usage, but the sludge (settled solids) and scum (floating solids) depth should never exceed 1/3 of the total depth. For older systems, pumping frequency should be every 2-3 years.

Usage is important, especially for the smaller lots common in lake areas. Homeowners should try to conserve water use in general, and avoid surge loading (i.e., many consecutive loads of laundry). Never dispose of chemicals through a septic system, although routine use of most household chemicals is okay. Avoid food products, such as those produced by trash disposals, and materials that are not readily degradable, such as condoms, cigarette butts, etc. It is especially important that clearwater discharges from sumps or water softeners should not be directed into the septic system.

To protect the seepage system, homeowners should avoid traffic, excessive cutting or filling over the system. Grass cover should be maintained for insulation and warmer season evapotranspiration (the total moisture that leaves an area by evaporation from soil, snow, and water surfaces plus that transpired by plants). Stormwater flows overland or from sumps and gutters should not be allowed to discharge across the seepage areas.

Septic systems discharging to the ground surface are a risk to the public health directly through body contact or contamination of drinking water sources, provide conditions favorable to insect vectors such as flies and mosquitoes, and contribute significant amounts of nitrogen and phosphorus to the watershed. Therefore it is imperative that homeowners don't ignore septic failures. If plumbing fixtures back-up or will not drain, the system is failing. It is illegal to discharge laundry or other graywater to the surface.

Typically in Lake County, lake area lots are at high risk for sewage related problems. The sites are generally very small, restricting the area available for wastewater treatment. Plus, urban-type population density in the lake areas (which also typically have older septic systems) increases the health risks. The Lake County Health Department is actively exploring ways to better address the existing and anticipated

problems in these difficult areas, viewing the individual septic systems as a single wastewater treatment “system”. Residents should keep an eye out for potential programs to improve the overall management of these systems.

TABLE J-11
SEPTIC INSPECTION SCHEDULE OF WORK

System Type	Partial	Final
I, II- Conventional System	• Septic Tanks, Lift stations, aerobic units or pretreatment filters • Absorption field, gravel trenches, paper cover, Infiltrator Chambers, soil conditions, fill, etc. • Any items prior to backfilling the system	• House Inspections • Final Grade & Seed • High Water Alarms • Water Well Location • Satisfactory Water Sample
III - (LPP) Low Pressure Pipe	• Septic Tanks, Lift stations, Class I aerobic units* • Plow Inspection on systems requiring fill • Absorption field, gravel trenches, paper cover, Infiltrator Chambers, soil conditions, fill, etc. • Low Pressure Piping	• House Inspections • Final Grade & Seed • High Water Alarms • Water Well Location • Satisfactory Water Sample
IV - At-Grade System	• Septic Tanks, Lift stations, Class I aerobic units or pretreatment filters* • Plow Inspection • Gravel Bed • Geotextile Fabric • Low Pressure Piping	• House Inspections • Final Grade & Seed • High Water Alarms • Water Well Location • Satisfactory Water Sample
V - Mound System	• Septic Tanks, Lift stations, Class I aerobic units or pretreatment filters • Plow Inspection • Fill Inspection - torpedo sand • Gravel Bed • Geotextile Fabric • Low Pressure Piping	• House Inspections • Final Grade & Seed • High Water Alarms • Water Well Location • Satisfactory Water Sample

*Class I aerobic units are required for Type III systems and require an annual maintenance agreement with the Health Department

2B.3. Detention Basin Retrofits

When properly designed, constructed and maintained, detention basins control stormwater release rates from developed sites. Although most were originally constructed as single purpose facilities for flood reduction, many of these basins can be retrofitted to significantly reduce water pollution from lawns, streets, sidewalks, parking lots and rooftops before it is discharged into a downstream water body.

The goal of detention basin retrofitting is to enhance the basin's water quality values by changing its functional design so it collects and filters sediment and other pollutants from stormwater while it is being stored. Existing detention basins can be retrofitted in several ways to improve water quality. Water flows can be adjusted by reducing release rates for more frequent rain events to provide more time for settling. For even better results, the outlets on dry bottom detention basins can be altered to create wet bottom (or wetland) basins that significantly improve water quality. Wet detention basins hold some level of water all of the time. Wet basins can store the first flush of runoff from impervious surfaces and allow sufficient time for sediment and other solids to settle out to the bottom of the basin. This settling process results in cleaner water being discharged from the basin than the inflow stormwater. Wetland plants in the basin aid in the water cleaning process by trapping, absorbing and transforming nutrients, solids and metals from the inflow stormwater. Therefore, the primary detention basin retrofit goals are to increase the residence time for stormwater in the basin so that pollutants can settle out; and using wetland vegetation in the basin in combination with deep-rooted plants around the basin to filter, absorb and transform pollutants and reduce erosion.

Redesigned detention basins also offer opportunities for improving the aesthetics of the basin, discouraging nuisance geese and providing habitat for other wildlife. Turf grass on the side slopes can be replaced with deep-rooted native vegetation to stabilize slopes and discourage nuisance geese and related pollution. For the best results, all of these techniques can be combined along with excavation of micro-pools and establishment of wetland vegetation in the basin to provide multiple benefits. Constructed wetland detention basins (detention wetlands) use features found in natural wetlands and lakes. They are designed with shallow shoreline slopes, emergent wetland vegetation and open water areas. Detention wetland designs allow for water quality improvement through filtration of runoff by vegetation and by allowing water to pool so sediment can settle out. Detention wetlands also provide more habitat for plants and animals, and are often more aesthetically pleasing. Detention wetlands generally require less maintenance than traditional designs, and are also less attractive to nuisance geese (Price and Dreher 1995, 1997; Price, Dreher and Schaal 1994; Terrene Institute 1994)

2B.3.1. Key Problems with Detention Basin Design and Maintenance

Several key design and maintenance problems are:

Shoreline and side slope structure and condition*:* Steep sideslopes are more likely to contribute to erosion and can present potential safety hazard. Another problem seen was sideslopes overgrown with weeds, reed canary grass, or purple loosestrife.

Turf grass*:* Turf grass is a poor choice for use in wet detention basins. It is relatively intolerant of frequent wetting and drying, conditions common to detention basins. Turf grass also attracts nuisance geese.

Turbidity*:* Turbidity problems are most likely due to shoreline erosion or erosion upstream of the basin.

***Excess algae**:* Problems are likely due to nutrient loading from upstream and surrounding land uses.

***Excess sediment accumulation**:* Sediment accumulation reduces the available volume for water storage.

***Inlet or outlet problems**:* Some of the problems identified include short circuiting between the inlet and outlet, unstable outlet structure, broken inlet pipe, scour or erosion around the inlet or outlet, inlet/outlet location, lack of restrictor or restrictor size, or lack of a trash rack on the outlet.

***Paved low-flow channels**:* These channels immediately pass runoff (with pollutants) downstream rather than allowing it to be filtered by vegetation. Concrete channels also preclude low flow runoff from infiltrating into the ground.

***Illicit connections**:* Only one apparently illicit connection was seen.

***Poor drainage in areas intended to be dry**:* Refers to wet conditions in areas that were intended to be dry bottom basins.

2B.3.2. Detention Basin Retrofit Opportunities

***Create wet or wetland basin**:* Dry basins can be converted to wetland basins by excavating portions of the basin bottom to create wetland pockets and/or redesigning the outlet to allow for some water retention and planting wetland vegetation. Settling (or stilling) basins could be installed at the inlets and the basins planted in native vegetation. The increase in pollutant removal effectiveness will be a function of the volume of stormwater stored as the first flush size and the length of time it is stored. The excavated wetland pocket(s) as well as the extent to which native vegetation is used in the basin and buffer areas will also be determinants in pollutant removal effectiveness.

DETENTION BASIN RETROFITS

- Modify outlet to reduce release rate for smaller storm events.
- Eliminate low-flow bypass channels and replace with meandering vegetated swales.
- Install berms to lengthen flow path and eliminate short-circuiting.
- Install stilling (or settling) basin at inlets.
- Replant basin bottom with wetland plants.
- Create wetland shelf along the periphery of a wet basin to stabilize shoreline, filter pollutants and provide habitat.
- Plant native grasses and flowers on the slopes and in a buffer around the basin to stabilize the soil, discourage nuisance geese and provide habitat for other wildlife.

***Remove concrete channels and low flow channels**:* Concrete channels could be removed and converted to vegetated swales or filled in to allow water to spread out throughout the basin. After the concrete is removed, the newly created swale and existing low-flow channels in other basins (not constructed of concrete) could be planted in native vegetation to improve infiltration and pollutant removal rates.

***Retrofit basins to reduce short-circuiting**:* Basins with severe short-circuiting problems can be retrofitted by adding a berm or other structure to prevent water from

flowing directly from the inlet to the outlet. Increasing the length of the flow path should increase pollutant removal effectiveness especially if the basin is planted in native vegetation.

***Repair inlet and outlet problems**:* Inlet and outlet problems vary in terms of the types of problems and the degree to which they are a problem. In many of the basins, the repair needed is as simple unclogging the inlet or outlet pipe. On the other hand, many of the inlets had serious erosion problems that require stabilization. Many of the outlets and/or inlets need to have trash racks installed to keep large debris out of the river. Depending on design capacity, restrictors in outlets can also be modified.

***Stabilize shorelines and improve buffers**:* Shorelines of wet basins with erosion problems could be stabilized using native vegetation. Eroding shorelines within the basin can contribute to the amount of sediment, nutrients and other pollutants eventually draining to the river. Native vegetation buffers should be established around the perimeter of all basins where possible to stabilize shorelines, discourage nuisance geese (and their pollution contribution) and filter pollutants.

***Replace turf grass with native vegetation**:* Turf grass is relatively intolerant of water level fluctuations and is maintenance intensive. In addition, it is not as effective as native vegetation for filtering, absorbing and transforming pollutants in runoff. For these reasons, strong consideration should be given to replacing turf grass with native vegetation in detention basins throughout the watershed.

Please keep in mind that reducing release rates or modification of the outflow structures must be done carefully so that adverse impacts (such as increasing the High Water Level) can be accommodated. Coordination with the SMC is advised.

2B.4. Outfall and In-line Pipe Retrofits

2B.4.1. Created Wetland Meanders

Outfalls, especially stormsewer pipes, can be retrofitted to add water quality benefits. One technique for retrofitting outfalls is to daylight stormsewers to flow through created pocket wetlands or wetland meanders before the stormwater is discharged to the stream. The created wetlands filter pollutants from the runoff and dissipate energy before the water reaches the stream. The Village of Barrington has successfully used this technique on Flint Creek.[5]

2B.4.2. End-of-Pipe Retrofits

End-of-pipe retrofits can also be used to filter runoff before discharging it to the stream. Sand filters are underground vaults that have a number of chambers with different media that remove pollutants from stormwater runoff. For this reason they are also known as a multi-chamber treatment train (MCTT). In a sand filter, the first chamber is usually empty or filled with water and is used to capture heavier solids. The second chamber contains sand or other filter media that removes smaller solids and dissolved and organic materials. Sand filters are moderately to highly effective for pollutant removal

[1] For more information on the design of created wetland meanders, contact John Heinz, Public Works Director for the Village of Barrington at 847-381-7903.

and can last for an extended period of time although they can require significant maintenance. MCTT filters have also been designed to use other filter media such as compost or peat.

A proprietary retrofit known as the Stormceptor® is used primarily on small, highly impervious sites, such as parking lots. A typical unit incorporates a circular holding tank that receives runoff from a flow diversion structure and allows solids to settle out. The normal flows are treated and high peak flows by-pass the unit to the downstream drainage network. The unit can trap sand, oil, and grease reasonably if the tank is regularly cleaned and maintained.[6]

An oil and grit separator is an underground structure with multiple chambers to remove pollutants from stormwater runoff at very small sites. The typical separator contains three chambers, one dry and two wet. The first chamber has a permanent pool of water and a trash rack designed to trap grit, coarse sediments, trash, and debris. Two 6" orifices open out from behind the trash rack to pass water to the second chamber. Water can also pass over the chamber wall from the first to the second chamber. An inverted elbow pipe drains the second chamber to the third chamber. It is expected that the oil and grease will initially float on the surface in the second chamber and then adhere to suspended particles, which eventually settle to the bottom of the chamber. The contents of both chambers should be removed on a quarterly basis as part of normal maintenance. Recent study has suggested that pollutant removal performance is extremely limited .[7]

2B.4.3. In-line Pipe Retrofits: Baffle Boxes

Baffle boxes, or sediment removal traps are concrete or fiberglass sediment boxes constructed in-line with existing storm drain pipes which are used to remove suspended solids and floating trash from stormsewer pipe flows. They are typically 10-15 ft long, 2 ft wider than the pipe, and 6-8 ft high. The box is divided into 3 chambers by weirs set at the same level as the pipe invert. There are trash screeners or skimmers to trap floating trash and yard debris. Manholes are set over each chamber to allow access for cleaning with vacuum trucks. Baffle boxes are mainly designed for sediment removal, but heavy metals and particulate phosphorus will bind to suspended solids and also be removed.[8]

2B.5. Streambank Stabilization

Streambank erosion results in a number of problems including poor water quality (because of high sediment loads), loss of terrestrial habitat (due to land loss) and degradation of aquatic habitat (loss of aquatic vegetation and clean substrate when deposited sediment buries the streambed).

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[6] Technical Note #104 from Watershed Protection Techniques. 3(1): 605-608.
[7] Shepp, D, 1995. "A performance Assessment of an Oil-Grit Separator in Suburban Maryland" and "Petroleum Hydrocarbons in Urban Runoff: A Study Overview." See references at end of chapter for full reference.
[8] Urban Water Infrastructure Management Committee's Task Committee for Evaluating Best Management Practice, 2001. "A Guide for Best Management Practice (BMP) Selection in Urban Developed Areas." See references at end of chapter for full reference.

Streambank erosion problems can be improved using a number of techniques that range from soft, natural solutions such as native vegetation to hard solutions like rock riprap. The preferred technique for streambank stabilization is soil bioengineering. Soil bioengineering utilizes living plant materials as the primary component of a structural system. The end result is a mechanically stable native plant community that is capable of self-repair over time.

With soil bioengineering, native vegetation can be used alone or in combination with harder structures such as A-jacks or lunkers. The use of native vegetation alone is a relatively low-cost method for stabilizing streambanks that is most effective in lower velocity portions of the river. Combining native vegetation with structural measures such as coconut rolls, A-jacks and lunkers can stabilize streambanks where volumes and velocities are higher. These measures are specifically used to stabilize the toe of the slope, providing a stable rooting area and habitat benefits (Dreher and Heringa 1998; Stowe and DuPage County 1991; Wildlife Society 1983; Illinois Department of Natural Resources 1983; Price, Dreher and Schaal 1994).

In cases where the volume and energy of the stormflow is extreme, a bioengineering solution may not be effective. In this case, rock outlet protection or riprap may be the most effective technique. Rock outlet protection refers to the use of riprap or stone underlain with filter fabric to prevent erosion or scour where a stormsewer or other outfall drains into a waterbody.

3.0 PROTECT AND RESTORE NATURAL RESOURCES

Natural resources in a watershed can be protected and enhanced by:

- Maintaining and connecting open space and protecting natural areas,
- Protecting threatened and endangered species and their habitat,
- Preserving and restoring wetlands,
- Restoring streams and riparian buffers, and
- Designating corridors for greenways, trails and river access.

Improving natural resources and providing recreational access near water bodies is key to increasing the public's recognition of water bodies as assets.

3A. PREVENTATIVE MEASURES: PROTECT NATURAL RESOURCES

3A.1. Protecting Open Space and Natural Areas

Several techniques can be used for protecting natural areas and open space in both public and private ownership. The first step in the process is to identify and prioritize properties for protection. The highest priority natural areas should be permanently protected in the ownership or under the management of public agencies or private organizations dedicated to land conservation. Other open space can be protected using conservation design development techniques, and is more likely to be managed by homeowner associations.

3A.1.1 Protected Ownership

There are several options for land transfer ranging from donation to fee simple purchase. Donations can be solicited and encouraged through incentive programs. Unfortunately, while preferred by money-strapped conservation programs, land donations are often not adequate to protect high priority sites. A second option is outright purchase (or fee-

simple land purchase). Outright purchase is frequently the least complicated and most permanent protection technique, but is also the most costly. The conservation easement is a less expensive technique than outright purchase that does not require the transfer of land ownership but rather a transfer of use rights. Conservation easements might be attractive to property owners who do not want to sell their land at the present time, but would support perpetual protection from further development. Conservation easements can be donated or purchased.

3A.1.2. Conservation Design Developments

The goal of conservation development is to protect open space and natural resources for people and wildlife while at the same time allowing development to continue. Conservation design developments designate half or more of the buildable land area as undivided permanent open space. They are density neutral, allowing the same density as in conventional developments, but that density is realized on smaller areas of land by clustering buildings and infrastructure. In addition to clustering, conservation design developments incorporate natural riparian buffers and setbacks for streams, wetlands, other water bodies and adjacent agricultural land (Dreher and Price 1997; Terrene Institute 1994; Schueler 1995; Arendt 1996).

The first and most important step in designing a conservation development is to identify the most essential lands to preserve in conservation areas. Natural features including streams, wetlands, lakes, steep slopes, mature woodlands, native prairie and meadow (as well as significant historical and cultural features) are included in conservation areas. Clustering is a method for preserving these areas. Clustered developments allow for increased densities on less sensitive areas of a site, while preserving the remainder of the site in open space for conservation and recreational uses (such as trails, soccer or ball fields).

Clustering is often used in planned unit developments (PUD) or planned residential developments (PRDs). PUDs contain a mix of zoning classifications that may include commercial, residential and light industrial uses, all of which are blended together. As with clustering, the purpose of a PUD is to maintain density while preserving open space. Well-designed PUDs usually locate residences and offices within walking distance of each other to reduce traffic. PRDs apply similar concepts to residential developments.

A good example of a clustered development and permanent open space protection is Prairie Crossing (Des Plaines River watershed) developed by Prairie Holdings Corporation. Prairie Crossing is a planned, mixed-use development including retail, restaurant, a hospital campus, and office space, in addition to 315 homes. The development is 677 acres with approximately 70 percent of that as open space, including more than 10 miles of trails, and a large lake with beach and boat dock. It is located adjacent to the 2,500 acre Liberty Prairie Reserve. Prairie Crossing also has an organic farm, a charter school, the Byron Colby historic barn, a stable, and the Metra Prairie Crossing-Libertyville Train Station. Additionally, buildings are being constructed to reduce energy consumption by approximately 50 percent as compared to conventional homes.

Another example of clustered development is the Mellody Farms project on the Middle Fork of the North Branch of the Chicago River in Lake Forest. Mellody Farms is a small

residential development containing approximately 10 homes. Lake Forest Open Lands Association (LFOLA) formed a partnership with a developer to protect open space on the site. By working together, the developer was able to build on the perimeter of the site, while at the same time allowing LFOLA to preserve sensitive savanna, wetland and prairie habitat in the interior.

3A.2. Threatened and Endangered Species

Threatened and endangered species are those plant and animal species whose survival is in peril. Both the federal government and the State of Illinois maintain lists of species that meet threatened or endangered criteria within their respective jurisdictions. Federally endangered species are those that are in danger of extinction throughout all or a significant portion of their range. A state-endangered species is any species that is in danger of extinction as a breeding species in Illinois. Threatened species are those that are likely to become endangered in the foreseeable future.

Considerations in protecting endangered species include:

- Making sure there is sufficient habitat available - food, water and “living sites”. For animals this means areas for making nests and dens and evading predators while for plants, it refers to availability of preferred substrate and other desirable growing conditions.
- Providing corridors for those species that need to move between sites.
- Protecting them from impacts due to changes in hydrology or increased pollutant loadings.

Several techniques can be used to protect threatened and endangered species. One technique is to acquire sites where threatened and endangered species occur. Purchase and protection of the site where the species is located (with adequate surrounding buffer) may be sufficient to protect that population. But, in some instances it just isn’t feasible or possible to buy the needed land. Where the site and buffer area isn’t available for purchase, where an animal moves in too large an area (or migrates between sites), or where changes in hydrology or pollution from outside the site affect the species, other techniques must be used to protect the threatened and endangered species. Developing a resource conservation or management plan for the species and habitat of concern is the next step. Resource plans consider the need for buffer areas and habitat corridors, and consider watershed impacts from hydrology changes or pollutant loadings. The conservation plan will include recommendations for management specific to the species and its habitat, whether located on private or public lands. The conservation plan will guide both the property owner, and the local unit of government that plans and permits adjacent land uses, in how to manage habitat to sustain the species.

3A.3. Greenways and Trails

Greenways can provide a large number of functions and benefits to nature and the public. For plants and animals, greenways provide habitat, a buffer from development and a corridor for migration. Greenways located along streams include riparian buffers that protect water quality by filtering sediments and nutrients from surface runoff and stabilizing streambanks. By buffering the stream from adjacent developed land use, riparian greenways offset some of the impacts associated with increased impervious surface in a watershed. Maintaining a good riparian buffer can mitigate the negative impacts of approximately 5 percent additional impervious surface in the watershed (Schueler 1995).

Greenways also provide long, linear corridors with options for recreational trails. Trails along the river provide watershed residents with an opportunity to exercise and enjoy the outdoors. Even more important, trails allow users to see and access the stream, thereby connecting people to their river and watershed. Trails can also be used to connect natural areas, cultural and historic sites and communities, and serve as a safe transportation corridor between work, school and shopping destinations (NIPC 1997a, 1997b; Labaree 1992).

Techniques for establishing greenways and trails involve several steps. The first step involves the development of a plan that proposes general locations for greenways and trails. In the case of trails, the plan also identifies who the users will be and provides direction on trail standards. Plans can be developed at the community and/or county level as well as regionally, statewide, and in a few cases, at the national level. Public and stakeholder input are crucial for developing successful greenway and trail plans.

Several techniques can be used for establishing greenways and trails. Greenways can remain in private ownership, they can be purchased, or easements can be acquired for public use. If the lands remain in private ownership, greenway standards can be developed, adopted and implemented at the local level through land use planning and regulation. Development rights for the greenway can be purchased from private landowners where regulations are unpopular or not feasible.

If the greenways will include trails for public use, the land for trails is usually purchased and held by a public agency such as a forest preserve district or local park system. In some cases, easements will be purchased rather than purchasing the land itself. Usually longer trail systems are built in segments, and completing connections between communities depends heavily on the level of public interest in those communities.

In new developing areas, the local planning authority can require trails. Either the developer or the community can build the trails. In some cases, the developer will voluntarily plan and build a trail connection through the development and use this as a marketing tool to future homebuyers. In other cases, the local planning authority may require the developer to donate an easement for the trail.

To install trails through already developed areas, land can purchased by a community agency with a combination of local, state and federal funds. Impediments to land purchase can significantly slow up trail connections in already established areas.

3A.4. Wetlands

Wetlands provide a multitude of benefits and functions. Wetlands improve water quality by removing suspended sediment and dissolved nutrients from runoff. They control the rate of runoff discharged from the watershed and reduce flooding by storing rainfall during storm events. Wetlands also provide habitat for plants and animals including many of those that are threatened and endangered.

Wetland protection techniques that can be employed in the watershed include:

- adopt a watershed regulation requiring no-net-loss of wetlands with a corresponding policy recommending gains in wetland acreages;
- develop management plans for the high quality (ADID) wetlands;
- prioritize and acquire high quality wetlands outright or purchase easements;
- develop regulatory requirements for wider wetland buffers;
- mitigate all wetland losses within the same watershed;

- provide local incentives for voluntary wetland protection and restoration; and
- solicit cost-share funding from established regional, state and federal funding programs for wetland acquisition and restoration.

3A.4.1. No-Net-Loss Wetland Mitigation

Since the 1970s, wetlands have been regulated through a permit program administered by the USACE under the authority of the Clean Water Act. Even with the regulatory program, wetlands continued to be converted, albeit at a slower rate.

In the 1990s the Federal government adopted a policy of no-net-loss of wetlands to stem the tide of continued wetland losses. The no-net-loss policy has generated requirements for wetland mitigation so that permitted losses due to filling and other alterations can be replaced. Wetland mitigation for some projects involves the purchase of credits in established wetland mitigation banks. Currently, wetland mitigation banks not located in every Lake County subwatershed. In permit cases that allow the purchase of mitigation credits, wetland conversions are sometimes being replaced outside the subwatershed where the impacts occur.

In order to address the specific circumstances and conditions in individual jurisdictions, and to protect local interests, state and local units of government have adopted more stringent laws than the Federal requirements to protect wetlands. Frequently these laws and ordinances add support to the no-net-loss wetland policy. Adoption of a watershed-wide no-net-loss policy for wetlands within the watershed plan could include a recommendation to the USACE that all wetland losses be mitigated or replaced in the same subwatershed.

3A.4.2. Management Plans for ADID Wetlands

An Advanced Identification (ADID) wetland inventory was completed in 1992 to identify high quality wetlands in Lake County. At the same time, the Lake County Wetland Inventory was completed to identify areas in the County that have a high probability of being wetlands.

Management plans, developed cooperatively between the wetland owners and local, state and federal agencies, are a measure that can prevent degradation of these high quality wetlands. The management plans would provide guidance to owners, whether private or public, on how to manage the ADID wetlands to sustain their values as high quality wetlands. Management plan recommendations could also be incorporated into appropriate park and forest preserve district plans, local land use and transportation plans, and watershed plans.

3A.4.3. Acquisition of High Priority Wetlands

Acquisition as a protection technique is covered under Protected Ownership in Protecting Open Space and Natural Areas. The location of threatened and endangered species, ADID wetlands and high quality natural areas are several criteria, among others, that could be used to prioritize wetlands for acquisition.

3A.4.4. Wetland/Stream Buffers

Wetland buffers protect a wetland from water quality and hydrologic impacts resulting from adjacent land uses. In addition, if vegetated and managed properly, buffers can provide considerable wildlife habitat. Buffers should be comprised of native, unmowed vegetation that is periodically managed for non-native and invasive species.

The Lake County WDO currently requires that buffers be maintained around all areas defined as Waters of the United States or Isolated Waters of Lake County, exceptional functional value wetlands (including ADID wetlands), other wetlands, lakes and ponds. The *Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois* is the minimum standard for revegetation of buffer areas. Buffers are divided into two types in the WDO: linear buffers and water body buffers.

Linear buffer requirements (designated along both sides of the channel)*:*

- For channels with a watershed >20 acres but < one square mile, a minimum buffer of 50 feet on each side of the channel is required.
- For channels with a watershed > one square mile, a minimum buffer of 30 feet on each side of the channel is required.
- For linear exceptional functional value wetlands and streams with an Index of Biotic Integrity greater than 40, a minimum buffer width of 100 feet is required

Water body buffer requirements*:*

- For water bodies or wetlands > 1/3 acre < 1 acre, a minimum 30-foot buffer is required.
- For water bodies or wetlands > 1 acre < 2 ½ acres, a minimum 40-foot buffer is required.
- For water bodies or wetlands > 2 ½ acres, a minimum 50-foot buffer is required.
- For all exceptional functional value wetlands (including ADID wetlands), a minimum 100-foot buffer is required.

These buffer requirements are considered to be the minimum standard for the county. Individual communities have the option of adopting more stringent buffer requirements. Adjacent land use, topography, runoff velocity and soil and vegetation types are all factors in determining the optimum buffer width for wetlands. Where a standard width is needed for regulatory purposes, 100 feet is considered a minimum buffer width for typical surface water requirements. Wider buffers are recommended for sensitive areas (Mitchell 1996). Required setbacks from the wetland should be calculated from the outer edge of the buffer rather than from the wetland itself.

3A.4.5. Wetland Incentives and Cost-Share Opportunities

There are a number of incentive programs to implement wetland projects. Fund sources for wetland protection and restoration, as well as technical assistance, are available from programs at the local, regional, state and federal levels of government.

USACE Continuing Authorities Program

At the Federal level, the USACE Continuing Authorities Program (CAP) from Section 206 of the 1996 Water Resources Development Act targets wetland restoration. This section, also known as the "Aquatic Ecosystem Restoration" program gives the USACE the authority to carry out aquatic ecosystem restoration and protection if the projects will improve the quality of the environment, are in the public interest and are cost effective. The objective of section 206 is to restore degraded ecosystem structure, function and dynamic processes to a less degraded and more natural condition. The local sponsors of aquatic ecosystem restoration projects are required to contribute 35 percent towards the total project cost.

USDA –NRCS Programs

The US Department of Agriculture - NRCS has four incentive programs that may have applicability in Lake County watersheds:

- Environmental Quality Incentives Program (EQIP)
- Wetland Reserve Program (WRP),
- Conservation Reserve Program (CRP), and
- Wildlife Habitat Incentive Program (WHIP).

The EQIP and WRP are only applicable to agricultural lands. The CRP requires the land use to be agricultural for 3 of the previous 5 years. The WHIP can be used for any private land. The local USDA-NRCS office can be contacted for additional applicability details at (847) 223-1056. The local NRCS contact is David Misek.

The goal of WRP is to restore and protect degraded wetlands such as farmed wetlands. WRP has three options available: permanent easements, 30 year easements and restoration agreements. NRCS will reimburse the landowners for easements on the property plus a portion of the restoration costs based on the type of easement agreed to by the landowner.

The EQIP program is accommodating to grass-roots conservation. Typically EQIP monies will fund 75 percent of land improvements and installation of conservation practices such as grade stabilization structures, grassed waterways, and filter strips adjacent to water resources (including wetlands). Funding for the EQIP program is possible if a watershed planning committee successfully nominates its watershed as a natural resource "priority area".

The goal of the CRP program (and CREP - Conservation Reserve Enhancement Program) is to give incentives to landowners who take frequently flooded and environmentally sensitive land out of crop production and plant specific types of vegetation. Participants earn annual rental payments and sign-up incentives. This program offers up to 90 percent cost share. Rental payments are boosted by 20 percent for projects such as installation of riparian buffers and filter strips. Windbreaks, contour buffer strips, and shallow water areas are additional funded practices.

The WHIP program is available for private landowners to make improvements for wildlife on their property. This program offers up to 75 percent cost share. This grant program is competitive and funding depends on the project's ranking compared to others in the state.

USFWS Partners for Wildlife
Up to 100 percent cost-share funding is available for private landowners with restorable wetlands through the Partners for Wildlife program of the US Fish and Wildlife Service and the Illinois Department of Natural Resources – Division of Wildlife Resources. The landowner must agree to maintain the restored wetland for a minimum of 10 years. The restored wetlands should fulfill multiple objectives including providing habitat for waterfowl, improving water quality, providing flood protection and recharging groundwater.

IDNR Conservation 2000
Because the Fish Lake Drain watershed is part of the Fox River watershed, funding is available on a competitive basis from the State of Illinois' Conservation 2000 Ecosystems Program (C2000). The C2000 program, administered by the IDNR Office of Realty and Environmental Planning seeks to "to maintain and enhance the ecological and economic conditions in resource-rich landscapes by supporting Ecosystem Partnerships of local and regional interests." C2000 funds are available both for wetland/habitat acquisition and restoration. The Fox River Ecosystems Partnership administers C2000 funding for the Fox River watershed.

IEPA Section 319
Funding for wetland related projects is provided by the Illinois Environmental Protection Agency through the Nonpoint Source Management Program (Section 319 of the Clean Water Act). Wetland-related projects funded with 319 funds, be they buffers, wetland restorations or other projects, must help "…to control nonpoint source pollution, improve Illinois water resources, and promote the public's knowledge and awareness of nonpoint source pollution.

Northeastern Illinois Wetlands Conservation Account
Wetland restoration funds are also available through grants from the Northeastern Illinois Wetlands Conservation Account. This funding source is applicable to the 6 county Chicago region and is jointly administered by The Conservation Fund and the US Fish & Wildlife Service.

Wetlands Restoration Fund
Wetland restoration money is available through this fund formed to accept fee-in-lieu of wetland mitigation monies generated by the wetlands permitting program. Corlands administers this fund for the 6 county Chicago region.

LCSWCD Technical Assistance
At the local level, technical assistance is available from the LCSWCD. The LCSWCD, along with NRCS staff, offers free assistance to develop conservation plans, assist with technical design of conservation practices and provide and interpret natural resources information. LCSWCD assistance would be especially useful in development of management plans for high quality (ADID) wetlands.

Tax Assessment Reduction
At the local level, incentives are available to preserve land in open space through the County Assessor's office. Land that remains in open space for at least three years is eligible for a dual assessment. This means that as long as the land is used as open space, taxes are paid on a lower use value (rather than market value) based on the value of the poorest open space land in the county (according to court decisions). In

order to be eligible for assessment as open space, the property must be at least 10 acres and meet a number of other criteria.

3B. REMEDIAL MEASURES: RESTORE NATURAL RESOURCES

3B.1. Stream Restoration

Stream restoration techniques are used to improve stream conditions so they more closely mimic natural conditions. For an urban stream reaches, restoration to natural conditions may not be possible or feasible. For instance, physical constraints due to adjacent development may limit the ability to re-meander a stream. In addition, the natural stream conditions may not be able to accommodate the increased volume of flow from the developed watershed. Other factors such as economics and politics may also come into play.

Even in cases where restoring the stream to its natural condition isn't possible, the stream can still be naturalized and improved by reestablishing riparian buffers, performing stream channel maintenance, stabilizing streambanks using bioengineering techniques, and, where appropriate, by removing dams and installing pool/riffle complexes. Stream restoration projects may be one component of floodplain restoration projects, and can be supplemented with trails and interpretive signs, providing recreational and educational benefits to the community.

3.B.2. Pool/Riffle Complexes

Establishing pool/riffle complexes in the streambed is another method for restoring stream conditions. Pools and riffles naturally occur in streambeds in a sequence that follows the meander of the stream. However, pool/riffle sequences are usually lost when streams are channelized.

Riffle restoration is usually done with rock weirs placed in sequences at spacing intervals determined by the bankfull width of the stream. The cobble and boulder weirs are spaced so a distance of approximately six bankfull widths separates them. Pools develop between the riffles. The pool/riffle sequences benefit fish and macroinvertebrates by aerating the water during low flow conditions, and by providing more diverse substrate and deeper water for habitat.

The placement of the stone for the riffles can also reduce streambank erosion immediately downstream as stream flow is funneled through the center of the stream channel and away from the banks. Pool/riffle complexes are often installed in conjunction with the other streambank stabilization techniques described above for even better stream restoration results (Illinois State Water Survey 1998).

3.B.3. Wetland Enhancement and Restoration

Because agriculture and urbanization have degraded many of the remaining wetlands in Lake County watersheds, wetland enhancement projects are necessary to improve the diversity and function of degraded wetlands. The term enhancement refers to improving the functions and values of an existing wetland. Converted wetland sites (or sites that were formerly wetlands but have now been converted to other uses) can also be restored to provide many of their former wetland benefits. Wetland restoration is the process of establishing a wetland on a site that is not currently wetland, but was in the past prior to conversion.

Wetland functional values vary substantially from wetland to wetland; they receive special consideration because of the many roles that they play. Because of the wetland protection laws currently in place,

the greatest impacts on wetlands from future development in Lake County watersheds will likely be a shift in the types of wetlands and their location. Often in mitigation projects, various types of marshes, wet prairies and other wetlands are filled and replaced elsewhere, usually with open water wetlands. This replacement may lead to a shift in the values served by the wetland communities due to a lack of diversity of wetland types. The wetland restorations that undertaken in Lake County watersheds should include a variety of different wetland types to increase the diversity of wetlands in the watershed.

The restoration of wetlands will provide new stormwater storage areas, will improve water quality by treating stormwater runoff and will create new and better plant and animal habitat. In addition to these values, wetlands can be part of a regional greenways or trails network, they can be constructed with trails to allow the public to explore them more easily and they can be used to educate the public through signs, organized tours and other techniques. Wetland restorations are an exceptional way to meet multiple objectives within a single project.

3B.4. Agricultural Practices

3B.4.1 Contour Buffer Strip

Contour buffer strips can be utilized to enhance wildlife habitat. To enhance wildlife habit, a native, warm season, grass specie mixture, recommended for wildlife purposes, can be used where adapted. Mowing the buffer strips should be delayed to every other year or every third year depending on geographical location. Mow only after the desired species of ground nesting birds have hatched and allow for regrowth before the growing season ends. To enhance wildlife cover, the width of buffer strips will be increased to 30 feet or wider as determined based on the requirements for nesting and escape cover of the target wildlife species. The maximum width between buffer strips should not exceed 300 feet.

3B.4.2. Filter Strip

To restore, create, or enhance herbaceous habitat for wildlife and beneficial insects, additional filter strip flow length devoted to this purpose must be added. Any addition to the flow length for wildlife or beneficial insects shall be added to the downhill slope of the filter strip. Plantings to enhance wildlife may be added to that portion of the filter strip devoted to other purposes to the extent that they do not detract from its primary functions. Plant species selected for this purpose shall be adapted to the wildlife and beneficial insect species targeted. The filter strips should not be mowed during the nesting season of the target species. Also, livestock and vehicular traffic should be excluded during the nesting season of the target species.

4.0 MAINTAIN AND IMPROVE WATERSHED STEWARDSHIP

4A. PREVENTATIVE AND REMEDIAL MEASURES

Most measures related to watershed stewardship can function as both preventative and remedial in nature.

4A.1. Planning and Policy Coordination

4A.1.1. Lake County Fox River Watershed Management Board

The FRWMB was established in 1990 as an advisory board to the Lake County SMC. The FRWMB, formed under the direction of the Lake County Comprehensive Stormwater Management Plan, is made up of the chief elected official from every municipality, township, drainage district and county board district in the Fox River watershed in Lake County. The Fox Waterway Agency was added to the board in 1999. The FRWMB makes recommendations to SMC on financial, institutional and programmatic aspects of the drainage system and stormwater management services within the watershed. The board's primary role is to serve as a forum for the coordination and allocation of resources, to contribute to basin planning and implementation projects and to resolve inter-jurisdictional watershed issues. Prior to 1998, the FRWMB met 3-4 times per year. Because of low meeting attendance, the number of meetings was reduced to one per year beginning in 1998.

Overall FRWMB participation in planning and priority setting efforts for the Fox River watershed has been very high. The Fox members are perhaps the most active of all of the watershed management boards. WMB cost-share funding for local projects in the Fox watershed has been approximately $25,000 per year. Cost-share funds have been provided for numerous drainage improvement projects. The following projects were funded in 2002: a culvert replacement, a flood mitigation alternatives and LOMR (Letter of Map Revision for Flood Insurance Rate Maps) analysis, a subdivision road drainage project, a sediment control project, a storm sewer installation, a pump station upgrade, and a storm sewer master plan.

4A.1.2. Regulatory Coordination

Several opportunities present themselves for regulatory coordination in Lake County watersheds. The most obvious coordination opportunity is with implementation of the WDO in Lake County. Intergovernmental coordination with the state and federal regulatory programs is a second opportunity for the watershed.

The Watershed Development Ordinance

Lake County's Watershed Development Ordinance was enacted as a preventative measure and requires that consistent stormwater management practices be applied countywide. In concept, the WDO should be a fairly effective measure for coordinating at the watershed level to prevent both water quantity and quality problems.

While SMC has over-all administrative responsibility for the WDO in the county, many communities, upon request, have been delegated the authority to administer and enforce the ordinance through a certification process. In the Sequoit watershed, both Antioch and Lake Villa, and the County Building and Zoning Department (for unincorporated areas), have been certified.

Because of limited staff and varied priorities, WDO enforcement by certified communities is not always as effective as it should be. Strategies to improve WDO enforcement that have been incorporated into the 1999 amendment of the ordinance include providing more training opportunities for enforcement officers, making participation in specific training workshops a requirement for community re-certification (rather than optional as they are now), and holding certified communities more accountable for lax enforcement within their jurisdictions during re-certification. In particular, the water quality

requirements in the WDO are not consistently applied and enforced throughout the watershed. WDO amendments adopted in 1999 have improved the ordinance language and more clearly specify WDO requirements so they are not as subject to loose interpretation and application.

Wetlands Regulations

Another preventative measure that can benefit Lake County watersheds is the wetlands' regulatory programs. Since the 1970s, wetlands have been regulated through a permit program administered by the USACE under the authority of the Clean Water Act. In 1997, the USACE, the NRCS, LCSWCD and the SMC entered into a cooperative agreement to more stringently review and enforce soil erosion and sediment control on development sites that include wetlands. While coordination among the permitting staff of these agencies has improved dramatically, Lake County watersheds would also benefit from better coordination regarding wetland mitigation and restoration.

Because of the existing flooding and water quality problems in the watershed, it is important that the watershed not lose any more wetland acreage through the USACE permit program. On August 14, 2001, the Lake County Board unanimously approved amendments to the WDO to protect isolated wetlands that were no longer under regulation by the federal Clean Water Act administered by the USACE). The amendments require the applicant to first submit a jurisdictional determination request to the U.S. Army Corps of Engineers. The Corps decides whether the wetland in question is jurisdictional under the Clean Water Act, or isolated by nature of the SWANCC Supreme Court Decision. SMC wetland staff will soon be authorized by the Corps to perform this first step under an Interagency Coordination Agreement (ICA).

Another measure to prevent wetland losses centers on where wetland mitigation and restoration occur. Historically, wetlands lost in a Lake County watershed could be mitigated in any watershed throughout the six-county Chicago metropolitan region. Recent WDO amendments require that all wetland losses in Lake County be mitigated in Lake County in order to receive a Watershed Development Permit.

As an alternative, a cooperative agreement could be developed between the permit agencies (LCSMC, USACE) and the US Fish & Wildlife Service and the Natural Resources Conservation Service that stipulates that any wetland mitigation required for unavoidable losses should be located within the same watershed where the loss or impact occurs. This agreement could also spell out the permitting agencies' roles and responsibilities in promoting, coordinating and funding wetland restoration projects within the Lake County watersheds.

4A.2. Not-For-Profit Involvement

4A.2.1 The Fox River Ecosystem Partnership (FREP)

FREP was formed in 1996 after the IDNR designated a core of high-quality ecological resources in the northern-most watershed as a "Resource Rich Area". Portions of eleven counties, including Lake, McHenry, Kane, Kendall and LaSalle, form the Fox River watershed, which is home to 11 percent of the state's population. The watershed contains the Fox Chain O'Lakes (one of the nation's busiest inland waterways), many high quality Natural Areas, and suburban areas with some of the highest growth rates in the state.

The Partnership is a diverse group, made up of landowners, businesses, non-profit organizations, agencies and governments within the Fox River Watershed region. In 1998 FREP began a comprehensive planning process, identifying 16 critical factors and 6 areas of concern. The result was the ***Integrated Management Plan for the Fox River Watershed in Illinois*** that makes 35 recommendations for action.

The FREP is a 501(c)3 not for profit organization. The Executive Committee consists of the President, Vice President, Treasurer, Secretary, Past President and Committee Chairs. Officers are elected by majority vote at an annual meeting. FREP Committees are: Agriculture, Education, Habitat, Lakes, Recreation, Water Quality and Stormwater.

4A.2.2.Friends of the Fox River (FOFR)

This organization is dedicated to building a watershed of caretakers in the Fox River watershed. The Friends of the Fox River carries out many programs and activities to educate citizens about river issues and advocates the adoption of practices by individuals and governments that will best protect and enhance the quality of the watershed. Some of its activities are described below.

Fox River Watershed Monitoring Network
Friends of the Fox River works with schools and citizens, developing a network of volunteers who monitor the biological and chemical health of the river and its tributaries. It provides training, lends equipment, and compiles data collected by its volunteers. These data serve to establish long-term trends in water quality, and can be the first warning sign of problems in the watershed.

Advocacy
When policies that will affect the health of the Fox River Watershed are debated, Friends of the Fox participates as an advocate for the river. It reviews and comments on EPA permits for municipal and commercial discharges in the Fox River and its tributaries, and attends and testifies at public hearings on water quality issues in the Fox Watershed. The group writes letters to the editors of Fox Valley newspapers, to legislators and to government agencies about
water quality issues and is also active in the membership of the FREP, helping to shape its watershed plan.

Annual Student Congress
In conjunction with Kane County Regional Office of Education, Friends of the Fox River sponsors an annual Student Congress for middle and high school students. This event gives several hundred students the opportunity to learn how to be volunteer stream monitors, and learn why watershed protection is such an urgent issue in their localities.

Annual Fox Rescue River Clean Up
Each May, volunteers in several communities turn out for the Fox Rescue event. These enthusiasts, which include students, scout troops, employee groups, as well as individual citizens, remove thousands of pounds of trash from the shores and waters of the Fox River and its tributaries.

To learn more about Friends of the Fox River, visit its website at friendsofthefoxriver.org.

It is a not-for-profit membership-based organization. To become a member, check out the 'To Join' page on the website or call 815-356-6605 to request a membership form.