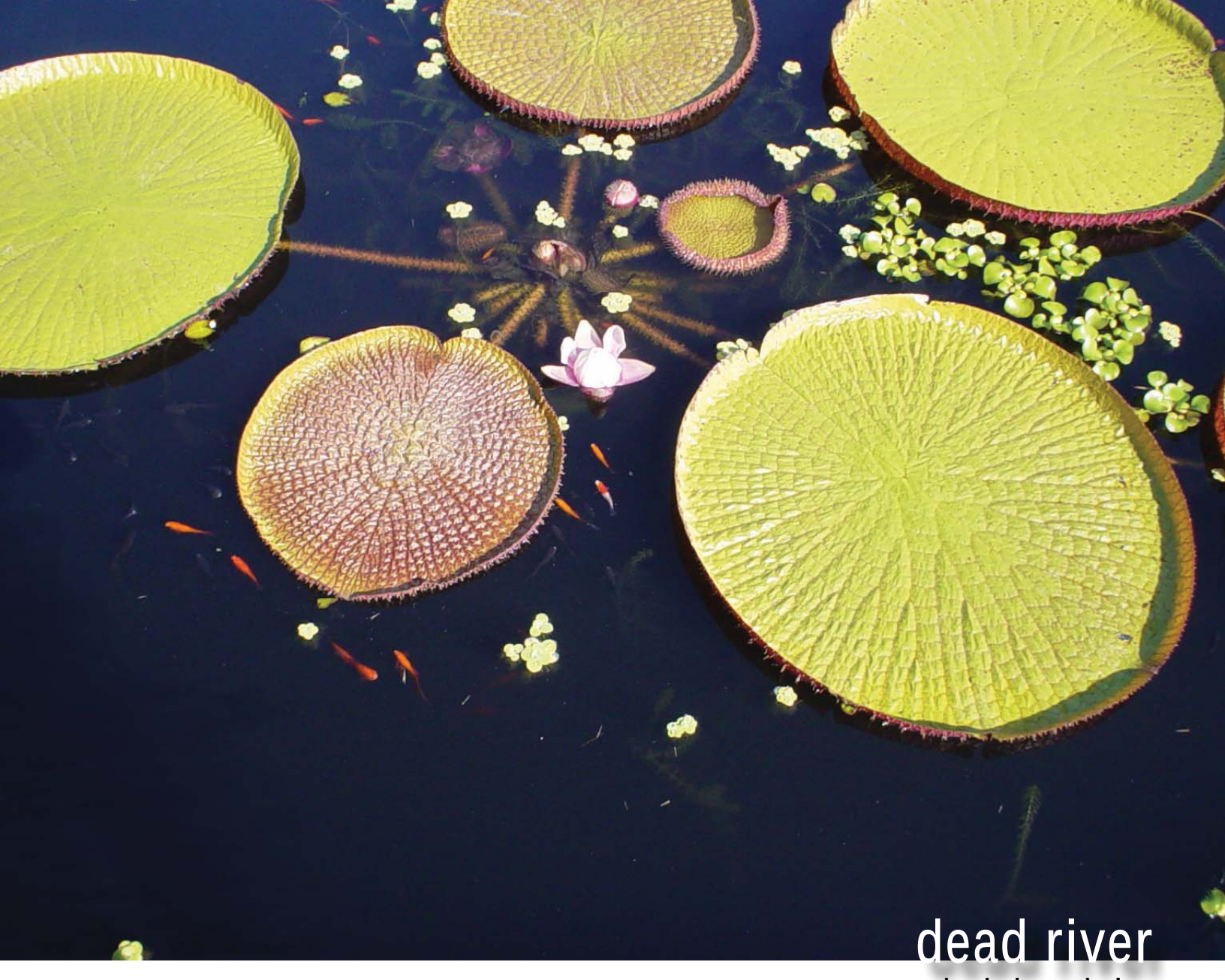


dead river

watershed - based plan

2008

foreword

The Dead River Watershed - Based Plan was developed through a cooperative effort between the Lake County Stormwater Management Commission and representatives of the watershed stakeholders. A number of different entities, ranging from homeowners to municipal governments and county agencies, consistently attended monthly meetings during the planning process. Twelve public meetings were held to solicit input from the stakeholder committee.

The Dead River Watershed Management Plan was developed to provide a "blueprint" for reducing flood damages, improving water quality, and protecting natural resources in the watershed. The Plan is intended to assist private citizens and the local, State, and Federal units of government concerned with managing the water resources of this watershed in a cost-effective and environmentally sound manner.

The Plan contains a summary of data collected for the watershed, quantifies water resource-related problems, presents goals and objectives agreed upon by the stakeholder group, and presents a list of recommended actions for effectively managing watershed resources in concert with activities such as comprehensive planning, development standards, and transportation planning. The Plan provides a basis for inter-jurisdictional communication and coordination on water resources issues.

This Plan is an advisory document for stakeholders of the watershed, but we encourage stakeholders to endorse the Plan, utilize the document as a reference, and pursue implementation. This document does not contain subwatershed regulatory requirements, but instead provides proactive guidance on opportunities to balance the uses and demands on the watershed's resources to improve the quality of life for future generations.

Lake County Stormwater Management Commission

Michael D. Warner, P.E., CFM
Executive Director

September 2008

Our vision for the Dead River Watershed is of . . .

a network of healthy streams and ecosystems where habitat for native plants and animals, and surface and ground water quality, are protected and enhanced;

unique, vibrant communities with sustainable and healthy economies;

a dedicated system of open space is protected, enhanced and preserved.

~ THE DEAD RIVER WATERSHED PLANNING COMMITTEE

executive summary

THE DEAD RIVER WATERSHED

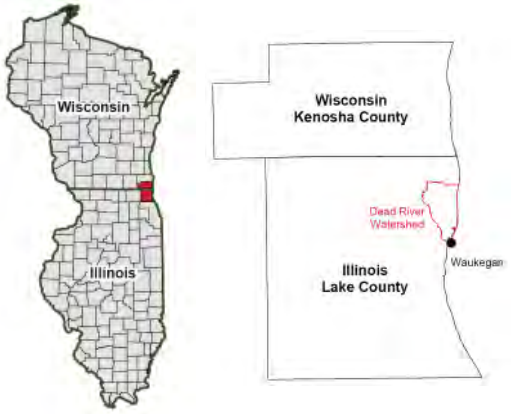
The Dead River watershed is the area of land where water that falls as rain or snow flows across the landscape, enters our streams and wetlands, and ultimately drains into Lake Michigan. The 16 square mile (10,200-acre) watershed is bounded by Green Bay Road on the west, Lake Michigan on the east, Waukegan Harbor on the south, and Shiloh 25th Street on the north.

The watershed is part of the Root-Pike watershed system that includes Kellogg Creek to the north and the Root and Pike Rivers in southeastern Wisconsin. The Dead River watershed is one of the few remaining Illinois tributaries that drains to Lake Michigan, and contributes to the overall quality and health of Lake Michigan and the Great Lakes system.

The watershed includes over twelve miles of stream and more than 1700 acres of wetlands. From north to south, the major stream channels inlcude an unnamed tributary, Bull Creek, and Glen Flora Tributary. Bull Creek is made up of the 27th Street Tributary, North Branch of Bull Creek, South Branch of Bull Creek, and the Wilson Avenue Tributary, which together become the Dead River in Illinois Beach State Park. The Glen Flora Tributary, formerly known as the Little Dead River, currently flows through the Johns Manville lagoons and discharges through a pipe to Lake Michigan.

The watershed includes part of Illinois Beach State Park, a National Natural Landmark visited by 2.8 million people annually, which contains 2000 acres of Illinois Nature Preserve, a high concentration of threatened and endangered species, and unique ecosystems found nowhere else on earth. The park also contains the last remaining undeveloped Lake Michigan shoreline and sand dune complex in Illinois.

The Dead River watershed includes areas of the City of Zion, Village of Beach Park, and City of Waukegan, as well as lands owned and managed by Lake County, the Lake County Forest Preserve District, the State of Illinois, and a number of other public and private entities.



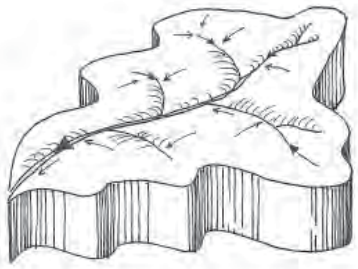
The Dead River watershed within the context of Illinois, Wisconsin, and the Great Lakes basin.

THE WATERSHED OVER TIME

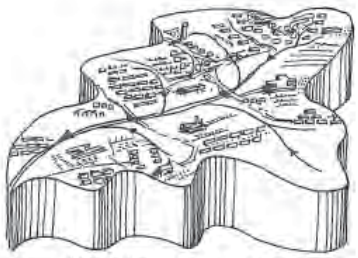
In the early 1800s, the watershed landscape consisted of scattered oak trees, prairies, and wetlands in the central and western thirds, large areas of open oak woodlands along the ridges and ravines, and a coastal 'beach ridge' along the Lake Michigan shoreline. Before settlement, the Dead River and tributary streams flowed cool and clear, and were surrounded with dense ground vegetation and scattered trees. When water reached the Lake Michigan beach plain, it spread out across the landscape creating a vast wetland and dune system and slowly seeped into the lake.

In the 1800's, the fertile soils and openness of the oak tree and prairie landscape attracted farmers, who converted these lands, including the draining of wetlands, for agriculture. In the early 1900's, urbanization of settlements began and continued with suburbanization following World War II. Today, the coastal beach ridge has been preserved as Illinois Beach State Park, and many of the ravine woodlands are intact. The rest of the watershed has been converted into downtown areas, older neighborhoods, and newer suburban development interspersed with commercial and industrial land uses.

A watershed is the geographic area of land that drains water to a particular stream, lake or wetland, and is defined by the topography of the landscape. The watershed includes not just the surface of the land, but also the area below the surface where water that infiltrates into the soil flows toward the receiving stream or waterbody as underground flow.



A WATERSHED DRAINS AN AREA OF LAND



URBANIZING WATERSHED

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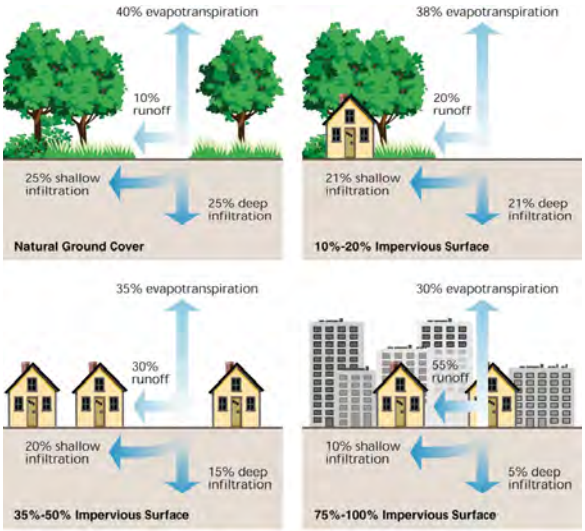
These landscapes have been restored to resemble presettlement condition similar to that found in the Dead River watershed.

THE IMPACT OF WATERSHED DEVELOPMENT

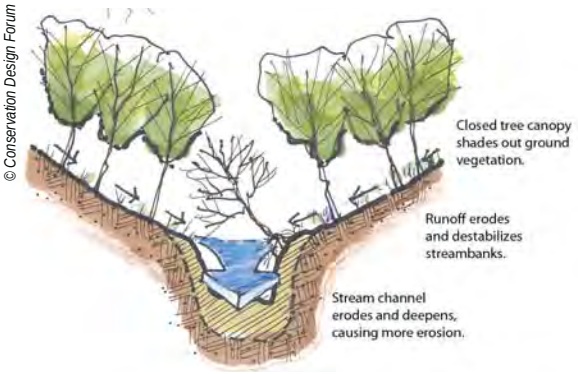
Under natural conditions, most of the water that falls on earth is used by plants, evaporates into the air, or seeps into the soil and becomes groundwater. Water that does not evaporate or infiltrate into the ground is called runoff. As a watershed develops, natural areas are converted into lawns, rooftops, roads, and parking lots. Instead of being used by plants or seeping into the ground, water that falls on these surfaces quickly flows to our streams directly or through the stormwater drainage and sewer system. As a result, streams and wetlands receive large pulses of water in shorter periods of time, resulting in erosion and destabilization of the stream channel and streambanks. When this happens, streambanks erode away, causing the loss of property and the pollution of our water with sediment. Where the landscape or the stormwater system is insufficient to contain this flush of water, flooding can occur.

Streambanks are further destabilized by the type and density of vegetation along the streambanks. Due to the introduction of plants that are not native to Illinois, and to the lack of natural landscape processes such as fire, deep-rooted ground vegetation that used to stabilize stream edges have been replaced with non-native plants and dense woods that shade out good vegetation and do not adequately stabilize the stream banks.

In addition to increasing the volume and rate of runoff, pollutants such as oil and grease, road salt, eroding soil and sediment, metals, bacteria from pet wastes, and excess nutrients (nitrogen and phosphorus) from fertilizers are washed from streets, buildings, parking lots, construction sites, lawns and golf courses into the streams and lake. This kind of pollution is called nonpoint source pollution. Additional pollutants include increased water temperature, altered pH, and low dissolved oxygen levels, making the river unhealthy for aquatic life.



Greater imperviousness results in a greater percentage of rainfall leaving as runoff and less infiltrating into the ground.



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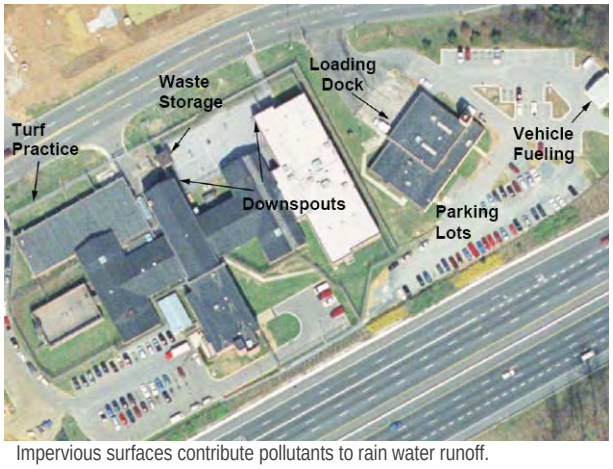
High runoff can cause erosion and incision of stream channels.



Impervious surfaces contribute pollutants to rain water runoff.

The health of the Dead River system and Lake Michigan are a direct reflection of land use activities throughout the watershed such as how we develop the watershed, and how we live in and manage our urban landscape, have a dramatic effect on the condition of watershed resources. Tthese impacts affect not only the residents and visitors of Zion, Beach Park, and Waukegan, but all of the communities that depend on Lake Michigan to provide water, recreation, food, economic well-being, or other values. Fortunately, there are proven practices for addressing these impacts, and landowners, business owners, public officials, and all who live, work, and play within the watershed can take positive action towards improving the watershed. One of the first steps in the process it to understand watershed problems and make a plan for moving forward -- a watershed plan.

WATERSHED PLANNING

Healthy watersheds offer many benefits including a healthy river with better water quality, enhanced opportunities for recreation and environmental education, opportunities for environmentally sustainable economic development, better wildlife habitat, reduced flood damage, and a healthier Lake Michigan.

One of the first steps to rediscovering and enhancing these watershed benefits is through a process called watershed planning. The purpose of the watershed planning process to better understand the condition of Dead River watershed resources, and to identify actions to prevent existing watershed problems from worsening as a result of future land use and management changes, preserve and improve water resources, reduce flood damage, protect property and infrastructure, and improve the quality of life for watershed residents. Watershed planning has the added benefit of bringing numerous communities together to plan for the greater good and to protect and improve the land and water resources they share and impact.

The following general steps were used in developing this watershed plan.

1. Conduct monthly Watershed Planning Committee meetings with watershed stakeholders and technical team members.
2. Solicit public input on watershed issues and opportunities and formulate watershed goals and objectives.
3. Review and analyze existing studies, watershed conditions, and watershed data to identify watershed problems.
4. Identify best management practices and policies to improve watershed resources.
5. Develop detailed watershed improvement action and implementation plan and recommendations.

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Watershed planning is a participatory process with watershed stakeholders.

WATERSHED ISSUES AND GOALS

During the first two Watershed Planning Committee meetings, watershed stakeholders developed a list of watershed issues and opportunities and prioritized them via a voting process. Specific areas of concern include the stream system and erosion problems, the ravines, the area north of Waukegan Harbor, and Lake Michigan and its shoreline. These and other issues were categorized into the following topic areas, with the number of votes received shown in parenthesis:

1. Stream Restoration and Management (53)
2. Floodplains (16)
3. Natural Resources (34)
4. Watershed Education & Coordination (32)
5. Stormwater Infrastructure (0)
6. Water Quality (0)

Due to the similarity and proximity of the Kellogg Creek and Dead River watersheds, these results were combined with those of the Kellogg Creek watershed as the foundation for developing the following watershed management goals, which are further detailed in Chapter 2:

Goal A: Restore the health and function of streams as part of a watershed *green infrastructure* (see description at right).

Goal B: Reduce and prevent flood damage to protect health, safety, property and infrastructure.

Goal C: Preserve and restore a *green infrastructure* network of land and water resources.

Goal D: Provide people with watershed improvement education, resources, and opportunities.

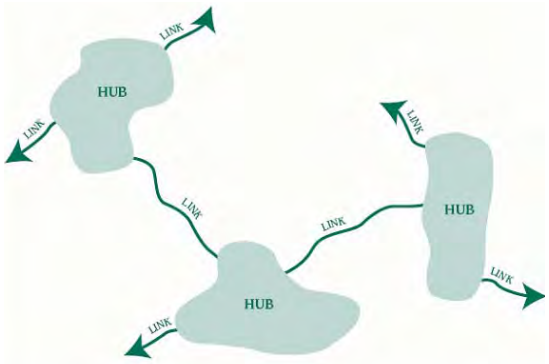
Goal E: Improve water quality by reducing the impacts of land use and development.

Goal F: Improve public, private, and non-profit coordination and decision-making.

Goal G: Stabilize the stream systems by reducing surface runoff.

Green infrastructure: On the local scale, municipal or neighborhood, green infrastructure consists of site-specific best management practices (such as naturalized detention facilities, vegetated swales, porous pavements, rain gardens and green roofs) that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls.

On the regional scale, green infrastructure consists of the interconnected network of open spaces and natural areas (such as forested areas, floodplains and wetlands, greenways, parks and forest preserves) that mitigate stormwater runoff, naturally recharge aquifers, improve water quality while providing recreational opportunities and wildlife habitat.



Conservation design: A county-wide method for developing land that conserves the green infrastructure elements of a site while providing for development at full density on the remainder of the site. Conservation design typically includes the use of stormwater management measures that filter and infiltrate runoff on site.

WATERSHED INVENTORY AND ASSESSMENT

Chapter 3 of this plan is an assessment of watershed conditions based on data, studies, and inventories, and the preparation of a series of watershed maps. The assessment included stream corridor conditions, stormwater infrastructure, flooding, water quality, land use, wetlands, and other relevant data and information. This information serves as baseline data for comparison with future watershed assessments. Five important conclusions based on this watershed assessment are summarized here.

1. The Dead River system exhibits rapid increases and decreases in water flow, level and velocity, which reduces water quality, reduces the quality of stream habitat, and destabilizes the stream channel, causing erosion of streambanks and ravines and damage to stormwater infrastructure.

2. Streambank and ravine erosion are a major concern along many reaches and require immediate attention. Stormwater discharge points are of particular concern as many of them were found to be failing or negatively impacting the stream system.

3. Water quality is impacted primarily by sediment, low dissolved oxygen levels, high phosphorous concentrations, and other typical urban watershed non- point source pollutants. The Waukegan Regional airport, other impervious surface areas, and the industrial legacy of Waukegan Harbor and areas to the north of the harbor are significant contributors to water runoff and pollution.

4. Preserving and restoring priority green infrastructure areas, including Illinois Beach State Park, Lyons Woods Forest Preserve, wetlands, and stream corridors, is critical for improving water quality and other watershed resources. Restoration measures include controlling invasive species, which threaten high quality natural, beach erosion in Illinois Beach State Park, and the habitat of the stream channel and the natural corridor through which the stream channel runs.

5. The municipalities, residents, businesses, landowners, and other organizations and agencies within the watershed lack the coordination and communication necessary to improve watershed resources.

WATERSHED BEST MANAGEMENT PRACTICE TOOLBOX

Chapter 4 of the watershed plan includes a description of best management practices and policies that can improve watershed resources. Included in this toolbox are actions that can be taken by residents, landowners, business owners, agencies, and municipalities to prevent conditions from worsening and to improve existing impaired conditions. Best management practices described in the toolbox include:

- Stabilize eroding streambanks using deep-rooted vegetation and other environmentally-friendly measures.
- Use conservation design principles for new development and retrofitting existing development with improved stormwater management practices.
- Install vegetated swales, raingardens, and filter strips, to help slow, filter, infiltrate, cool, and cleanse stormwater before being discharged to our streams and wetlands.
- Reduce the area of impervious surfaces and using permeable paving practices that allow water to infiltrate into the ground rather than run across the surface.
- Maintain deep-rooted, native vegetation buffers around streams, wetlands, and detention basins.
- Preserve green infrastructure including open space, stream corridors, wetlands, and natural areas.

WATERSHED ACTION PLAN

The effectiveness of the Dead River watershed plan will be largely dependent on the quality of the action plan in Chapter 5. The action plan provides the "who, what, where and when" for making watershed improvements and includes programmatic, policy, and site-specific recommendations. The site-specific action items are tied to a particular location in the watershed or along the stream corridor, and include details such as area, length, cost, responsibility, schedule, and priority. The eleven most important recommendations are summarized as follows:

1. Stabilize streambanks and ravine slopes to reduce erosion, protect property and infrastructure, improve water quality, and improve habitat.

2. Restore and manage stream corridors by restoring native riparian buffers, reducing the density of trees, removing excessive debris, and stabilizing the stream bed with practices that also enhance habitat.

3. Manage, retrofit, and stabilize the stormwater management system including detention basins and culverts, with focused attention on stormwater discharge points (pipes and ditches), to reduce runoff rate and volume and to improve water quality in the streams and Lake Michigan.

4. Preserve and restore priority green infrastructure areas to provide natural surface water storage areas, provide space for installing best management practices, and preserve an ecologically functioning network of open space, wetlands, streams, and natural areas as part of an interconnected system.

5. Manage and restore watershed natural areas including wetlands, former wetlands / hydric soil areas, and especially Lyons Woods Forest Preserve and Illinois Beach State Park.

6. Develop positive and creative new uses for the Zion Nuclear Power Plant and Waukegan Harbor areas, ensuring that these uses are compatible with protecting and improving watershed resources and Lake Michigan.

7. Remediate existing flood problems and prevent future flooding by reducing stormwater runoff and preserving areas for surface water storage and absorption such as floodplains, depressional storage areas, and wetlands, which also provide water quality improvement benefits.

8. Use better stormwater management, conservation design, and low impact development practices for new and existing development that slows, filters, infiltrates, cools, and cleanses stormwater runoff, especially in Critical Subbasins. This includes source controls and lot level best management practices such as vegetated swales, naturalized detention basins, rain gardens, stream buffers, filter strips, and reduced use of lawn chemicals and fertilizers.

An eroding stream channel before (left) and after restoration (right).

Monitoring is an important part of improving watershed resources.

9. Modify and use planning and development standards, policies, and capital improvement plans and budgets to protect and enhance water quality.

10. Provide public education and outreach to enhance understanding and apprciation of watershed resources and problems, to provide solutions, and to provide opportunities for people to get involved in watershed improvement activities.

11. Monitor and evaluate watershed plan implementation and physical watershed conditions to guage progress towards watershed goals.

MONITORING AND EVALUATION PLAN

A monitoring and evaluation plan was developed to provide a means of measuring progress towards watershed goals and plan implementation. This plan should be used by watershed plan stakeholders and other implementers to monitor watershed resources and to track whether meaningful progress is being made towards plan goals. The monitoring plan includes details such as the frequency of monitoring, short, medium, and long term milestones, responsible party, and mode of collection.

THE FUTURE OF THE WATERSHED DEPENDS ON ALL OF US

This plan has limited usefulness without the dedication and commitment of watershed stakeholders to the improvement, restoration, management, and stewardship of watershed resources. As the primary land use, development, and infrastructure authorities in the watershed, municipal and county officials and staff have a significant amount of the responsibility for plan implementation. County, state, and federal agencies also have a significant role in watershed plan implementation, by approving and supporting projects with funding, and by providing technical information, tools, and resources to assist local authorities and watershed organizations in their efforts. Watershed residents and landowners must also accept responsibility for managing their own land and water resources, for identifying watershed problems and opportunities, and for working with others to implement this plan.

All of these people and organizations will need to work together to successfully protect and restore the Dead River watershed, to ensure long-term watershed stewardship, and to share the responsibilities, costs, and benefits of watershed improvements. Plan implementation will also depend on a watershed organization to oversee, guide, coordinate and monitor watershed activities on behalf of the stakeholders. This organization typically forms as an outgrowth of the Watershed Planning Committee with support coming from a variety of state and local agencies as well as local land use authorities and decision makers. This is the primary mechanism for the general public to be involved in watershed activities, to support the implementation of the watershed plan, and to voice their concerns and celebrate their successes in restoring watershed resources.

THIS PLAN IS A BLUEPRINT

The Dead River Watershed-Based Plan provides specific guidance for addressing impacts and for preserving and enhancing the valuable resources of the watershed. It provides a source of information and recommendations for municipalities, forest preserves, developers, residents, county and state agencies, and others to effectively plan and conduct land use and other activities in a way that is appropriate for protecting watershed resources. It provides guidance for comprehensive planning, development standards, green infrastructure preservation, natural resource restoration, land management, and water quality improvement, with an overall focus on water resources. It also provides indirect guidance for capital improvement planning and budgeting.

acknowledgements

The Lake County Stormwater Management Commission secured the funding and provided project oversight and management. The dedication and support of the Dead River Watershed Planning Committee and other watershed stakeholders in the planning process made development of this plan possible. The municipalities of the watershed graciously hosted our planning committee meetings. Special acknowledgment goes to Beach Park who hosted the majority of our meetings due to their central location in the watershed. Conservation Design Forum and Montgomery Watson Harza assisted with data collection and plan preparation. Funding for the Dead River Watershed Management Plan was made available through the United States Department of Agriculture Natural Resources Conservation Service and Lake County Stormwater Management Commission.

The following people generously gave their time to speak to the Planning Committee about watershed issues: Tim Girmscheid, Liberty Prairie Conservancy; Don Wilson, Illinois Beach State Park; Deb Maurer, Lake County Forest Preserves; Joe Hughes, Bull Creek Stakeholders Association; Tony Wolff, Patty Werner, Mike Prusila, Scott Paszkiewicz, and Crissy Mehle, SMC; Jason Navota and Tom Price, CDF; and Erin Maloney, MWH.

Contributors to the watershed plan included representatives from both Kellogg Creek and the Dead River watersheds:

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Dead River Watershed - Based Plan

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Dead River Watershed - Based Plan

Prepared for:
Dead River Watershed Planning Commission

Prepared by:
Conservation Design Forum
Montgomery Watson Harza

1

introduction

1 introduction

1.1 THE DEAD RIVER WATERSHED

1.1.1 WATERSHED SETTING

The Dead River watershed is the area of land where water that falls as rain or snow flows across the landscape, enters our streams and wetlands, and ultimately drains into Lake Michigan. The 16 square mile (10,200-acre) watershed is bounded by Green Bay Road on the west, Lake Michigan on the east, Waukegan Harbor on the south, and Shiloh 25th Street on the north.

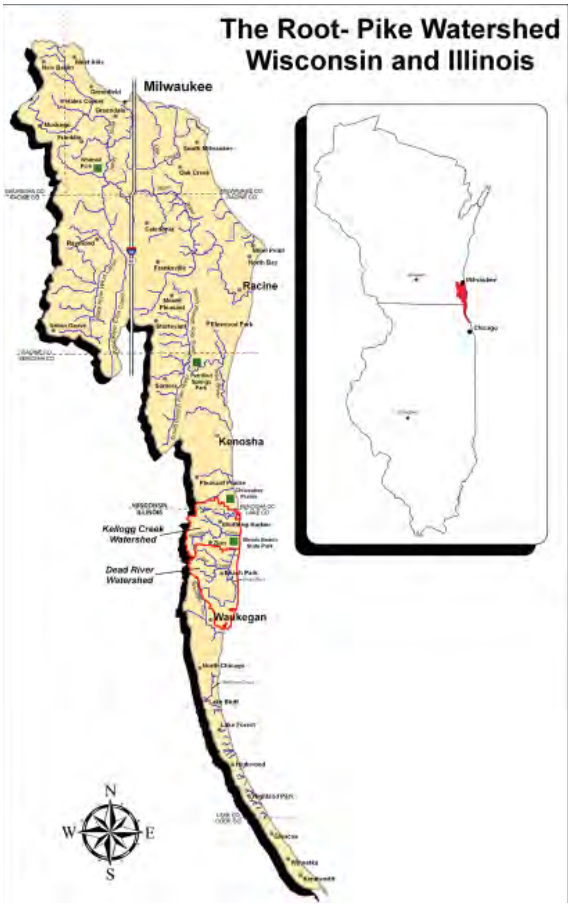
The watershed is part of the Root-Pike watershed system that includes Kellogg Creek to the north and the Root and Pike Rivers in southeastern Wisconsin. The Dead River watershed is one of the few remaining Illinois tributaries that drains to Lake Michigan, and contributes to the overall quality and health of Lake Michigan and the Great Lakes system.

The watershed includes over twelve miles of stream and more than 1700 acres of wetlands. From north to south, the major stream channels inlcude an unnamed tributary, Bull Creek, and Glen Flora Tributary. Bull Creek is made up of the 27th Street Tributary, North Branch of Bull Creek, South Branch of Bull Creek, and the Wilson Avenue Tributary, which together become the Dead River in Illinois Beach State Park. The Glen Flora Tributary, formerly known as the Little Dead River, currently flows through the Johns Manville lagoons and discharges through a pipe to Lake Michigan.

The watershed includes part of Illinois Beach State Park, a National Natural Landmark visited by 2.8 million people annually, which contains 2000 acres of Illinois Nature Preserve and unique ecosystems found nowhere else on earth. The park contains the last remaining undeveloped Lake Michigan shoreline in Illinois.

The Dead River watershed includes areas of the City of Zion, Village of Beach Park, and City of Waukegan, as well as lands owned and managed by Lake County, the Lake County Forest Preserve District, the State of Illinois, and a number of other public and private entities.

The Dead River watershed context in Illinois and Wisconsin.



The Dead River watershed is a subwatershed of both the Root-Pike and Lake Michigan watersheds.

1.1.2 THE WATERSHED OVER TIME

In the early 1800s, the watershed landscape consisted of scattered oak trees, prairies, and wetlands in the central and western thirds, large areas of open oak woodlands along the ridges and ravines, and a coastal 'beach ridge' along the Lake Michigan shoreline. Before settlement, the Dead River and tributary streams flowed cool and clear, and were surrounded with dense ground vegetation and scattered trees. When water reached the Lake Michigan beach plain, it spread out across the landscape creating a vast wetland and dune system and slowly seeped into the lake.

In the 1800's, the fertile soils and openness of the oak tree and prairie landscape attracted farmers, who converted these lands, including the draining of wetlands, for agriculture. In the early 1900's, urbanization of settlements began and continued with suburbanization following World War II. Today, the coastal beach ridge has been preserved as Illinois Beach State Park, and many of the ravine woodlands are intact. The rest of the watershed has been converted into downtown areas, older neighborhoods, and newer suburban development interspersed with commercial and industrial land uses.

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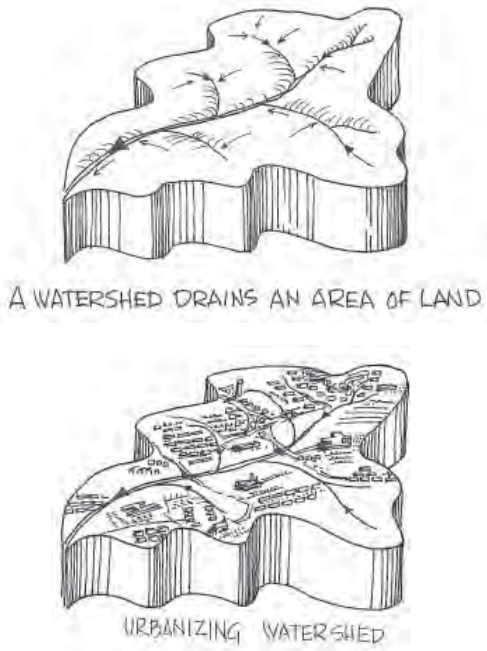
These landscapes have been restored to resemble presettlement condition.

A watershed is the geographic area of land that drains water to a particular stream, lake or wetland, and is defined by the topography of the landscape. The watershed includes not just the surface of the land, but also the area below the surface where water that infiltrates into the soil flows toward the receiving stream or waterbody as underground flow.



1.1.3 IMPACTS OF WATERSHED DEVELOPMENT

Under natural conditions, most of the water that falls on earth is used by plants, evaporates into the air, or seeps into the soil and becomes groundwater. Water that does not evaporate or infiltrate into the ground is called runoff. As a watershed develops, natural areas are converted into fields, lawns, rooftops, roads, and parking lots, which reduces the amount of land available for the natural evaporation or infiltration of water into the ground. Water that falls on these surfaces quickly flows to our streams through the stormwater drainage and sewer system.

This rapid drainage of water to our streams results in what is called “flashy” hydrology. A “flashy” hydrology means that the water level in the stream rises very quickly during a storm and falls quickly afterward. Low flows are considerably lower and high flows are considerably higher.

High flows that can not be conveyed by the stormwater system can result in flooding damage to property of watershed residents. Heavy flows can dislodge, damage, and erode around stormwater infrastructure components such as culverts and discharge pipes. High flows can also move and carry logs, branches, and other debris which can be deposited in large debris jams that are very difficult to dislodge. These debris jams can cause erosion problems as water finds its way around them.

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High flows can cause debris jams.

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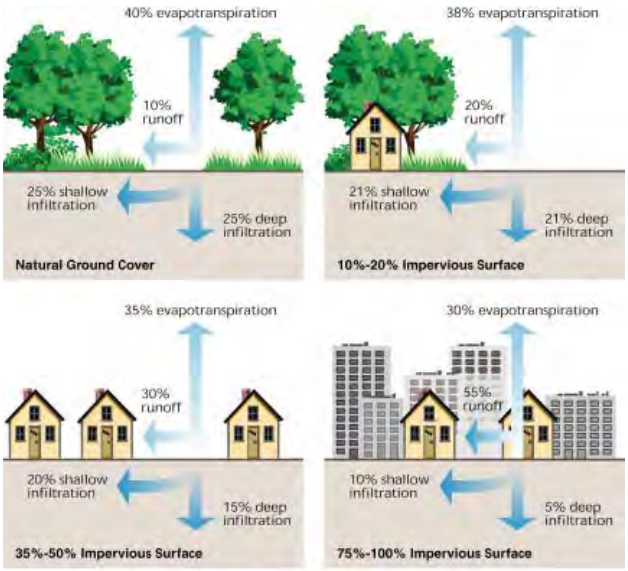
The hydrologic cycle.



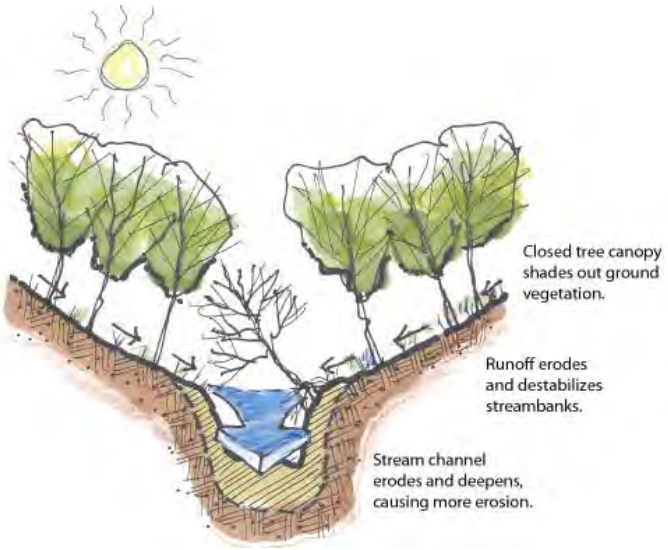
Greater imperviousness results in a greater percentage of rainfall leaving as runoff and less infiltrating into the ground.

1 introduction

As a result of this flashy hydrology, streams and wetlands receive large pulses of water in shorter periods of time, causing erosion of the streambed and/or streambanks. As the streambed erodes over time, the channel deepens and becomes more entrenched, in a process called downcutting. If the streambed is composed of materials that are more resistant to erosion such as gravel or stone, then the flow will tend to widen the channel by eroding the streambanks, rather than deepening it. As the stream erodes away, it takes property with it and exposes and damages infrastructure such as roads and bridges.

Erosion of the streambed or streambanks also results in heavier loads of sediment being transported and settling out of the water column and into the channel, which makes the habitat unsuitable for some species.

Streambanks are further destabilized by the type and density of vegetation along the streambanks. Due to the introduction of plants that are not native to Illinois, and to the lack of natural landscape processes such as fire, deep-rooted ground vegetation that used to stabilize stream edges have been replaced with non-native plants and dense woods that shade out good vegetation and do not adequately stabilize the stream banks.



High runoff can cause erosion and incision of stream channels.

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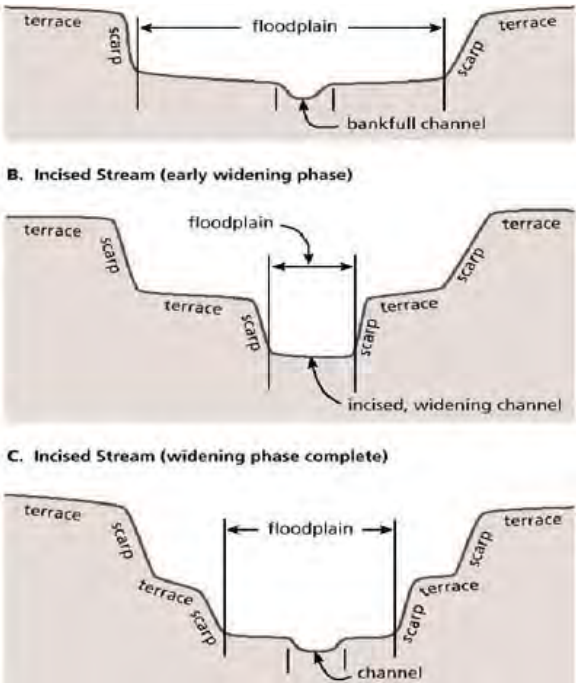
Erosion can damage infrastructure, such as storm sewer pipes.



High flows can deepen and widen the stream channel and floodplain.

In addition to increasing the volume and rate of runoff, pollutants such as oil and grease, road salt, eroding soil and sediment, metals, bacteria from pet wastes, and excess nutrients (nitrogen and phosphorus) from fertilizers are washed from streets, buildings, parking lots, construction sites, lawns and golf courses into the streams and lake. This kind of pollution is called nonpoint source pollution and reduces the quality of our streams for aquatic life, as well as for human uses such as fishing, swimming, and bird watching. These pollutants accumulate as the water flows downstream and eventually begin to degrade the quality of Lake Michigan for similar and other uses. In this way, every small bit of pollution adds up to a very large problem. And in this way, every small action to reduce the pollution problem adds up for the greater good for everyone.

An eroding stream channel before (left) and after restoration (right).

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Impervious surfaces, such as those identified in the top photo, contribute pollutants to rain water runoff.

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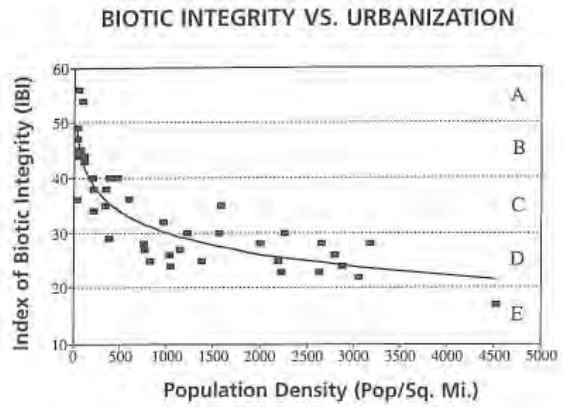
Severe erosion is common within the Dead River watershed.

1 introduction

In addition to chemicals and other substances picked up from the landscape, non point source pollution includes other measures such as temperature, acidity, and the amount of oxygen in the water. Aquatic organism, including fish and insects that are critical links in the food chain, need oxygen that is dissolved in the water to breathe. Low flows and non-point source pollution can cause the dissolved oxygen levels in the water to fall below healthy levels. When this happens, some plants and animals will die, in some cases causing large fishkills, and others will leave that location to try to find more habitable waters.

Water temperature can also cause problems. Many fish and other aquatic animals require cool or cold flowing water to survive. As rainwater flows across urban surfaces and through the sewer system, these surfaces warm the water causing the overall temperature of the receiving stream to be too warm for many aquatic plants and animals. This water can also be either more acidic or more alkaline than is healthy for these organisms to survive.

A number of studies have demonstrated the impact of urbanization of a watershed with stream health. In one set of studies, the number of people per square mile of a watershed was found to be inversely related with the biological health of a stream, as measured by the Index of Biotic Integrity (IBI). In another set of studies, the percentage of impervious cover of a watershed (streets, rooftops, parking lots, etc.) was inversely related to stream quality. In sum, these studies show that urbanization has a significant and direct impact on stream health and water quality.



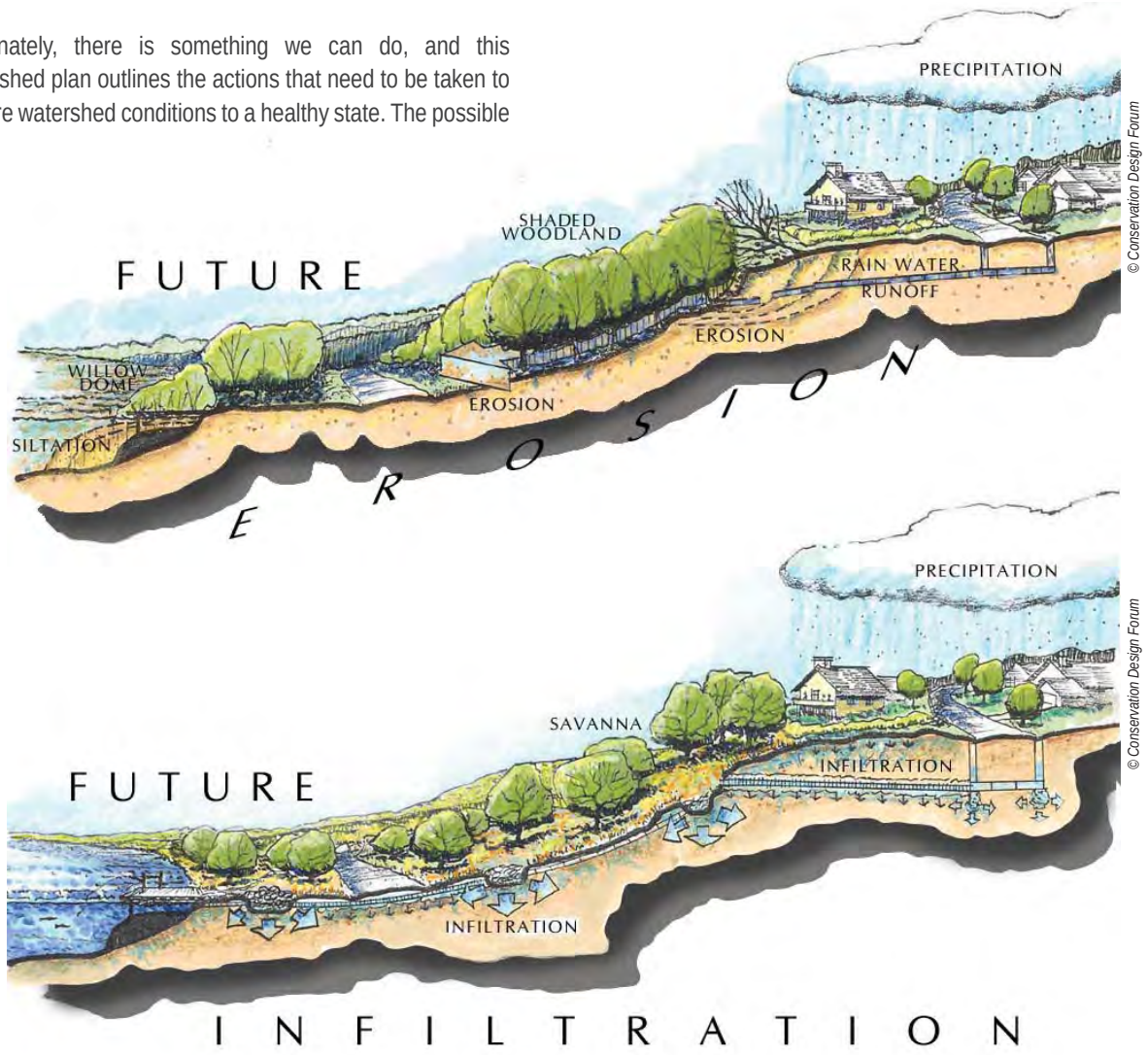
Urbanization negatively impacts the biological quality of streams.

Impervious cover also negatively impacts stream quality.

1.1.4 WHERE WE GO FROM HERE

As illustrated in the previous section, the health of the Dead River system and Lake Michigan are a direct reflection of land use activities throughout the watershed such as how we develop the watershed, and how we live in and manage our urban landscape. These impacts affect not only the residents and visitors of Zion, Beach Park, and Waukegan, but all of the communities, both human and natural, that depend on Lake Michigan to provide water, recreation, food, economic well-being, and other values.

Fortunately, there is something we can do, and this watershed plan outlines the actions that need to be taken to restore watershed conditions to a healthy state. The possible futures of the watershed depend largely on how we manage stormwater and how we manage the natural and urban landscape, as illustrated below. The business-as-usual trajectory, using conventional development, stormwater management, and landscape management practices will result in continued erosion and degradation of watershed resources. A new trajectory, however, that incorporates proven and environmentally-friendly stormwater and landscape management practices, can reverse this trend and begin the road to recovery.

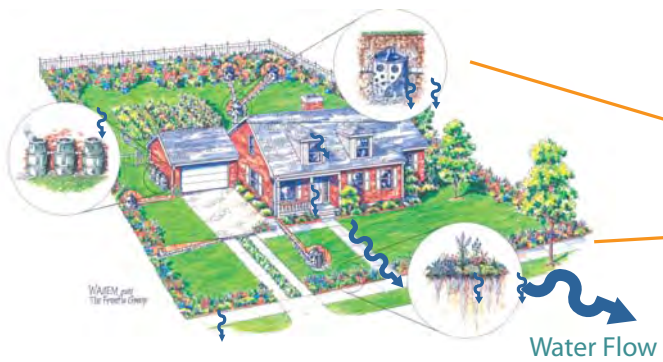


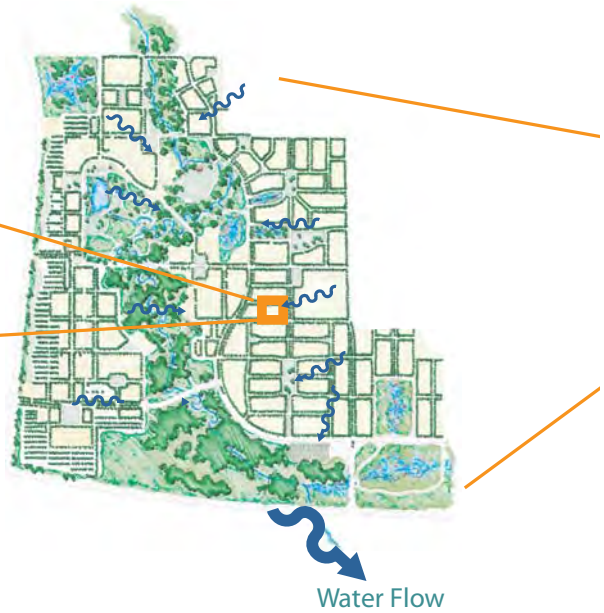
Possible futures include one of continued high runoff and streambank erosion, and another of infiltration and stable streambanks.

1 introduction

There is no single fix for watershed problems. They are the result of thousands of different decisions and actions made across the 10,000 acres of the watershed, and it will take an equal number of decisions and actions to improve the watershed. Every landowner, business owner, resident, public official, public works employee, golf course superintendent, farmer, teacher, banker, and bus driver—EVERY SINGLE PERSON who lives, works, and plays in the watershed—can take simple and positive actions to help improve it for you, your children, and your children's children.

Take your yard as an example. If you replace 10 square feet of your turf grass lawn with native plants, you'll need to mow, fertilize, and control weeds on 10 square feet less. This translates into less air pollution from lawn mowers, less fertilizers and pesticides making their way into the stream, and reduced yard maintenance needs (and costs) for you. Now consider the impact of all of your neighbors, the entire town, and the entire watershed doing the same thing. The combined impact of many small actions has a significant positive impact on overall health of the watershed.





Individual Lot Scale

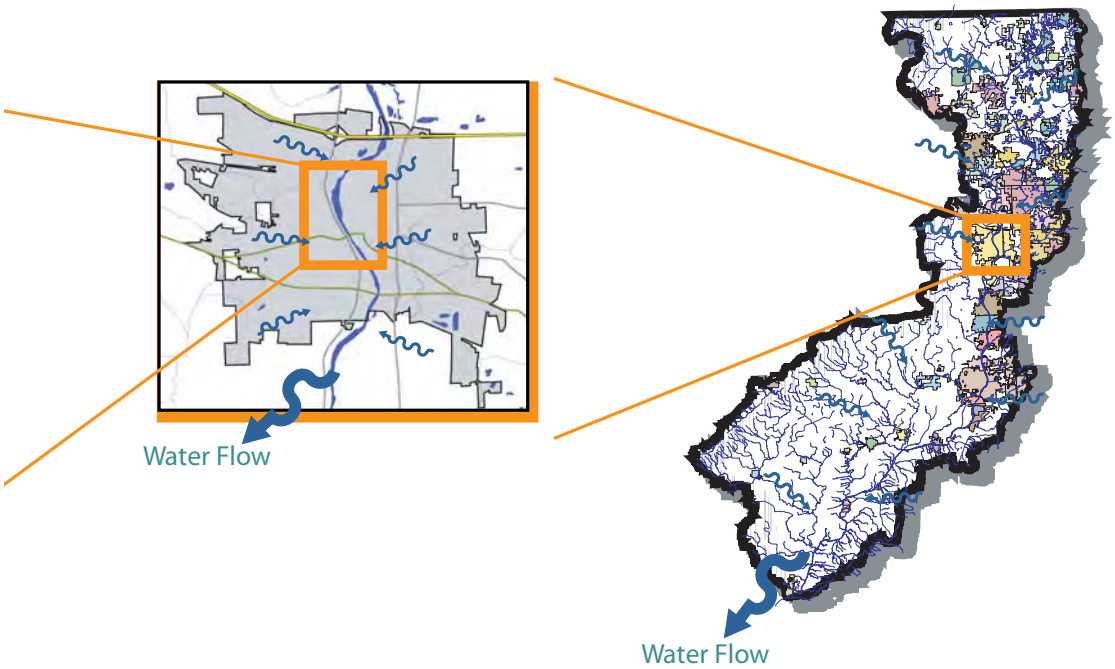
Every lot is part of a larger watershed. The degree to which water is properly managed at the lot scale is the degree to which downstream flooding, water quality, and habitat degradation can be avoided. Many practices described in this plan can be applied on individual residential and commercial lots, including green roofs, rain gardens and bioswales, native landscaping, and permeable paving. Although governed by community standards and regulations, implementation of lot-scale BMPs is generally the responsibility of property owners.

Neighborhood Scale

Greater benefits can be achieved through application of a conservation design approach at the neighborhood and campus scale. Proper planning at this scale ensures that onsite natural areas, water quantity, and water quality are protected. Conservation design and other approaches protect onsite resources from disturbance. Stormwater management approaches that mimic natural infiltration, evaporation, and runoff processes will protect offsite resources from the impacts of urban runoff.

Likewise, actions can be taken at every scale, from the individual lot to the neighborhood, town and watershed, to postiively impact watershed resources, as illustrated in the graphic below. Just as each landowner can do their part, everyone who works at these scales also must take responsibility for improving the watershed.

This watershed plan is a first step in helping you understand what you can do to help restore and highlight the unique and valuable resources of this wateshed. The watershed plan and planning process are described in the following section.



Community Scale

Communities are responsible for land use planning and thus have the ability to implement green infrastructure plans through comprehensive planning, development standards, easements, and planning assistance. Communities should establish stormwater and natural resource standards based on regional and watershed goals. Conversely, traditional community landscape and subdivision standards often can discourage environmentally-friendly conservation design in favor of more traditional development practices.

Watershed Scale

Since a watershed is composed of many communities, the actions of each of the communities will affect their watershed neighbors. Analysis of water resources and attention to goals at the watershed scale will ensure full protection of the region's lakes, streams, and wetlands. Green infrastructure plans established at the watershed scale can create ecologically functioning open space networks that can also serve as recreational resources.

1.2 ABOUT THIS WATERSHED PLAN

1.2.1 PROJECT PURPOSE

The Dead River Watershed-Based Plan provides specific guidance for addressing impacts and for preserving and enhancing the valuable resources of the watershed. If no action is taken, our watershed resources will continue to degrade. Water quality will continue to decline, our streams and streambanks will continue to erode and impact property and infrastructure, our natural areas will continue to lose their rare qualities as habitat, and Lake Michigan, a source of water and recreation to many, will continue be neglected.

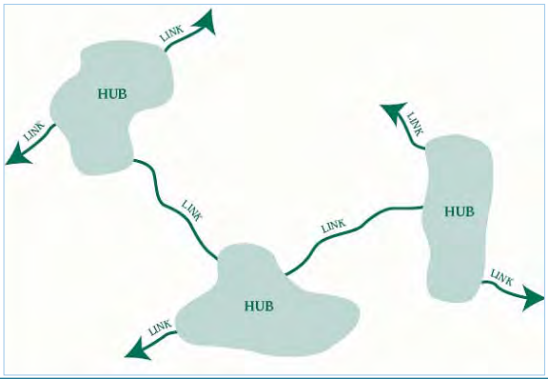
This plan provides information and a set of recommendations for municipalities, developers, residents, county and state agencies, and others to effectively plan and conduct land use and other activities in a way that is appropriate for protecting watershed resources. It provides guidance for comprehensive planning, development standards, capital improvement budgeting, green infrastructure preservation, natural resource restoration, land management, and water quality improvement, with an overall focus on water resources. Watershed planning also brings communities together and cooperate to protect and improve the land and water resources they share and impact.

1.2.2 SMC WATERSHED PLANNING AUTHORITY

The Lake County Stormwater Management Commission's (SMC) authority for stormwater management and watershed planning is provided by state legislation enacted in response to major flooding in 1986 and 1987 that caused widespread damage. Lake County subsequently developed and adopted a Comprehensive Stormwater Management Plan in June 1990 and an update in 2002. The Dead River Watershed-Based Plan will be adopted as an amendment to the 2002 Comprehensive Plan. SMC's authority for stormwater management enables it to enact and implement a countywide stormwater management plan, prescribe and enforce rules and regulations for watershed, floodplain, and stormwater management, and collect an annual tax to implement the stormwater management plan.

Green infrastructure: On the local scale, municipal or neighborhood, green infrastructure consists of site-specific best management practices (such as naturalized detention facilities, vegetated swales, porous pavements, rain gardens and green roofs) that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls.

On the regional scale, green infrastructure consists of the interconnected network of open spaces and natural areas (such as forested areas, floodplains and wetlands, greenways, parks and forest preserves) that mitigate stormwater runoff, naturally recharge aquifers, improve water quality while providing recreational opportunities and wildlife habitat.



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Conservation design: A countywide method for developing land that conserves the green infrastructure elements of a site while providing for development at full density on the remainder of the site. Conservation design typically includes the use of stormwater management measures that filter and infiltrate runoff on site.

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1.2.3 PROJECT FUNDING

This project was initiated and funded by the Lake County Stormwater Management Commission with a grant from the US Department of Agriculture Natural Resources Conservation Service. Participating municipalities and interest groups contributed staff time to provide information and participate in the watershed planning process. They included the Village of Beach Park, City of Zion, City of Waukegan, Beach Park and Benton Townships, Lake County Planning, Building and Development Department, Lake County Health Department, Lake County Forest Preserve District, Waukegan Harbor Citizens Advisory Group, Waukegan Airport, North Shore Sanitary District, Land Conservancy of Lake County, Illinois Dunesland Preservation Society, and a number of concerned citizens.

1.2.4 WATERSHED PLAN ELEMENTS

One of the key federal programs supporting watershed improvement projects is the Nonpoint Source Management Program, also known as Section 319 of the Clean Water Act. This program supports a wide variety of watershed activities including funding for education, watershed planning, demonstration projects such as streambank stabilization, and monitoring to assess the success of nonpoint source implementation projects. To be eligible for Section 319 funding, however, watersheds are required to have a Watershed Based Plan that addresses the following nine 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.

1.2.5 PRIOR WATERSHED STUDIES AND PLANS

A number of studies and inventories provided input for this plan. The Lake County Health Department collected water quality and flow data from August to November 2006 and from April to November 2007, and the North Shore Sanitary District provided additional water quality data. In 2005 the Illinois Department of Natural Resources collected biological stream data. The Lake County Stormwater Management Commission has collected stream inventory and detention basin inventory data, which provides a significant foundation for making recommendations for watershed improvement. The Lake County Stormwater Management Commission also has conducted a Flood Problem Area Inventory, as well as a detailed flood mitigation plan for the Lake County Gardens subdivision. Illinois Beach State Park and Lyons Woods have been studied and management plans developed by the Illinois Department of Natural Resources and the Lake County Forest Preserve District respectively. Waukegan Harbor has been assessed by the US Environmental Protection Agency. These studies have been summarized and included within the relevant watershed assessment section, and a list of past studies and resources is included in the References list at the end of the plan.

Monitoring is an important part of improving watershed resources.

1.2.6 PROCESS AND PLAN ORGANIZATION

The watershed planning process consisted of six primary steps that translate into the six main sections of the plan document. The following general steps were used to develop this watershed plan.

1. Assemble Planning Committee

A successful watershed management plan depends on the interest, input, commitment, and engagement by watershed stakeholders. A stakeholder is anyone that has an interest or 'stake' in the watershed. For the Dead River watershed, this included the Lake County Stormwater Management Commission, Health Department, Forest Preserve District, township representatives, municipal representatives, special interest and citizens groups, and other interested parties, collectively known as the Watershed Planning Committee. Committee meetings were held regularly beginning in October 2006 and continuing through early 2008. Each meeting presented information and sought stakeholder input regarding major elements of the plan. Meeting topics and minutes are provided in the report Appendix.

2. Identify Issues and Goals

During the first Watershed Planning Committee meetings, watershed stakeholders developed a list of watershed issues and opportunities and prioritized them via a voting process. The major topics of concern included: stream restoration and maintenance, water quality, flooding, watershed coordination, watershed hydrology, and natural resources.

3. Inventory and Assess Watershed Resources

The project planning team assessed watershed conditions and prepared of a series of watershed maps based on data, studies, inventories, and stakeholder input. The assessment includes information on stream corridor conditions, stormwater infrastructure, flooding, water quality, land use, wetlands, and other relevant information. This information not only provides a snapshot of current conditions but also serves as baseline data for comparing future watershed assessments.

4. Build Best Management Practice Toolbox

After the watershed condition was determined, a best management practice toolbox was assembled to identify the range of actions needed to improve watershed resources. This toolbox includes practices in the areas of policy and planning, development standards, stormwater management, erosion control, streambank stabilization, yard and landscape management, habitat restoration, natural area preservation, and flood reduction. It also provides a number of details for implementing recommended practices.

5. Develop Action Plan

The effectiveness of the Dead River watershed plan will be largely dependent on the quality of the action plan. The action plan provides the "who, what, where and when" for watershed improvement and includes programmatic (general) and site-specific recommendations. The site-specific action items are tied to a particular location in the watershed or along the stream corridor, and they include details such as area, cost, responsibility, schedule, and priority.

6. Devise Monitoring and Evaluation Plan

A monitoring and evaluation plan was developed to provide stakeholders and other implementers with a way to monitor watershed conditions and track whether meaningful progress is being made towards plan goals. The monitoring plan includes milestones, parties responsible for monitoring, and the frequency and method for collecting data.

1.2.7 PLAN REVIEW AND ADOPTION PROCESS

Once a draft plan is completed, it is reviewed by SMC staff and released to the watershed planning committee. This starts an official 60-day public review and comment period, which will include at least one public hearing. The plan will also be submitted to the IL Department of Natural Resources (IDNR) Offices of Water Resources and Resource Conservation and the Chicago Metropolitan Agency for Planning (CMAP) for review and recommendations. The SMC will review and consider the comments received and may amend or approve the plan and recommend it to the county board for adoption. The county board may then enact the proposed plan by ordinance as an amendment to the Lake County Comprehensive Stormwater Management Plan. Municipalities will also be asked to adopt the plan and incorporate its recommendation into local plans and policies, such as comprehensive plans, park and recreation plans, and capital improvement budgets.

1.3 USING THIS PLAN

1.3.1 WHO SHOULD USE THIS PLAN

This plan has limited usefulness without the dedication and commitment of watershed stakeholders to the improvement, restoration, management, and stewardship of watershed resources. As the primary land use, development, and infrastructure authorities in the watershed, municipal and county officials and staff have a significant amount of the responsibility for plan implementation. County, state, and federal agencies also have a significant role in watershed plan implementation, by approving and supporting projects with funding, and by providing technical information, tools, and resources to assist local authorities and watershed organizations in their efforts. Watershed residents and landowners must also accept responsibility for managing their own land and water resources, for identifying watershed problems and opportunities, and for working with others to implement this plan.

All of these people and organizations will need to work together to successfully protect and restore the Dead River watershed, to ensure long-term watershed stewardship, and to share the responsibilities, costs, and benefits of watershed improvements. Plan implementation will also depend on a watershed organization to oversee, guide, coordinate and monitor watershed activities on behalf of the stakeholders. This organization typically forms as an outgrowth of the Watershed Planning Committee with support coming from a variety of state and local agencies as well as local land use authorities and decision makers. This is the primary mechanism for the general public to be involved in watershed activities, to support the implementation of the watershed plan, and to voice their concerns and celebrate their successes in restoring watershed resources.

1.3.2 HOW TO USE THIS PLAN

For those unfamiliar with watershed planning and management, this document may appear overwhelming. There are pages of information to absorb, complicated tables to navigate, and hundreds of costly recommendations that an individual could not possibly begin to implement. But there are simple, straightforward actions that each person can take today to help improve the watershed.

First, remember that every action, no matter how small, can have an impact and improve watershed resources. Next, read the Executive Summary at the beginning of the plan to get a good overview of what this plan is all about. For additional details, browse the Table of Contents and flip to the relevant section, or refer to Table 1.1 and the suggestions that follow to help find more information. Table 1.1 below is intended to help you understand priority actions to be taken today to help improve watershed resources.

Table 1.1 Priority Actions by Stakeholder Type

If you are a	.... the top priority actions to be taken include
Resident	1. Stabilize streambanks and ravine slopes, restore native riparian buffers, reduce the density of trees, and remove excessive debris from the stream corridor. 2. Dispose of yard and household waste appropriately, not into stream channels or into storm sewers or ditches. 3. Capture rain water runoff using rain gardens, rain barrels, or other practices, and avoid discharging stormwater directly into stream corridors.
Business or Institution	1. Manage your property appropriately by using environmentally friendly lawn care practices and by regularly cleaning parking lots and other paved areas. 2. Install stormwater best management practices to help slow and cleanse stormwater runoff from your property.
Government Official or Staff	1. Manage, retrofit, and stabilize the stormwater management system including detention basins, culverts, and especially stormwater discharge points (pipes and ditches). 2. Adopt the watershed and greenway plan recommendations into local plans, policies, and regulations. 3. Preserve and restore priority green infrastructure areas including stream corridors, floodplains, depressional storage areas, natural areas, and wetlands. 4.Require the use of better stormwater management, conservation design, and low impact development practices for new and existing development that slows, filters, infiltrates, cools, and cleanses stormwater runoff. 5. Modify and use planning and development standards, policies, and capital improvement plans and budgets to protect and enhance water quality. 6. Manage parks, streets, and other publicly managed land appropriately by using environmentally friendly lawn care practices, by cleaning streets and other paved areas regularly.
Developer or Homebuilder	1.Use better stormwater management, conservation design, and low impact development practices for new and existing development that slows, filters, infiltrates, cools, and cleanses stormwater runoff. 2.Develop positive and creative new uses for the Zion Nuclear Power Plant and Waukegan Harbor areas, ensuring that these uses are compatible with protecting and improving watershed resources and Lake Michigan.
Land Manager	1. Manage and restore watershed natural areas including wetlands, former wetlands / hydric soil areas, and especially Lyons Woods Forest Preserve and Illinois Beach State Park. 2. Manage your property appropriately by using environmentally friendly lawn care practices and by regularly cleaning parking lots and other paved areas.

To find out ...

... **what this plan is intended to accomplish**, read about the watershed goals and objectives in Chapter 2, Goals and Objectives.

... **detailed information about the watershed resources and conditions**, read the watershed inventory and assessment in Chapter 3, Watershed Inventory and Analysis.

... **what sorts of education and outreach is needed in the watershed**, refer to Chapter 5 Section 4, Information and Education Plan.

... **the watershed problems that are close to a specific home or business**, first refer to the maps in Chapter 3 to find out which Subwatershed Management Unit and stream reach is closest to the area of interest. Once the location in the watershed has been determined, the maps and text in Chapter 3 can help identify what issues that area is experiencing.

... **what types of actions can be taken, in general, to improve the watershed**, then read Chapter 4, Watershed Best Management Practices Toolbox and Chapter 5 Section 2, the Programmatic Action Plan. These sections of the plan are presented in an expanded form in the plan appendices, which are available electronically via the SMC website (www.co.lake.il.us/smc/) or on the CD that accompanies the plan. Table 1.1 can help narrow the search.

... **what types of actions can be taken that can help fix the problems in a specific area**, first find the Subwatershed Management Unit and stream reach near the area of interest by reviewing the maps in Chapter 3. Next, turn to the maps and tables in Chapter 5, Section 3, Site Specific Action Plan. Within the table, each recommended action has a three digit identification number (SMU, Reach, and ID#) under the heading "Recommendation Identification #." For example, the identification number 3c.7.4 refers to an action in Subwatershed Management Unit 3a, reach DR07 (Dead River reach #7), and action number 4, thus, 3c.7.4. These three digit identification numbers are used to locate the action on the SMU maps in Chapter 5 Section 3. They can also be used to locate additional detailed information such as cost, responsible party, and the action's impact on watershed resources for that particular action recommendation in Appendix K (accessible electronically via the SMC website (www.co.lake.il.us/smc/) or on the CD that accompanies the plan).

... **what kind of funding is available for watershed projects**, turn to Appendix L, Plan Implementation Funding Sources.

2

goals and objectives

2 goals and objectives

2.1 WATERSHED ISSUES AND OPPORTUNITIES

The following list of watershed issues and concerns was identified and prioritized by the Dead River Watershed Planning Committee during the initial meetings, shown below with priority vote counts. Issues identified during the watershed assessment are shown in *italics*.

A. Stream Restoration (61)

1. Encourage good stream bank protection measures and remove poor practices and debris including the removal of concrete rip rap/armoring
2. Streambank erosion control and restoration in ravine areas
3. Bluff erosion / *property damage* in ravines
4. Streambank vegetation / *buffer* restoration
5. *Streambank modification*
6. *Fish habitat restoration / sedimentation in IBSP*
7. Make grant funds available for homeowner to make bank repairs

B. Stream Maintenance (44)

8. Create a group to maintain stream where homeowners are unable
9. Establish regular (annual/semi-annual) stream cleanup
10. Stream obstructions / *debris* / enclosures
11. Garbage/ yard waste in streams
12. Location and cleaning of existing infrastructure including concrete "banks"
13. If there is a dedicated drainage easement, whoever holds the easement needs to maintain the property

C. Water Quality (36)

14. Stormwater infiltration into sanitary sewers in streams and other areas
15. *Bluff / soil* erosion and sediment control
16. *Streambank erosion from, and at, stormsewers, point discharges, and/or hydraulic structures (9)*
17. Algae in creeks
18. Pollutants in stormwater runoff (includes road salt/chlorides, and fertilizers, pesticides, and herbicides from agricultural/lawn/playing field/golf course applications, sediment and nutrient loads)
19. *Contamination/ industrial point sources of pollution*
20. Need water quality monitoring for metals and other pollutants
21. Impact from airport such as fuel spills
22. Burning leaves in ditches
23. *Land use change*
24. *Beach closures*

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Bull Creek

D. Flood Risk/Damage (33)

25. Update floodplain maps and adopt corrections (to remove properties or buildings from the flood insurance purchase requirement)
26. Reduce flooding
27. *Floodplain protection*

E. Watershed Coordination (30)

28. Coordinate transportation projects with SMC
29. Better coordination among governments within the watershed especially related to stormwater management goals & responsibilities (effort & financing)
30. Drainage District role and participation
31. Identify responsibilities of each jurisdiction and homeowners (need to clarify lead for activities – should there be a local organization?)
32. Need up-to-date data

F. Watershed Hydrology (21)
   33. *Hydrologic modification*
   34. Investigate impact of changing land use on groundwater and surface water levels
   35. Restore hydrology for Glen Flora Tributary historic floodplain/wetland outfall location per Waukegan City Master Plan
   36. Identify historic water flow patterns (ground and surface)
   37. Remove concrete and other debris from abandoned properties

G. Education/Communication (15)
   38. Periodic homeowner newsletter of BMPs

H. Natural Resources (14)
   39. Information on control and identification of invasive and exotic species
   40. *Instream and riparian / buffer* habitat identification and management
   41. Encourage or restore fish passage from lake up into streams
   42. *Protect and restore wetlands and seeps*
   43. *Threatened and endangered species and habitat*
   44. *Beach erosion*
   45. *Low biological stream quality*

In order to streamline the watershed planning process for the Kellogg Creek and Dead River watersheds, the above list was combined with Kellogg Creek issues and opportunities to create the combined list below, prioritized based on the sum of the votes cast in similar issue categories. This combined list was used to develop the goals and objectives for both watersheds.

1. Stream Restoration and Management (158)
2. Flood Risk & Flood Damage (49)
3. Natural Resources (48)
4. Watershed Education & Communication (47)
5. Water Quality (36)
6. Watershed Coordination (30)
7. Watershed Hydrology (21)

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Failing stormwater infrastructure

2.2 GOALS AND OBJECTIVES

Based on the issues and concerns identified by stakeholders, and on the resources and condition of the watershed, the following goals, objectives, and indicators were established.

ISSUE 1: STREAM RESTORATION AND MANAGEMENT

Goal A: Restore and manage the stream system to preserve and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.

Objectives – Restoration

1. Remediate detrimental stream channel conditions such as armoring, channelization, siltation, and lack of habitat characteristics with in-stream and channel-specific restoration enhancements such as remeandering, regrading, bioengineering approaches to stabilization, and habitat structures (pools and riffles, boulders, root wads, etc.)

   Indicators: number of sites with detrimental channel conditions addressed by restoration project.

2. Remove or retrofit problem impoundments, dams, and weirs to support fish passage and migration and natural baseflow.

   Indicators: number of fish found in upstream reaches; seasonally consistent baseflow.

3. Stabilize all moderately and severely eroded streambanks using BMPs.

   Indicators: linear feet of streambanks with moderate or severe erosion stabilized.

4. Beginning with downstream reaches, develop a stream restoration plan and cost estimate for each reach that suffers moderate to severe stream bank erosion.

   Indicators: number of restoration plans developed.

5. Reduce the erosive capacity of storm sewer outfalls, drain tiles, and sump pump, roof, and footing drains being discharged into the stream channel through on-site infiltration practices and outfall retrofit and stabilization projects.

   Indicators: number of erosion-inducing storm sewer outfalls, drain tile outfalls, and building drains addressed with erosion-reduction / energy-dissipation measures (as assessed by rapid stream inventory every 3 years.)

6. Preserve or establish a minimum 50 foot native riparian buffer to preserve the stream corridor from impacts of adjacent land uses and to support wildlife habitat.

   Indicators: linear feet / acres of riparian buffer restored; average buffer width and condition (as assessed by rapid stream inventory every 3 years).

7. Preserve steep slopes and stream corridors with minimum setback and native buffer requirements for land disturbance activities including new development, structures, and redevelopment of previously developed land.

   Indicators: number of municipalities adopting setback/ buffer requirements.

8. Reduce sedimentation and remeander of stream reaches within Illinois Beach State Park and Spring Bluff Forest Preserve where possible to enhance instream habitat quality and support Lake Michigan aquatic species.

   Indicators: improved in-stream habitat quality as measured using biotic indices such as MBI, IBI, or other accepted measure.

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Severe streambank erosion

Objectives – Management

9. Develop a stream management and maintenance plan.

   Indicators: development of stream maintenance plan that includes a schedule, proposed funding source, and implementation partner.

10. Develop a program with authority and funding to implement the stream management and maintenance plan.

    Indicators: number of stream reaches being addressed by a management and maintenance program.

11. Clear, repair, or replace blocked, damaged, and failing culverts, outfall pipes, stream channels, and other stormwater infrastructure to maintain conveyance and reduce erosion and other impacts of an impaired or blocked stormwater system.

    Indicators: number of structures (culverts, outfalls, and headwalls) cleared, repaired, and replaced; number of blockages / debris jams removed.

ISSUE 2: FLOOD RISK AND FLOOD DAMAGE

Goal B: Reduce flood damage and prevent increased flooding to protect public health & safety, and public and private property and infrastructure investments.

Objectives

1. Maintain riparian and depressional floodplain and wetlands as open and undeveloped to maximize flood storage and conveyance.

   Indicators: number of new structures in the floodplain &/or number of floodplain or wetlands permits issued, floodplain and wetland acres preserved as dedicated open space.

2. Mitigate flood damages through flood-proofing of at-risk structures.

   Indicator: number of flood damage reports.

3. Mitigate sanitary sewer backup flood damages through remediation / correction of infiltration and cross connections with sanitary sewer system.

   Indicators: number of flood damage reports; *removal of FPA from inventory.*

4. Mitigate local drainage capacity flood damage by providing additional flood storage and or maintaining / improving local drainage system.

   Indicators: removal of FPA from inventory; number of flood damage reports; acre-feet of flood storage constructed.

ISSUE 3: NATURAL RESOURCES AND HABITAT

Goal C: Preserve, restore, and enhance a green infrastructure network of terrestrial and aquatic natural resources including streams, riparian corridors, wetlands, and upland resources.

Objectives

1. Adopt and prioritize Green Infrastructure Plan elements and recommendations in local land use plans, policies, and maps to establish the community vision, direction, and intent.

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Wetland

   Indicator: number of municipalities adopting Green Infrastructure Plan elements into local land use plans, policies, and maps.

2. Implement the Green Infrastructure Plan to guide prioritization, preservation, restoration, and management of important core and connecting green infrastructure elements and buffers.

   Indicators: acres of Category 1 or 2 Green Infrastructure lands / linear feet of stream channel and buffer preserved and restored (through public ownership, conservation organization ownership, conservation easement, or other preservation measure)

3. Preserve and improve ecological and biological quality of aquatic and terrestrial natural resources by improving habitat characteristics, stabilizing watershed hydrology, improving water quality, reducing coverage of exotic and invasive species and preserving threatened and endangered species.

   Indicators: biological survey data (Macroinvertebrate Biotic Index, Index of Biotic Integrity, and Floristic Quality Index scores), threatened and endangered species populations

4. Reduce shoreline / beach erosion in Illinois Beach State Park to preserve rare plant communities and habitat for

resident and migratory species.

Indicators: linear feet/acreage of shoreline lost or gained.

5. Reduce the potential of contamination from adjacent land uses to Illinois Beach State Park, its waters, and Lake Michigan.

   Indicators: agency contamination reports and monitoring data; remediation of contaminated sites completed.

6. Remove barriers to fish and other species migration by restoring and enhancing hydrologic connections of streams to Lake Michigan.

   Indicators: number of barriers removed / hydrologic connections restored; number of barrier-free stream miles / stream miles accessible from Lake Michigan.

ISSUE 4: WATERSHED EDUCATION AND COMMUNICATION

Goal D: Watershed residents, students, and communities have adequate knowledge, skills, resources, motivation, and stewardship opportunities to take action on implementing the watershed plan.

Objectives

1. Increase watershed stewardship opportunities and participation in management, monitoring, and restoration.

   Indicators: number of watershed stewardship events; number of participants in watershed stewardship activities; number of stream reaches covered by a stewardship group.

2. Convey messages from the education plan with public relations, education, outreach and media vehicles to increase public awareness and understanding of watershed issues.

   Indicators: number of placements and mentions in local and regional media; number of presentations and number of audience members reached by presentations.

3. Provide technical assistance to watershed communities, the development community, residents and other stakeholders to help them implement watershed plan recommendations.

   Indicators: Technical/informational items distributed to target audiences (subject matter/messages specified in education plan); number of participants in technical workshops.

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Lake Michigan beach, Illinois Beach State Park

4. Provide conservation and / low impact development (LID) practice guidelines and case studies to educate municipalities and the development community about innovative or alternative development approaches.

   Indicators: number of local government officials and staff participating in LID workshops; number of permits for / acres of new conservation developments as compared to conventional development; pre- and post-workshop knowledge assessment tools (e.g., tests).

5. Educate and involve students through watershed stewardship activities and watershed-based curricula.

   Indicators: number of students participating in watershed stewardship activities; number of students reached by watershed-based curricula.

ISSUE 5: WATER QUALITY

Goal E: Improve water quality in streams, lakes, and wetlands by reducing pollutants in stormwater runoff and addressing modified hydrology.

Objectives

1. All watershed streams and lakes meet or exceed state water quality standards.

   Indicators: Phosphorous < 0.05 mg/L
   Dissolved oxygen (DO) > 5.0 mg/L
   Index of Biotic Integrity (IBI) > 30
   Macroinvertebrate Biotic Index (MBI) < 6.0
   Trophic State Index < 70 (Sand Pond)

2. Reduce non-point source pollution loading from existing and new development (streets, parking lots, turf grass lawns, and other impervious surfaces) by controlling inputs and using on-site best management practices (BMPs).

   Indicators: water quality monitoring data (DO, phosphorous, turbidity); linear feet / acres of BMPs installed; linear feet of retrofitted drainage swale.

3. Prevent erosion from construction sites to reduce turbidity and total suspended solids.

   Indicators: turbidity of construction site runoff; number of violation notices for construction sites.

4. Prevent erosion and flow of chemical pollutants (fertilizers and pesticides) from farmland, golf courses, parks and yards into streams and wetlands by reducing / controlling inputs.

   Indicators: acres / linear feet of BMPs installed and/ or BMP implemented, both across the landscape and along the stream channel; number of wetlands and/ or onsite detention ponds enhanced for water quality improvement.

5. Prevent dumping of inappropriate substances (e.g., yard waste, garbage, household or automotive fluids, etc.) within the stream channel, riparian corridor, and stormsewer network.

   Indicators: number of dumping occurrences detected during rapid inventory; municipal reports on IDDE.

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Glen Flora Country Club

6. Reduce fecal coliform contamination on Lake Michigan beaches / nearshore waters by controlling contributing sources including gull populations.

   Indicators: number of beach closures; water quality sampling / fecal coliform data.

7. Improve infiltration and reduce stormwater flows to improve in-stream hydrologic and baseflow conditions, to address low dissolved oxygen, water temperature, and streambank erosion.

   Indicators: water monitoring data (streamflow, temperature, and dissolved oxygen).

8. Develop and implement a watershed monitoring program to collect and monitor water quality and biological data on a regular basis.

   Indicator: established monitoring program; record of monitored data.

9. Retrofit existing stormwater management structures such as detention ponds and roadside swales to improve water quality.

   Indicator: number or acres of retrofitted detention basins; linear feet or square feet of retrofitted swales.

10. Reduce or modify the use / application of road salt and other chemicals for snow and ice management to reduce the impact of chlorides and toxic substances on water quality.

Indicator: specific conductivity water quality data; long-term tracking of salt use by municipalities, county and other road maintenance authorities; number of road maintenance agencies educated regarding de-icing practices.

ISSUE 6: WATERSHED COORDINATION

Goal F: Improve coordination and decision-making between public, private, and non-profit stakeholders to implement the watershed plan.

Objectives

1. Pursue cost-sharing arrangements between jurisdictions for watershed preservation/improvement projects that have broad benefits and impacts.

   Indicators: number of projects funded by multiple jurisdictions and/or stakeholders.

2. Establish a watershed organization or council with funding and support to guide watershed plan implementation, provide technical assistance to watershed stakeholders, coordinate multi-partner projects, and coordinate with the Lake Michigan Watershed Ecosystem Partnership.

   Indicators: establishment of lead organization with budget and executive committee; number of projects advanced/undertaken under the auspices of the watershed organization.

3. Adopt, strengthen, and enforce standards and guidelines intended to preserve watershed resources.

   Indicators: number of communities adopting, strengthening, and enforcing standards and guidelines.

4. Watershed municipalities coordinate land use planning and report plans and progress to the watershed council.

   Indicators: number of communities using LID and conservation-oriented approaches; number of communities participating in watershed council meetings and reporting on land use changes.

5. Help communities and stakeholders secure project funding by disseminating information to communities and stakeholders on funding sources and mechanisms for implementing watershed projects.

   Indicators: number of communities receiving funding for watershed improvement projects; number of projects installed / undertaken.

6. Local public agencies incorporate watershed improvement best management practices in ongoing management, maintenance, and infrastructure projects (i.e. streets, the manmade drainage system etc.).

   Indicators: number of communities adding watershed improvement practices and functions (BMPs) to ongoing activities, plans, and budgets.

7. Understand and track watershed conditions by monitoring watershed resources and trends (hydrologic, biologic, and water quality) and implementation of plan recommendations.

   Indicators: watershed monitoring data; years of data collected; number of recommendations implemented.

ISSUE 7: WATERSHED HYDROLOGY

Goal G: Restore and enhance watershed hydrology and stabilize the stream systems by reducing surface runoff.

Objectives

1. Reduce/minimize the rate and volume of runoff from the developed and developing landscape by installing urban BMPs.

   Indicators: peak flow data / hydrographs showing reduction in peak flows for the 1-year event; change in rainfall event attenuation time; reduction in stream flow for a given rainfall event.

2. Preserve, restore and enhance overland flow paths.

   Indicators: change in rainfall event attenuation time.

3. All new development incorporates conservation design and LID practices to minimize changes / maintain pre-development hydrology and minimize impervious cover.

   Indicator: stormwater management plans demonstrating maintenance of pre-development hydrology; percentage

of impervious cover in watershed.

4. Restore natural hydrologic regime to watershed wetlands and natural areas, including Illinois Beach State Park, Spring Bluff Nature Preserve, and Lyons Woods Forest Preserve.

   Indicator: natural area management and monitoring reports.

These watershed goals were used to guide identification of watershed action recommendations and used as the framework for the action and implementation plan.

3

watershed inventory and analysis

3 watershed inventory and analysis

3.1 INTRODUCTION

An understanding of the unique features and natural processes associated with the watershed, as well as the current and potential future condition, is critical to developing an effective watershed plan. The watershed inventory and analysis organizes, summarizes, and presents watershed data in a manner that clearly communicates the issues and processes that are occurring in the watershed so that Dead River watershed stakeholders can make informed decisions about the watershed's future. The inventory and analysis helps to identify causes and sources of watershed impairment and provides the basis for recommending both programmatic and site specific actions intended to improve the watershed, which are found in Chapter 5.

As part of this effort, the project team collected and reviewed available watershed data and reports, investigated stream reaches, wetlands, natural areas, and other resources in the field, and gathered input from watershed stakeholders. Examples of information investigated includes water quality, streambank erosion, soils, wetlands, flood damage areas, the detention and drainage system, population, and current and future land use.

Geographic Information System (GIS) software was used to compile, analyze, and display this complex geographical information in graphical and map format so that stakeholders can easily understand the condition and location of watershed resources. The project team also investigated water quality by modeling the amount of different pollutants that are expected from various land uses.

This chapter presents the results of the inventory and analysis in a series of maps, tables, graphs, photographs, and narrative format. A summary of the watershed assessment is included at the end of the chapter.

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Bull Creek headwaters near Lewis Avenue (BL04).

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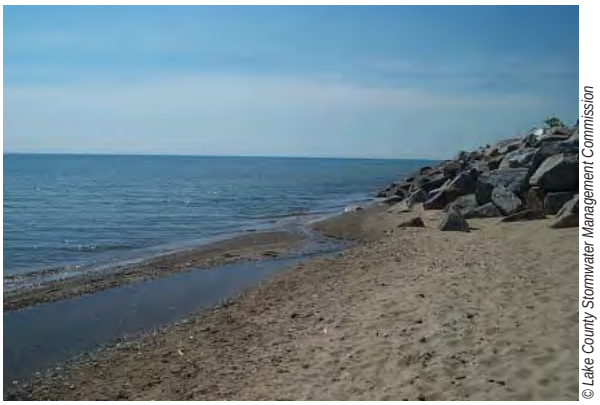
Lower reaches of Bull Creek (BL08) upstream of Illinois Beach State Park.



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The Lake Michigan shoreline.

3.2 WATERSHED SETTING

The 15.9 square mile (10,115 acres) Dead River watershed is located at the most northeastern corner of Lake County and Illinois, within the Lake Michigan watershed. The Dead River watershed drains from west to east, from the fairly flat headwaters reaches in the west, through a number of ravines, to the lake plains of Illinois Beach State Park before discharging to Lake Michigan. Stream reaches and tributaries flow through the municipalities of Beach Park, Zion, and Waukegan.

The watershed includes a number of large wetlands, depressional areas, significant natural areas, 55 threatened and endangered species recognized by the State of Illinois and four threatened and endangered species recognized by the federal government. Illinois Beach State Park and the Nature Preserve are highly unique natural area containing assemblages of species found nowhere else on earth, and is one of the few remaining undeveloped shorelines in the State of Illinois, providing important migratory habitat for five distinct bird species groups. It also deserves special mention that the overall quality and connection of the Bull Creek, Glen Flora Tributary, and Dead River stream systems to Lake Michigan is highly important for the proper management and stewardship of this valuable aquatic resource.

3.3 WATER RESOURCES

The water resources within the Dead River watershed are composed primarily of 12.6 miles of stream and 1719 acres of wetlands. From north to south, the major stream channels are: an unnamed tributary to the north, Bull Creek, which flows into the Dead River, and Glen Flora Tributary, which flows into Lake Michigan. Bull Creek is made up of four tributaries, listed from north to south: the 27th Street Tributary, North Branch of Bull Creek, South Branch of Bull Creek, and the Wilson Avenue Tributary, as illustrated in Figure 3.1.

The Glen Flora Tributary, formerly known as the Little Dead River, used to discharge south of Midwest Generation into a ditch. Current alignment of the Glen Flora Trib is under the railroad tracks, north into Johns Manville lagoons, and then east through ponds and a pipe that discharges to the Lake.

The Dead River is intermittently hydrologically connected to Lake Michigan and at other times this connection is obstructed by a sand bar dam created by littoral drift, which is broken during high river flows. Nonetheless, the Dead River watershed is one of the few remaining Illinois tributaries that drains to Lake Michigan. Thus, the importance of managing watershed resources to protect Lake Michigan water quality can not be overstated.

3.4 CLIMATE AND PRECIPITATION

The climate of the Dead River watershed, and of Northeastern Illinois, exhibits a wide range of temperatures over the calendar year. Mean high summer temperatures are in the low eighties; mean low winter temperatures are in the low teens. Although the temperatures fluctuate from season to season, the large thermal mass of Lake Michigan makes the fluctuation less extreme than is typical in Northwestern Illinois, for example. This attenuation of extreme high temperatures during the summer months and extreme low temperatures during the winter months results in a slightly milder microclimate along the Lake Michigan shoreline.

Precipitation and snowfall in the watershed average 34.09 and 37.9 inches per year, respectively. While Lake Michigan helps to moderate temperature, it contributes to the region's heavy winter snowfalls in the form of lake-effect snow. Precipitation is greatest during the late spring and summer and is typically associated with low-pressure weather systems. These systems result in the thunderstorms that are commonplace across the Midwest during the summer months. The ravines of the watershed have unique micro-climates and assemblages of plant species due to the moderating effect of Lake Michigan. Tables 3.1 and 3.2 present the 1971–2000 temperature and precipitation normals for the watershed.

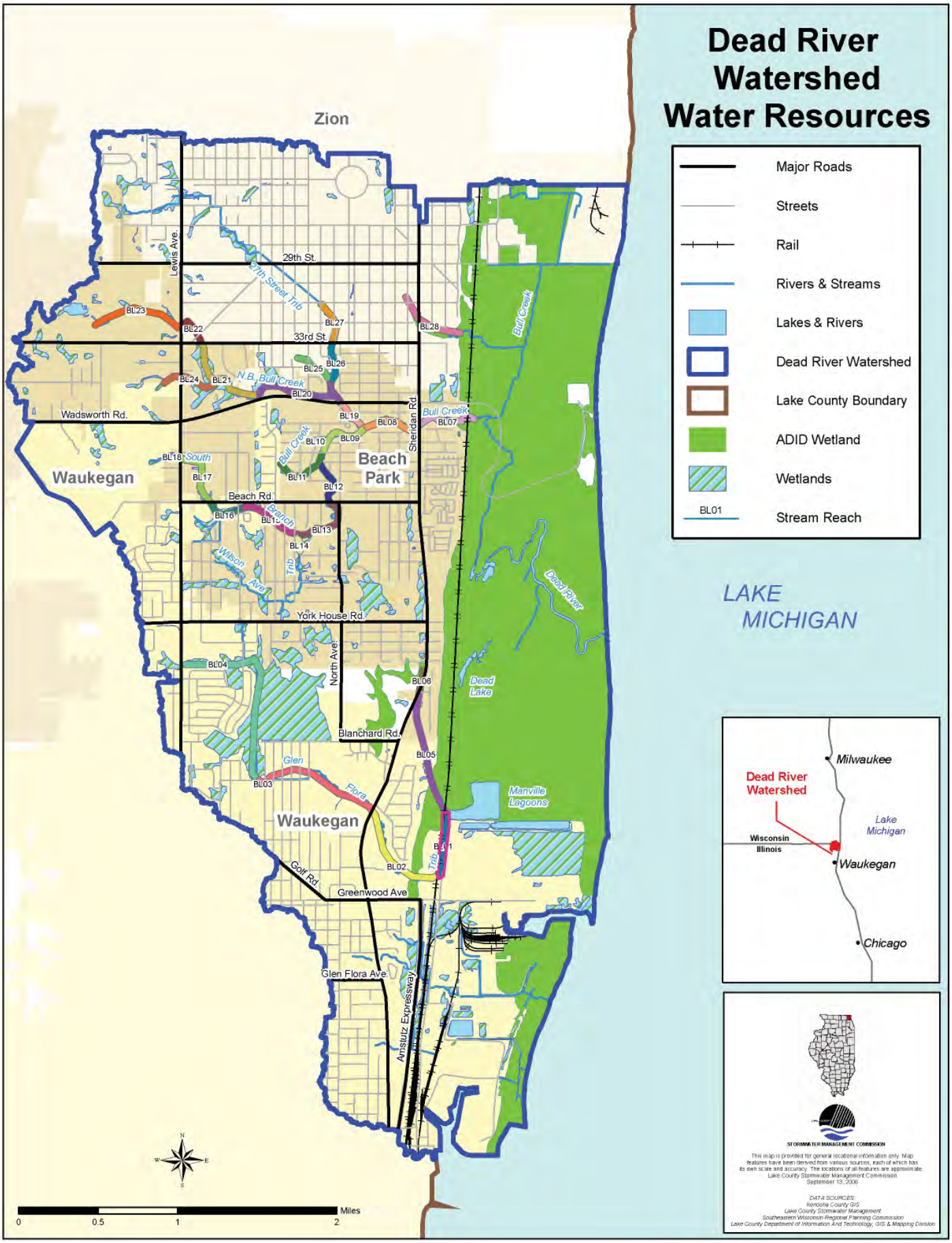

FIGURE 3.1: WATER RESOURCES

Table 3.1 1971-2000 Temperature data for Waukegan climate station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Totals
High (deg. F)	28.5	32.9	43.0	54.6	66.7	77.1	81.7	80.1	73.1	61.6	47.3	33.9	
Low (deg F)	12.0	16.6	25.0	35.6	45.8	55.3	61.3	60.5	52.4	40.6	29.9	18.3	
Mean (deg. F)	20.3	24.8	34.5	41.5	56.3	66.2	71.5	70.3	62.8	51.3	38.6	26.1	
Days High=90 (num)	0.0	0.0	0.0	0.0	0.3	2.2	4.3	2.9	0.9	0.0	0.0	0.0	10.6
Days High=32 (num)	19.0	12.8	5.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	2.3	13.2	52.6
Days Low=32 (num)	29.5	25.2	23.8	10.3	0.9	0.0	0.0	0.0	0.3	5.0	18.3	27.9	142.2
Days Low=0 (num)	7.0	4.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.4	14.8

Table 3.2 1971-2000 Precipitation data Waukegan climate station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Totals
Rainfall (inch.)	1.60	1.40	2.15	3.73	3.44	3.62	3.49	4.22	3.40	2.42	2.57	2.05	34.09
Days Total=0.01' (num)	7.9	7.1	8.7	10.4	10.6	9.7	9.1	9.4	8.6	8.3	9.3	9.1	108.4
Days Total=0.10' (num)	4.2	3.9	5.1	7.1	6.8	6.7	5.9	6.4	5.8	5.0	5.9	5.1	68.3
Days Total=0.50' (num)	1.0	0.7	1.3	2.7	2.5	2.4	2.5	3.3	2.5	1.5	1.8	1.4	24.1
Days Total=1.00' (num)	0.2	0.2	0.5	1.1	0.9	0.8	1.1	1.3	0.9	0.4	0.5	0.3	8.3
Snowfall (inches)	11.5	9.5	5.3	1.4	0.0	0.0	0.0	0.0	0.0	0.1	1.9	8.2	37.9
Days Total=0.1' (num)	4.8	4.8	2.8	0.5	0.0	0.0	0.0	0.0	0.0	0.1	1.4	4.8	20.0
Days Total=1.0' (num)	3.0	3.0	2.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.7	12.5
Days Total=2.0' (num)	2.0	2.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.6	7.5
Days Total=5.0' (num)	0.4	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.5

Source: Illinois State Climatologists Office, Illinois State Water Survey, http://www.sws.uiuc.edu/atmos/statecli/.

3.5 GEOLOGY AND TOPOGRAPHY

The Dead River watershed is located within the Wheaton Morainal Country subdivision of the physiographic division called the Great Lake Section of the Central Lowland Province. The Dead River watershed is in the area of northeastern Illinois whose character resulted from the most recent Wisconsin Episode of glaciation (approximately 14,000 years ago), which left drift (broken up rock and sediments) and moraines (piles and ridges of rocky debris left by retreating glaciers) more than 50 feet thick. The youngest moraine in Illinois, the Zion City Moraine, is comprised of three small ridges in and around Zion. The Zion City Moraine is one of five Lake Border moraines, all roughly parallel to the present-day shoreline of Lake Michigan. The western limit of the Dead River watershed, or the watershed divide, is created by the Highland Park Moraine, another Lake Border moraine. Green Bay Road (Illinois 131) generally follows the crest of this moraine through Lake County (see Figure 3.3.)

Illinois Beach State Park is part of a distinct and unique coastal landform called the Zion beach-ridge plain, an expanse of coastal land formed by deposition and migration of a succession of nearly parallel beach sand ridges. Sixty-six acres of the globally rare Panne ecosystem type is found here. Pannes are groundwater fed wetlands found within the depressions between sand ridges or dunes. Coastal processes, such as waves, nearshore currents and fluctuating lake levels, cause the erosion, movement and distribution of sand and sediment along the Lake Michigan shore, which present shoreline erosion and coastal management issues. The net direction of this sand movement is southward due to prevailing winds from the north and northeast that push wave action south along the shoreline.

The topography of the Dead River watershed is variable and slopes from a high point in the northwest to the east where it meets with the Lake Michigan water level elevation. It is generally flat or gently sloping in the eastern third (the beach plain), relatively flat in the western third with a few areas of greater (but still gentle) slopes, and the central third is generally flat but dissected with steep ravines formed by downcutting and other hydrologically-driven changes. (See Figure 3.4)

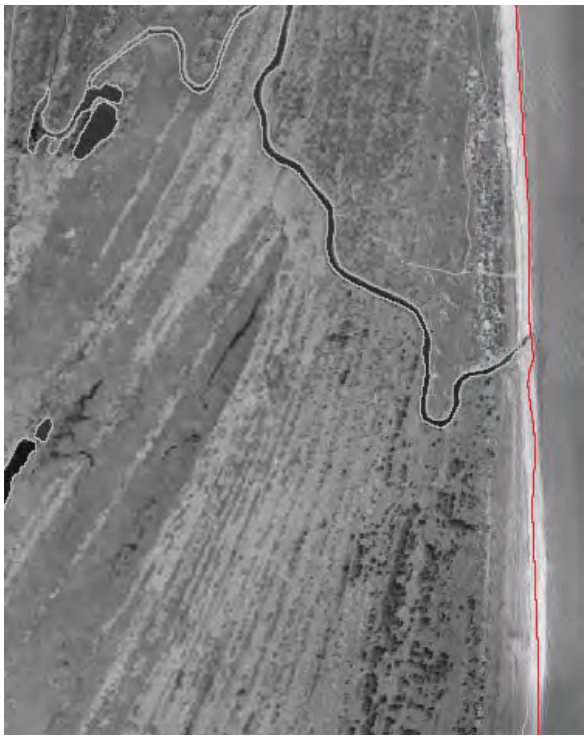

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FIGURE 3.2 ILLINOIS BEACH STATE PARK
DUNE AND SWALE SYSTEM

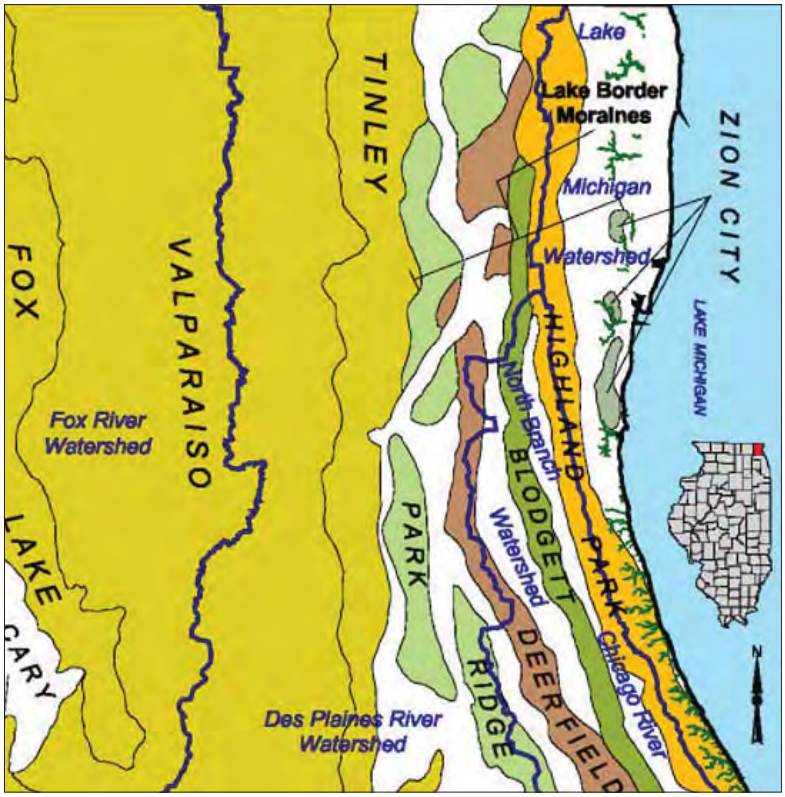


FIGURE 3.3 LAKE COUNTY LANDFORMS
(data source: Illinois State Geological Survey; Lake County Department of Information; and Technology, GIS and Mapping Division; Lake County Stormwater Management Commission.)

The stream headwaters begin at approximately 760 feet above sea level and enter the beach ridge plain at around 580 feet. Thus, the watershed elevation varies between approximately 760 feet and 575 feet at Lake Michigan. The elevation data for the watershed, depicted in Figure 3.4, was used in a number of the inventory and assessment steps of the watershed planning effort, including identifying watershed boundaries, flooding assessments, and defining smaller drainage areas within the watershed that are referred to as Subwatershed Management Units (SMU's), which is discussed in Section 3.13.2 below.

3.5.1 RAVINES

The bluff and ravine system associated with the Lake Michigan coastal plain and Bull Creek deserves special mention because it is a unique landform feature. These ravines formed prior to European settlement when water running off the western areas of the watershed towards Lake Michigan found the path of least resistance creating a small channel down the eastern slope of the moraine. As more water followed this same course, the channel deepended until the ravines were deeply cut through the moraine. the locations of the ravines are illustrated in Figure 3.4.

Over time, the ravines developed some interesting characteristics. The incision of the ravines into the underlying soils eventually intersected with the groundwater table in some locations, and water slowly seeped out through the steep ravine banks. This water caused wetland-like conditions to develop at the bottom of the slopes, creating unique, groundwater-fed growing conditions and plant assemblies called fens or seeps. These fens are rare in northeastern Illinois and deserve special consideration for preservation. These are described in further detail in Section 3.11.3.

Ravines also experience microclimates, small areas where the climatic conditions (such as temperature and humidity) are different from those of the surrounding landscape, sometimes due to air masses moving up and down the ravines from the Lake Michigan beach plain. These air masses have different characteristics than those outside of the ravines, whcih creates unique growing conditions and communities of plants and animals.

Due to development of the watershed, the increase in impervious cover, and stormwater collection and conveyance systems, a greater volume of runoff water reaches the stream and ravines more quickly today than in the past, subjecting the relatively fragile slopes to more destructive runoff energy than prior to development. This increased speed and volume of runoff entering ravines has led to destabilization and erosion of the stream and ravine banks and incision of the stream bed. Debris blockages, common in ravines, can trap sediment and cause water to back up behind the blockage and, in some cases, cause flooding. Blockages also divert water towards the streambanks, further exacerbating erosion problems. Development near or adjacent to ravine edges and bluffs has further compromised these systems. Removal of vegetation for development reduces the stability of the soil and can cause significant and catastrophic bank failure, threatening property and infrastructure. Roof and footing drains direct water into the ravines, adding to erosional forces. The sensitivity of these ravine systems, combined with the problems associated with development of the watershed, create special management challenges for watershed stakeholders.

© Conservation Design Forum

Typical ravine

Sources: Guide to the Geology of Illinois Beach State Park and the Zion Beach-Ridge Plain, Lake County, Illinois, Michael J. Chrzastowski and Wayne T. Frankie, Illinois State Geologic Survey, 2000.

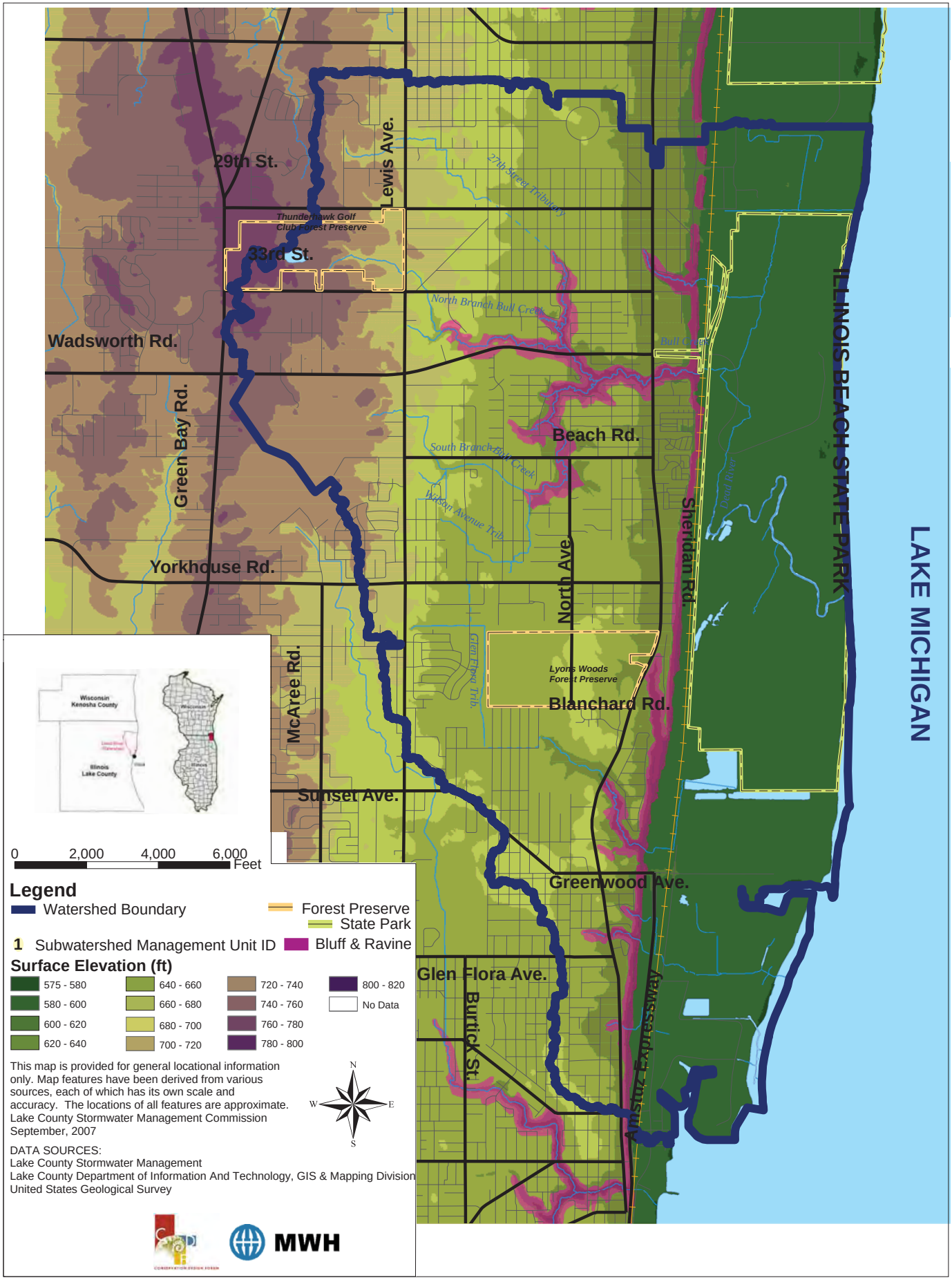


FIGURE 3.4 SURFACE ELEVATION

Chicago River/Lake Shore Area Assessment Volume 1: Geology, Critical Trends Assessment Program, Illinois Department of Natural Resources, 2001.

Ravine Systems in the Lake Michigan Watershed, Illinois. Illinois Coastal Management Program Issue Paper – TAG D. Illinois Department of Natural Resources, August 8, 2007.

Lake Michigan Action Plan DRAFT, June, 2006.

3.6 SOILS

Three categories of soil characteristics were investigated and mapped for this inventory. These were hydric soils, hydrologic soil group, and soil erodibility. Hydrologic and hydric soils help us determine which management practices are appropriate for different applications throughout the watershed. Understanding the extent and location of hydric soils helps to identify possible locations for restorinig former wetlands. Erodible soils indicate areas where development or improper management may cause erosion, and where maintaining vegetative cover can help hold soils in place.

3.6.1 HYDRIC SOILS

Hydric soils are those that have been saturated, flooded, or ponded long enough during the growing season to develop anaerobic (oxygen-lacking) conditions in the upper part or soil layer. These conditions favor the growth and regeneration of hydrophytic (wetland) vegetation. Hydric soils have unique physical and chemical properties that can be detected in the field. Hydric soils that are drained will retain those chemical and physical properties.

Hydric soils occur throughout the Dead River Watershed, as shown in Figure 3.5. Approximately 2436 acres (24%) of 10,194 total acres are hydric soils. The hydric soils data is from the Lake County Soil Survey developed by the Natural Resources Conservation Service and was provided by Lake County. The greatest concentration is within Illinois Beach State Park, along some of the current or former stream channels, and associated with current or former large wetland complexes. These hydric soils in their natural state were often poorly drained soils, or well-drained soils that are saturated due to a high water table, typically associated with wet prairies, wetlands, and streams. See Figure 3.9 Presettlement Vegetation, which illustrates the location of these wet landscape elements.

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 where no apparent connection exists, and where restoration can improve hydrology.

3.6.2 HYDROLOGIC SOIL GROUPS

Under a system devised by the U.S. Department of Agriculture, soils are classified into four hydrologic soil groups (HSG), A, B, C, and D, based on the degree to which certain soil types absorb and infiltrate precipitation. Precipitation that is not absorbed or infiltrated becomes runoff. Therefore, hydrologic soil groupings within a watershed are one determinant of how much rainfall will run off as surface flow to streams. In general, Group A (sandy soils) has the highest permeability and least runoff potential whereas Group D (predominantly clay soils) has the lowest permeability and highest runoff potential. Figure 3.5 shows the location of Hydrologic Soil Groups in the Dead River watershed. Note that there are two classifications for open water: Open Water (shown as blue) is based on the Lake County GIS system, and HSG Z (shown as white) is based on the county soil survey which classifies water as Z. Thus, both blue and white areas are considered as water features for this map.

For many hydric soils, the runoff potential depends on the drainage capacity of the soils. In their drained state, soils tend to have lower surface runoff potential since water can infiltrate into the soil. In their natural undrained state, with the water table at or near the surface, hydric soils often have high surface runoff potential (HSG D) since the soil is already saturated and can not accept or infiltrate more water. For the mapping, hydric soils that have modifiers such as “ponded” or “undrained”, were mapped based on the undrained HSG. Hydric soils with no such modifier were mapped based on the drained HSG. The percentages of each HSG in the watershed are shown in Table 3.3.

As indicated in Figure 3.5, the hydrologic soil groups change

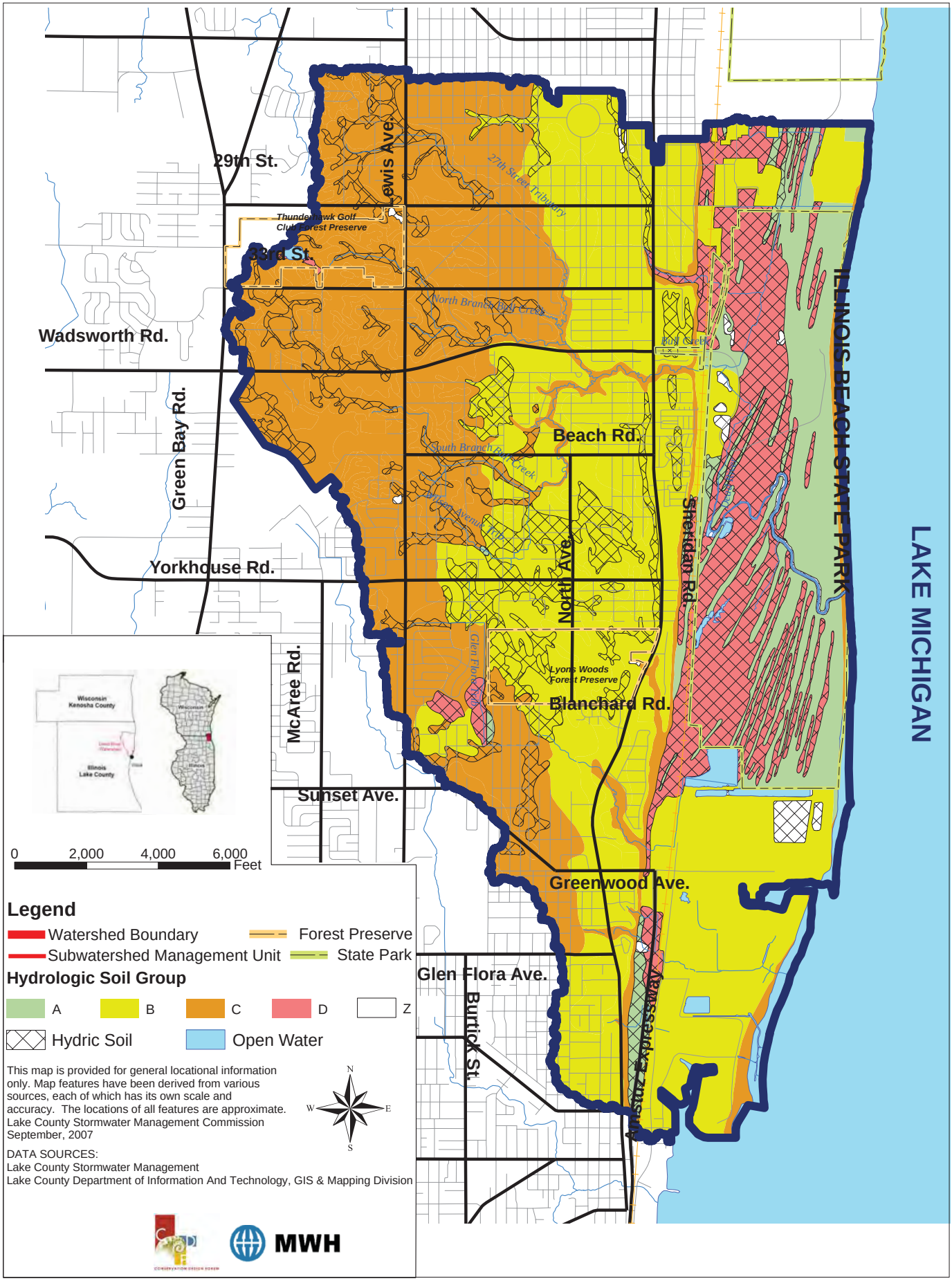


FIGURE 3.5 HYDROLOGIC SOIL GROUPS

from C to A moving from west to east along the topographic gradient with B and C soils generally occurring west of the bluff line and A soils occurring in the lake plain. Most D soils occur within the lake plain and along the drainageways. Nearly all occurrences of D soils in the Dead River watershed are hydric and classified as D due to poor drainage resulting from landscape position where there is a high water table rather than due to very low permeability. Some of the hydric D soils are muck soils that have very high organic content, with the greatest prevalence of muck soils occurring in the lake plain.

Hydrologic soil groups can influence the types of management measures that can be used. For example, stormwater infiltration practices designed to reduce stormwater runoff by allowing some of it to seep into the ground, will be more effective on A and B soils where permeability is higher than on C and D soils, where infiltration of water would be difficult. Likewise, attempting to restore wetlands on A soils, where water infiltrates easily, would not be very successful because water will not pond or sit near the ground surface, which is typical of most wetlands.

3.6.3 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 runoff. Slope is also an important determinant of erosion potential. Erosion potential increases (for a given erosion factor) when slope increases.

In the Dead River Watershed, approximately 537 acres (5.3% of the watershed area) of soils are considered highly erodible. These results are illustrated on Figure 3.6 using Lake County GIS data. Much of the highly erodible soils are located within areas of steep slope, such as the ravines, and along the Lake Michigan bluff east of Sheridan Road, but they also occur in other areas of the watershed. The erodible soils should be preserved from development or alteration when possible, and should remain under vegetative cover to maintain soil stability.

Table 3.3 Hydrologic Soil Groups

Hydrologic Soil Group	Acres	Percentage
HSG A	1,005	9.9%
HSG B	4,296	42.1%
HSG C	3,542	34.7%
HSG D	1,197	11.7%
HSG Z	155	1.5%

Source: Lake County Soil Survey, U.S. Department of Agriculture & National Resource Conservation Service, 2005.

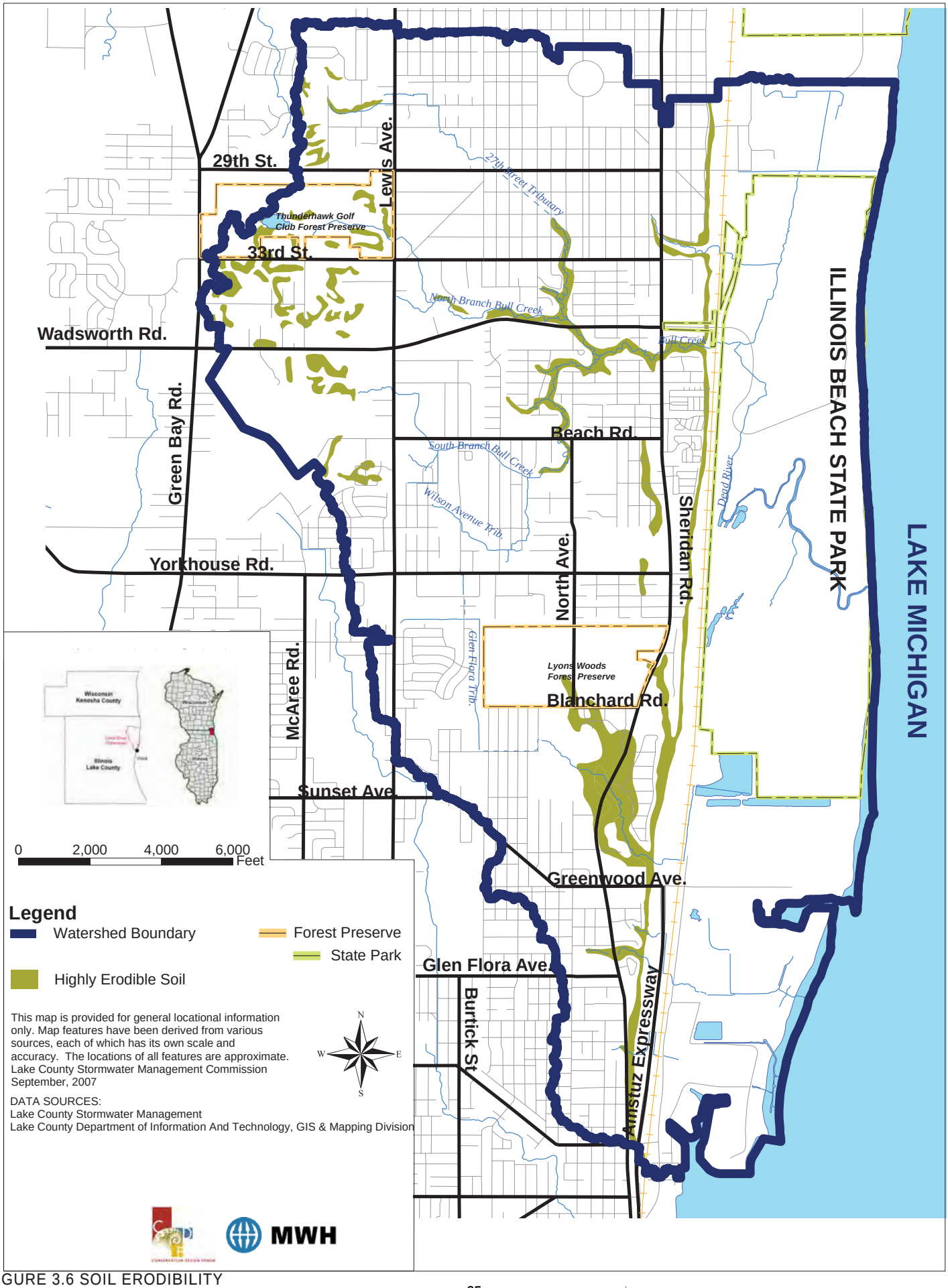


FIGURE 3.6 SOIL ERODIBILITY

3.7 WATERSHED JURISDICTIONS

The Dead River watershed includes parts of the municipalities of Zion, Beach Park, and Waukegan, which are responsible for most land use and development decisions, as well as stormwater management, within their boundaries. Zion and Waukegan Townships have limited jurisdictional authority within the watershed, limited primarily to some highways and roads. Lake County retains land use and development jurisdiction over unincorporated areas. The Lake County Forest Preserve District owns and manages natural areas, such as Thunderhawk Golf Course and Lyon's Woods Forest Preserve. The State of Illinois Department of Natural Resources maintains and manages Illinois Beach State Park and the nature preserves within the park.

Elementary School Districts in the watershed include Zion District 6, Beach park Community Consolidated District 3, and Waukegan Community Unit 60. High School Districts include Zion Benton Township District 126 and Waukegan Unit 60. Zion and Waukegan Park Districts manage both natural and recreational / developed parklands within the watershed.

The North Shore / Beach Park and North Shore Sanitary Districts provide sanitary sewer service for the entire watershed. The Beach Park Drainage District maintains drainage ways within a boundary that covers portions of Beach Park and small portions of other communities as well; its boundary does not follow the municipal boundary because the drainage district pre-dates the incorporation of the village. The drainage district first tries to address drainage and flooding problems that may cause damage to property and/or structures and then removes debris from stream channels as a secondary goal. The Waukegan Port District is responsible for Waukegan Harbor and the Waukegan Regional Airport.

The following political jurisdictions are covered by the Dead River watershed: County Board Members Randall E. Whitmore (2nd), Brent C. Paxton (4th), Robert Sabonjian (8th), Mary Ross Cunningham (9th), and Angelo D. Kyle (12th); State Representative Eddie Washington (60th) and JoAnn Osmond (61st); State Senators Terry Link (30th) and Michael Bond (31st); United States Representatives Melissa Bean (8th) and Mark Steven Kirk (10th); and United States Senators Barack Obama and Dick Durbin.

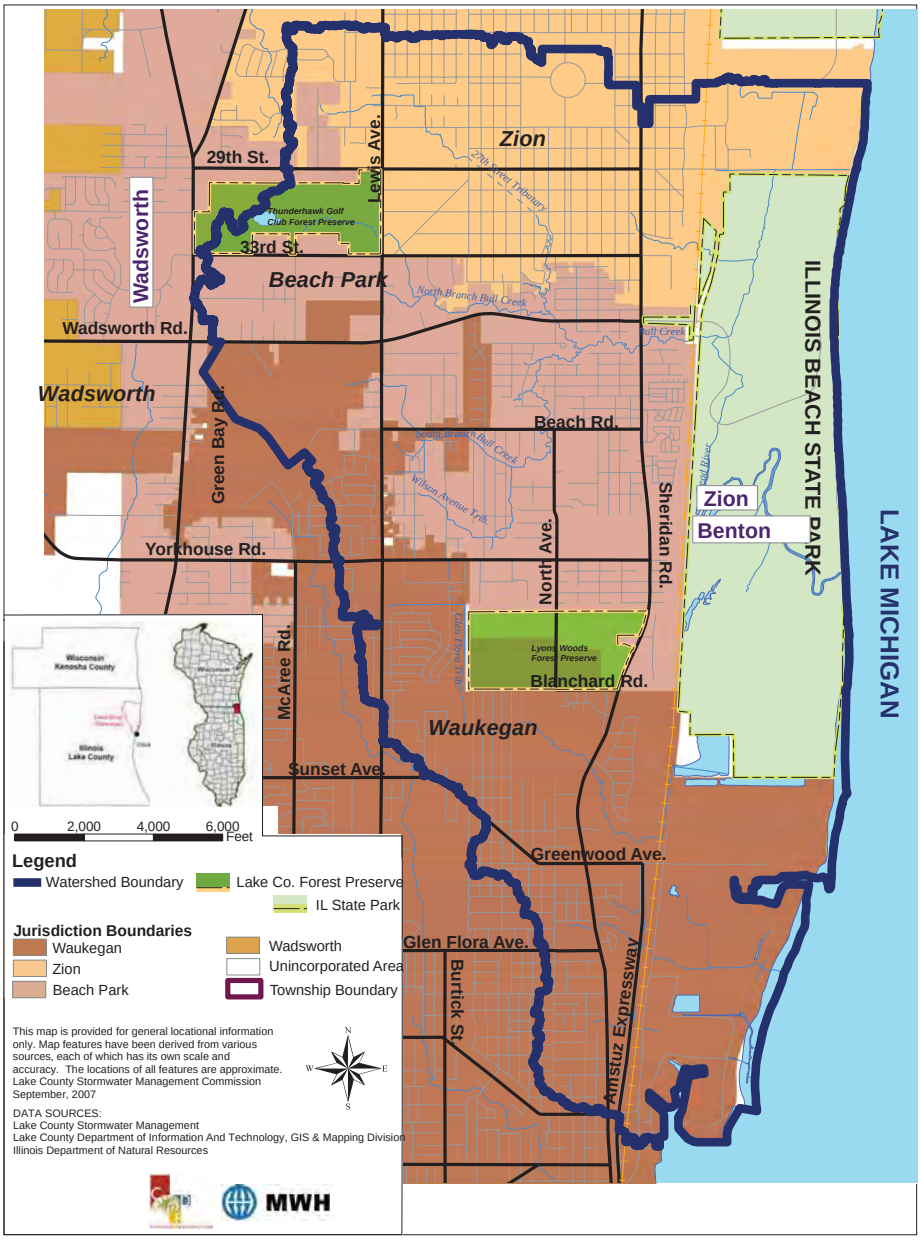
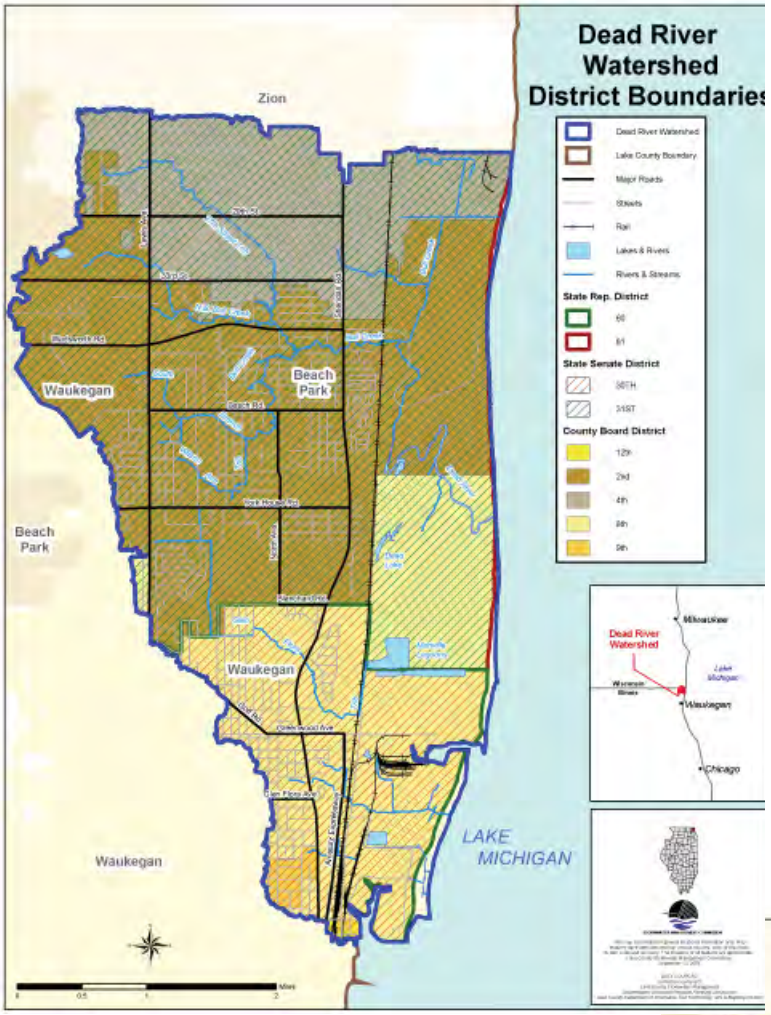


FIGURE 3.7 JURISDICTIONAL BOUNDARIES



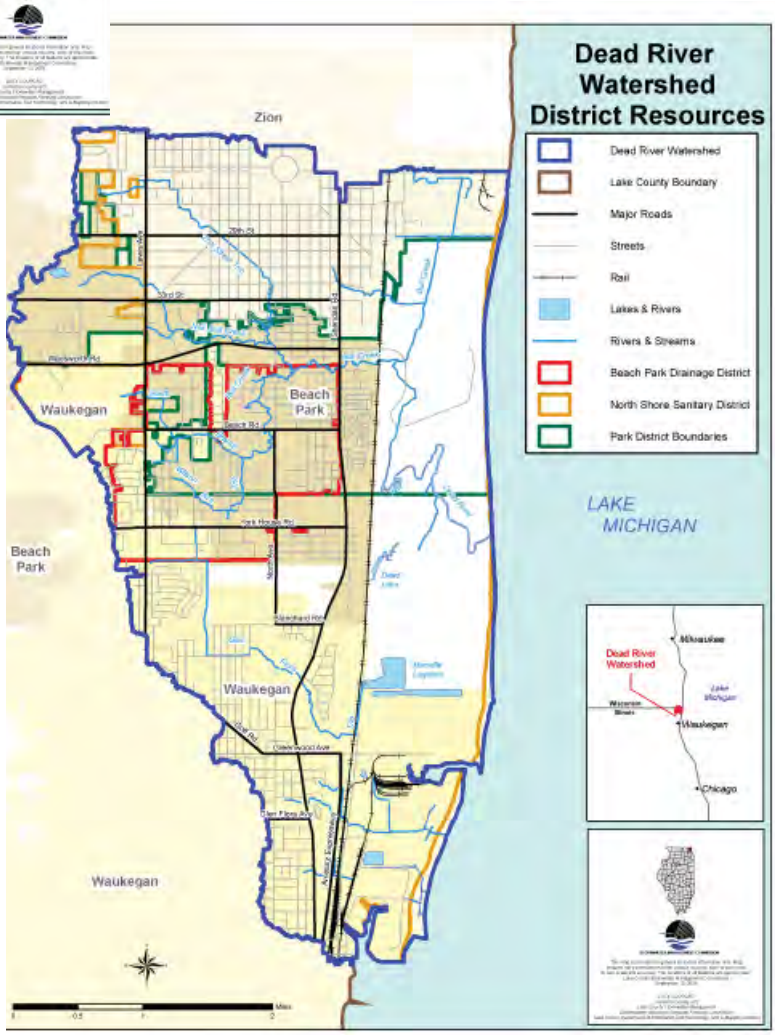


FIGURE 3.7 JURISDICTIONAL BOUNDARIES (CONTINUED)

This list of jurisdictional parties and responsibilities within the watershed, and the cross-jurisdictional nature of streams and other natural resources (i.e., they do not stop at jurisdictioinal boundaries), demonstrates the need for cooperation and coordination among jurisdictions to achieve watershed improvements. Jurisdictional boundaries are illustrated in Figure 3.7.

Source: Lake County Illinois Maps Online, http://gis2.co.lake.il.us/maps/.

3.8 WATERSHED DEMOGRAPHICS

The Chicago Metropolitan Agency for Planning (CMAP, formerly the Northeastern Illinois Planning Commission) is responsible for the northeastern Illinois region's official forecasts of population, households, and employment. Updated every three years, these forecasts are intended to portray a most likely future given market forces and the impacts of expected public policy. Forecasts are based largely on expected changes in local land use patterns and municipal boundaries as presented by each of the region's 272 municipalities and 6 counties between the present and 2020, and between the present and 2030. The Chicago Metropolitan Agency for Planning uses the type of land use change and the area that will be affected to determine the effect of those changes on population, employment, and housing. For example, a municipality planning to change land from a vacant manufacturing factory to single family housing can reasonably expect that change to reduce employment and increase population and households.

Table 3.4 and 3.5 list demographic data for the Dead River watershed and for Beach Park, Waukegan, and Zion individually. Table 3.4 shows figures for the area of the three municipalities within the watershed boundary only. The figures in Table 3.5, however, reflect each municipality in its entirety. Population distribution is graphically represented in Figure 3.8. The data indicates slow growth, and occassional decline for some areas, in population, household, and employment figures for the years 1970 to 2000. These figures are based on actual census data. Projections from the Chicago Metropolitan Agency for Planning and Lake County indicate continued slow growth in population, households, and employment through 2020. However, individual municipalities are forecasted to grow significantly by the year 2030, most of which is assumed to occur outside of the watershed boundaries.

This type of data is useful for planning the types of improvments and best management practices that are most appropriate for the watershed. In a rapidly growing watershed, best management practices that prevent the degradation of watershed resources should be highlighted and recommended for those areas expected to be developed and built. In more stable watersheds, such as Dead River / Bull Creek, recommendations for watershed improvements can focus more directly on restoring watershed streams and natural resources and on installation of best management practices to reduce the impacts of the developed landscape

Table 3.4 Watershed Demographics

Dead River Watershed Demographics				
	Year	Population (%change)	Households (%change)	Employment (%change)
Existing	1970	44,907 (na)	No data	21,791 (na)
	1980	44,635 (1%)	15,737 (na)	19,420 (-11%)
	1990	43,757 (-2%)	15,814 (1%)	18,435 (-5%)
	2000	50,163 (15%)	16,720 (6%)	19,251 (4%)
Forecasted	2020	51,225 (2%)	19,444 (16%)	20,857 (8%)

Table 3.5 Watershed Demographics by Municipality

Dead River Watershed Demographics				
	Year	Population (%change)	Households (%change)	Employment (%change)
Beach Park	2000	10,072	3,636	565
	2030	16,729 (66%)	5,674 (56%)	1,012 (79%)
Waukegan	2000	87,901	27,787	37,146
	2030	92,714 (5%)	31,516 (13%)	44,702 (20%)
Zion	2000	22,866	0,552	6,076
	2030	32,585 (42%)	11,390 (51%)	10,032 (65%)

Source: Chicago Metropolitan Agency for Planning, endorsed 2030 forecasts, September 2006.

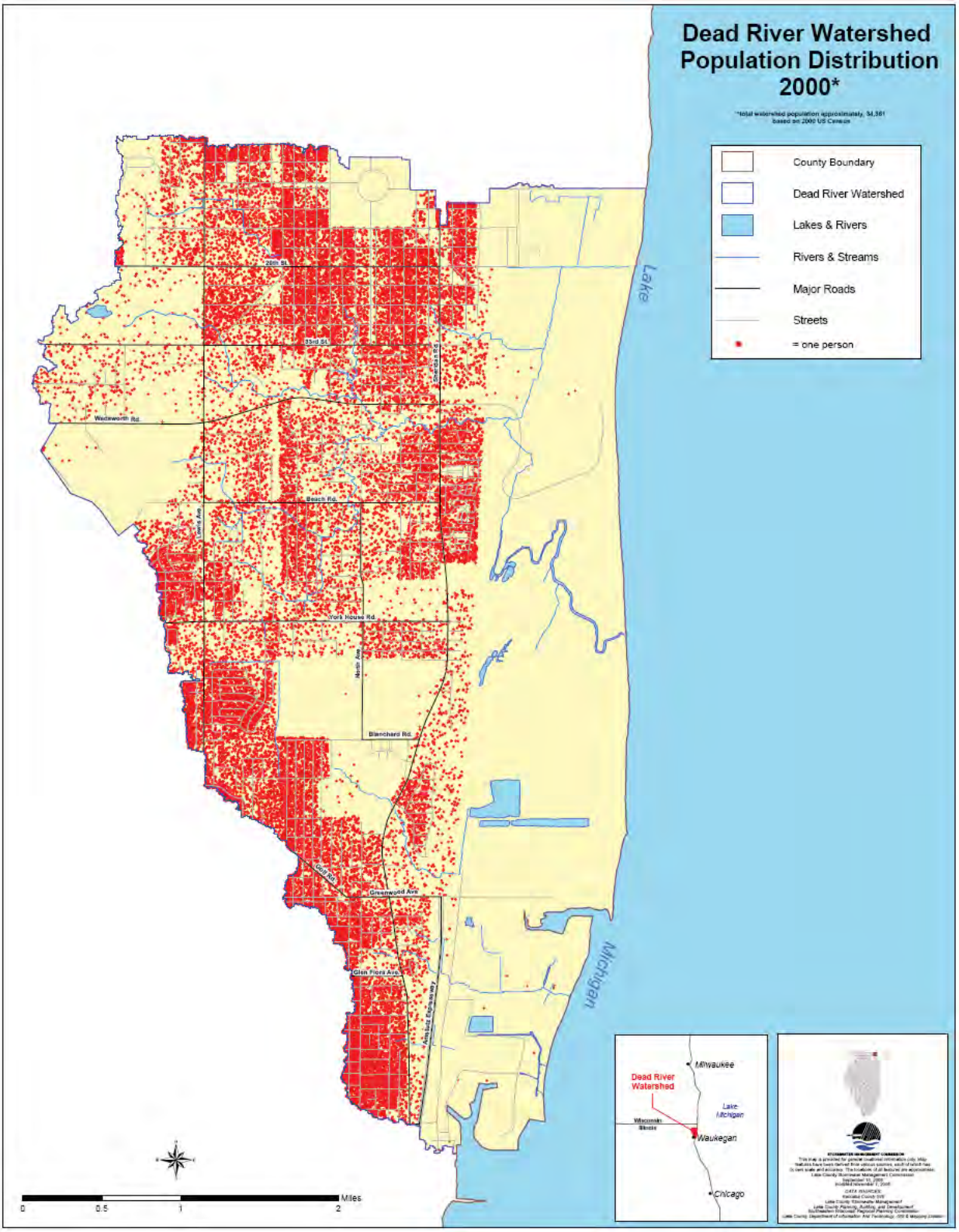


FIGURE 3.8 POPULATION DISTRIBUTION

on watershed resources.

Source: Chicago Metropolitan Agency for Planning, endorsed 2030 forecasts, September 2006.

3.9 LAND USE AND COVER

Land use and cover refer to the type of use assigned to a parcel, such as residential or commercial, and the type of surface coverage found on a parcel, such as forest and grassland, respectively. This information, as well as an understanding of the landscape characteristics prior to European settlement, provide a foundation for understanding the impact of current and future land use on watershed resources and the restoration potential.

3.9.1 PRESETTLEMENT VEGETATION

The pre-European settlement land cover map (Figure 3.9) for the Dead River watershed was derived from the US General Land Survey Office surveyor's field notes. This historic information provides significant clues to understanding and planning restoration activities within the watershed.

The map illustrates that in the early 1800s, savanna (a mix of scattered oak trees within prairies) covered the majority of the upland areas in the central and western thirds of the watearshed, and beach ridge (a ridge of sand running parallel to the shoreline) covered the eastern third along the Lake Michigan shoreline that is now Illinois Beach State Park. The beach ridge consisted of low dunes that were typically capped with stunted cedars, juniper berries and pine, oak and willow trees. A few large areas of oak woodlands (wooded areas dominated by oak species but also including other tree and shrub species) existed along the ridges and ravines that now line Sheridan Road, with a small line of upland forest extending up the Bull Creek ravine. A few small patches of wet meadow, wet prairie and marsh (types of wetlands, with wet meadow the driest and marsh the wettest of those listed) were scattered within the central area of the watershed. The savannah 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. Oak woodland landscapes were more densely wooded than savanna, but would have been considered open by today's standards, with an understory of grasses and forbs.

Except for the beach ridge and oak woodlands along the ravines, most of the presettlement vegetation cover types were converted to agriculture and urban land uses (including areas developed to provide living, working, learning, recreation, and other uses for people.) The beach ridge is the only large contiguous area where the existing land cover remains generally consistent with pre-settlement conditions.

3.9.2 CULTURAL RESOURCES

In the 1700s, the Lake Michigan dunes area originally, which is now Illinois Beach State Park, was part of the "Three Fires" of the Algonquin Nation: the Potawatomi, Chippewa, and Ottawa. Prior to then the area had been occupied by the Miami. In the late 1600s French explorers first visited the area as part of their survey of what was then known as the Northwest Territory. By the time Illinois became a state in 1818, the area was full of transient hunters and trappers. In 1836, a treaty was made with the local Native Americans, who were moved westward, and the area became part of Lake County.

A number of historical structures, primarily homes and current and former businesses, are found within the watershed. With regard to archeological potential, however, the Illinois Historic Preservation Agency does not make known archaeological areas available to the public. Nonetheless, it is the professional opinion of the planning team that any remaining archeological resources would be found either within the beach ridge plain and Illinois Beach State Park,

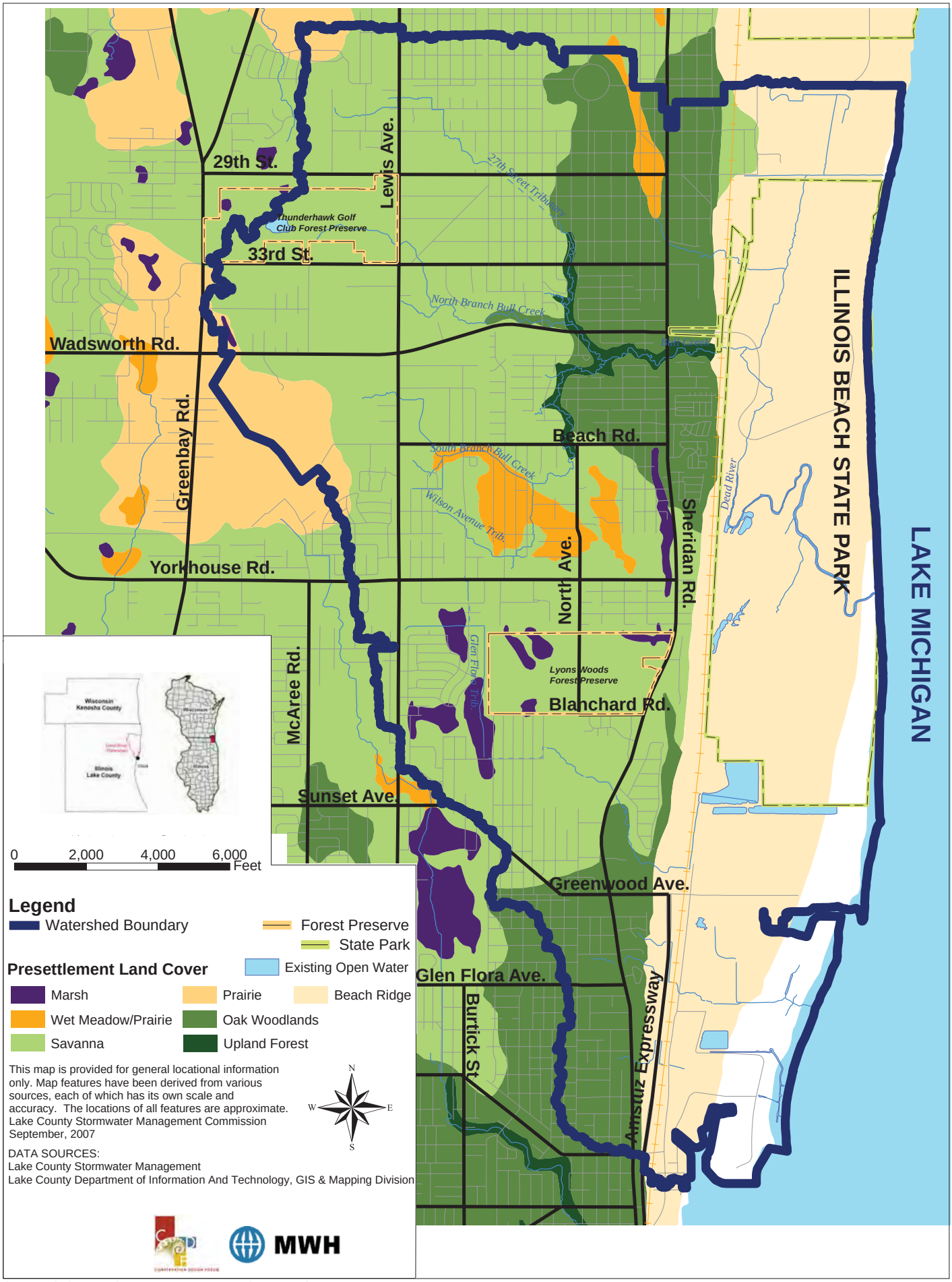


FIGURE 3.9 PRESETTLEMENT VEGETATION

along the coast of Lake Michigan, or along streams and within watershed ravines and surrounding areas.

Source: www.stateparks.com/illinois_beach.

3.9.3 EXISTING LAND USE

The composition of existing land use and cover for the Dead River watershed are shown in Table 3.6 and Figure 3.10. The watershed consists primarily of older developed neighborhoods, with some more recent development occurring in the western, headwaters of the watershed. In aggregate, natural and open lands, located largely in the coastal plain of the watershed, comprise more than a third of the land area in the watershed and single family residential a quarter. This information is used to understand the impacts of development on watershed resources and water quality, and will be used as part of the non-point source pollution loading modeling in Section 3.14.4.

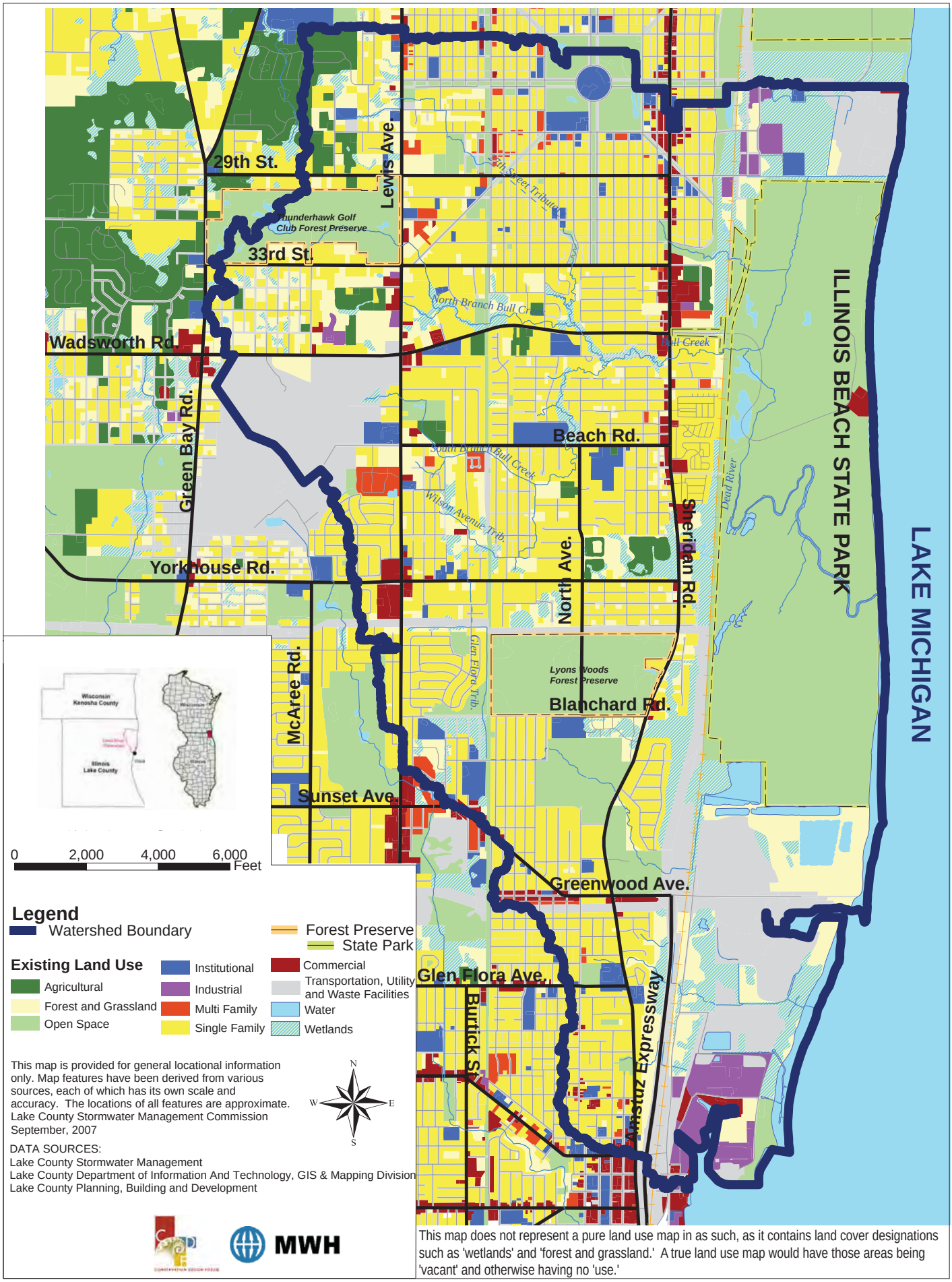
Single and multi family residential development make up a little over one quarter (26.3%) of the watershed acreage.

Table 3.6 Existing Land Use and Cover

Land Use & Cover	Acres	Percentage
Agricultural	201	1.9%
Commercial	209	2.0%
Government and Institutional	268	2.6%
Industrial	164	1.6%
Multi Family	98	0.9%
Single Family	2,651	25.4%
Transportation, Utility and Waste Facilities	2,218	21.3%
Forest and Grassland	935	9.0%
Public and Private Open Space	2,791	26.8%
Wetlands	658	6.3%
Water	226	2.2%

Table 3.7 Land Use Categories

Land Use & Cover Category	Definition
Agricultural	Cropland, pastureland, orchards, nurseries and greenhouse operations, and horse farms and stables.
Commercial	Shopping malls and parking, office and research parks, office buildings and hotels, retail (such as department stores, grocery stores, hardware stores), and cultural / entertainment (such as museums, historic sites, fairgrounds, recreation centers, yacht clubs, and marinas and harbors).
Forest and Grassland	Forested land or grassland that is vacant, which means undeveloped and unused land, forests not located within parks or forest preserves, and other land that has not been developed for any human purpose.
Government and Institutional	Government administration and services, medical and health facilities, educational facilities, correctional facilities, and religious facilities.
Industrial	Mining, mineral extraction, manufacturing and processing, warehousing and distribution centers, wholesale facilities, and industrial parks.
Multi Family	Apartment and retirement complexes.
Public and Private Open Space	Parks, golf courses, nature preserves, playgrounds and athletic fields when associated with another open space activity, swimming beaches, camping and picnicking, and group or organized camps & retreats
Single Family	Single homes, duplex homes, townhomes, and farmhouses.
Transportation, Utility and Waste Facilities	Roads, railroads, airports, non-residential parking areas; communications (telephone, radio, and television facilities, towers, and dishes; utilities (power lines, gas, water, sewage, solid waste / landfills, pipelines, treatment plants and power substations); and rights-of-way for these uses.
Water	Rivers, streams canals, lakes, ponds, reservoirs, lagoons, and Lake Michigan.
Wetlands	Wetlands over 0.25 acres in size.



This map does not represent a pure land use map in as such, as it contains land cover designations such as 'wetlands' and 'forest and grassland.' A true land use map would have those areas being 'vacant' and otherwise having no 'use.'

FIGURE 3.10 EXISTING LAND USE

Commercial, industrial, transportation, utility, and waste (landfill) facilities make up 24.9% of the watershed, and government and institutional only 2.6%. Combined, the urban land uses make up 53.8% of the watershed area.

Agricultural land, forest and grassland, open space (including recreational areas and some nature preserves), water, and wetlands make up 46.2% of the watershed - a large portion of which are the publicly held Illinois Beach State Park and Lyons Woods Forest Preserve and three golf courses. Open space is typically different from forest and grasslands in that it is usually associated with at least some sort of human use, from bird watching in a nature preserve to soccer fields. Review of Figure 3.10 shows significant open space along Lake Michigan except to the south where the lake plain is covered by industrial and utility land uses. Transportation / Utility (Waukegan airport) also covers a significant portion of the west central portion of the watershed. Commercial use is located primarily along Sheridan Road and Lewis Avenue. Single family residential is scattered throughout the watershed, intermixed with pockets of multi-family residential, institutional, and wetlands.

3.9.4 FUTURE LAND USE

Through land use decisions and development standards and controls, the municipalities and Lake County have the majority of the land use discretion to determine the future of the watershed. Without proper attention to development location and design, future impacts to watershed could include increased flooding and streambank erosion and the degradation of water quality, aquatic habitat, and floristic diversity. A note on land use tables and figures: the categories and acreage totals for the existing and future land uses are different due to differences in the way Lake County and the Chicago Metropolitan Agency for Planning categorize and calculate them. For example, it is unlikely that the watershed will lose 90 acres of due to conversion or other land use change, though this is how the data is currently reported.

Table 3.8 and Figure 3.11 show the distribution of future land use and cover for the Dead River watershed and is based on municipal comprehensive plans and data provided by the Lake County Department of Information and Technology. Much of the watershed is expected to be single family residential in 2020 (35%) with commercial and industrial uses clustered along Lewis Avenue, Sheridan Road, Wadsworth Road, and Yorkhouse Road, as well as along Green Bay Road. Conversion of 1200 acres of open lands to more urban uses is expected to occur, primarily to residential use, in the northwest and southwest quarters of the watershed. Interestingly, some existing development land uses are indicated as changing to a different land use. For example, the area around the State Highway 173 and Kenosha Road intersection is planned to become primarily industrial and commercial with some multifamily residential and mixed use development. Lewis Avenue is planned to become a commercial and industrial corridor rather than primarily residential and open space. The northern half of Sheridan Road will convert from residential and scattered commercial to mixed use development.

Table 3.8 Future Land Use and Cover (Illinois 2020)

Future Land Use	Area (Acres)	Percentage	Change from 2006 (Acres)
Agricultural	0	0.0%	-201
Commercial	407	4.0%	198
Institutional	125	1.2%	-143
Industrial	28	0.3%	-136
Multi Family	373	3.6%	275
Single Family	3,551	34.6%	900
Mixed Use	185	1.8%	185
Transportation, Utility and Waste Facilities	2,097	20.4%	-121
Open Space	3,371	32.8%	-1013
Water	136	1.3%	-90

According to this table, we can assume that the Dead River watershed will become more heavily residential and commercial by converting agricultural, institutional, industrial, and especially open spaces to residential and commercial use. Typically, conversion of industrial and institutional land to residential use results in less impervious cover and a lower impact on water runoff and quality than industrial and institutional. This is due largely to the reduction of parking lots and an increase in turf grass lawn coverage. However, this apparent gain will be more than offset by the water quality and runoff impacts that will result from convertion of open space and agricultural land to more urban uses, including residential, due to the increase in impervious cover.

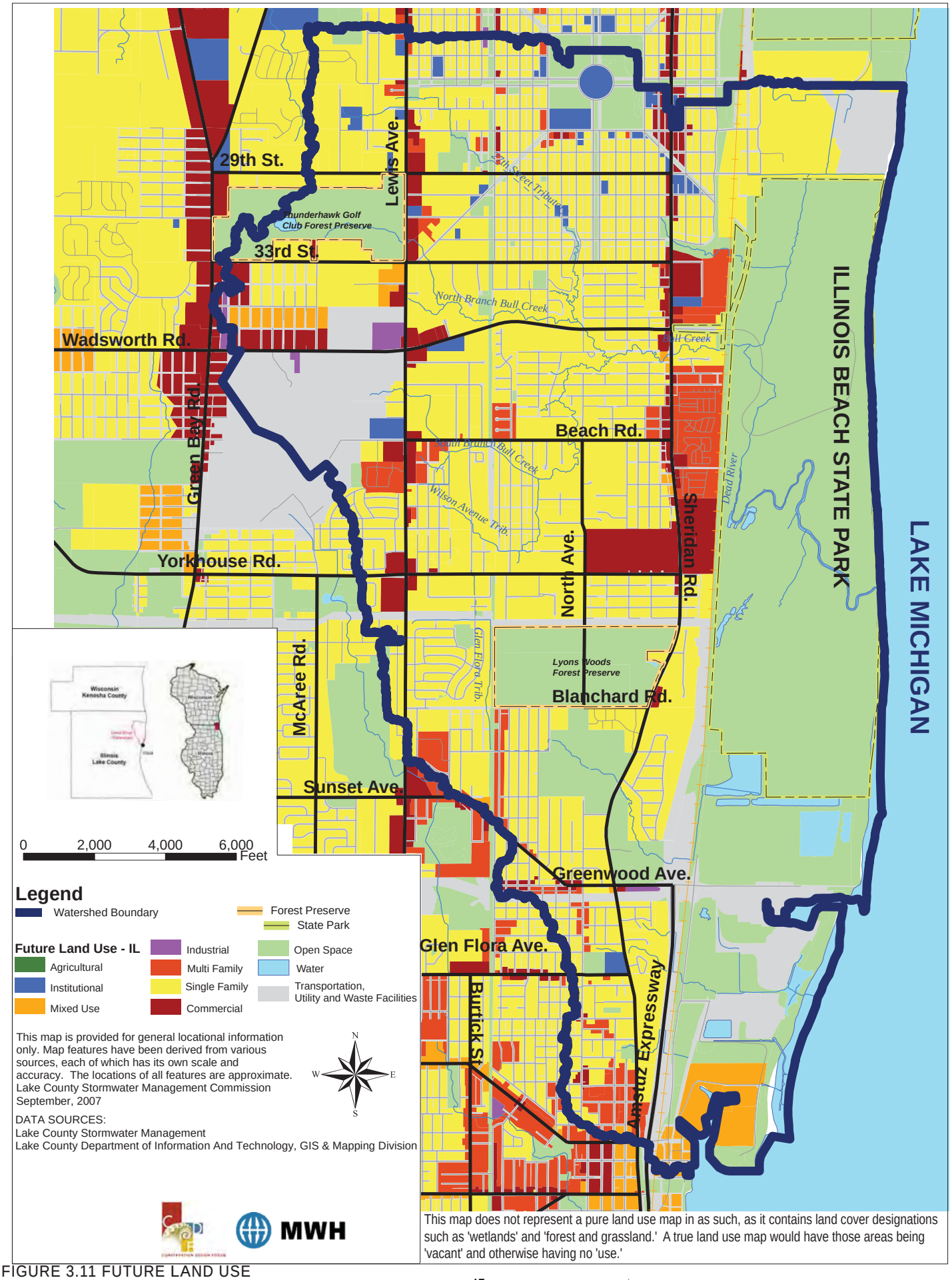


FIGURE 3.11 FUTURE LAND USE

Land use conversion from primarily open to a more urban land use will increase the impervious cover of the watershed, which will also have a significant impact on flooding, water quality, and other watershed resources. To help reduce the negative impact of additional impervious surfaces, best management practices should be integrated into development designs wherever possible. Conversely, the redevelopment that is projected for the watershed provides opportunities to provide stormwater BMPs for urban areas that currently have little or no stormwater controls. Conservation development, a practices that attempts to preserve the drainage and infiltration capactiy of the developed landscape, is another very effective way to ameliorate the negative effects of land use conversion.

Discussions to expand the Waukegan Regional Airport to the north and east of its current footprint are currently underway. These discussions have resulted from the desire to improve safety and accommodate future demand by lengthening and/or relocating the airport's primary runway. A number of alternatives exist for the airport, some of which would include the acquisition and conversion of residential, open / recreational, and commercial land uses to transportation, utility, and waste facility land use category. Alternative expansion designs would likely convert between 128 to 290 acres of existing land uses for airport use. The impact on imperviousness in the area is unknown, since the areas of runway and turf grass of the airport expansion are unknown at this time. However, any change may result in additional discharges of airport-related engine and deicing chemicals into the Bull Creek stream system. However, when properly implemented, the airport's spill prevention plan can significantly reduct the risk of impact to water quality and watershed resources. This plan is discussed in Section 3.14.4 of this chapter.

3.9.5 WAUKEGAN LAKEFRONT REVITALIZATION

In December of 2003 the Waukegan City Council amended its Comprehensive Plan to incorporate *A 21st Century Vision for Waukegan's Downtown and Lakefront* Master Plan as part of the overall land use strategy. The Master Plan, which establishes the planning and actions necessary for a revitalized downtown and lakefront, includes recommendations for the area from Waukegan Harbor to Illinois Beach State Park. (See Figure 3.12.) These recommendations are likely to have a positive impact on the City of Waukegan, watershed resources, and Lake Michigan and its shoreline.

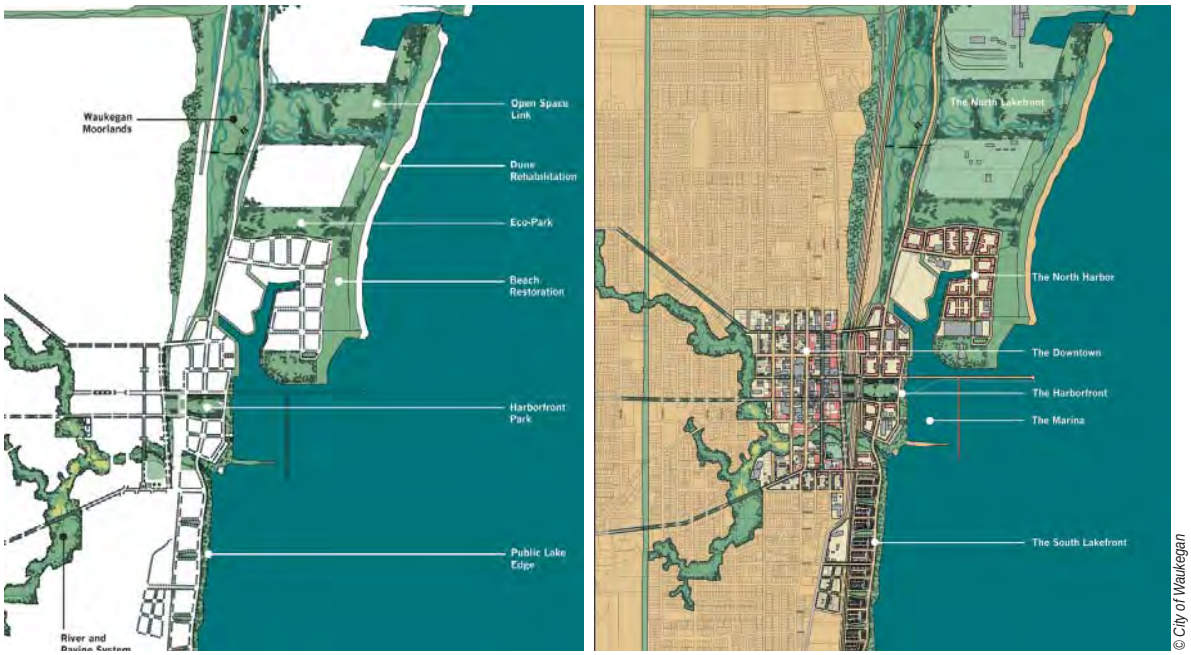
The plan recommends sensitive redevelopment of the North Harbor, which suffers from an industrial legacy (as detailed in the Water Quality section), and ecological and hydrological restoration of the valuable and rare North Lakefront, which will include wetlands, beach habitat, and public access and recreation. The North Lakefront will be reconnected to Illinois Beach State Park, Lake Michigan, and other local open space resources (ravines, the Waukegan River, and the Robert McClory bike trail), both recreationally and ecologically.

The Waukegan Moorlands, located generally along North Sand Street, east of the Union Pacific tracks and west of Midwest Generation and bounded by East Greenwood Avenue to the north, will be an open space area containing restored wetlands, waterways, wildlife habitat, and recreation trails that will interface with future potential open space integrated into the current arrangement of public and private property. Partnerships with local landowners such as Midwest Generation and the North Shore Sanitary District will be essential to this effort. The Moorlands also may include the restoration of the former Little Dead River (see Figure 3.24) and the creation of treatment wetlands for North Shore Sanitary District overflow.

The plan recognizes the global importance of the freshwater dune and swale system of the lakefront and recommends enhancing and expanding this ecosystem within the North Lakefront area and as an extension of Illinois Beach State Park. In spite of the industrial legacy of the area, remnant ecosystems remain including fore-dune wetlands adjacent to the beach and patches of plants and wetlands.

3.9.6 ZION NUCLEAR POWER STATION

The Zion Nuclear Power Station site, located on the Lake Michigan shoreline between the Illinois Beach State Park North and South Units at the southeastern corner of the watershed, was permanently shut down and retired in February, 1998 after 25 years of operation. In March 2008, plans were announced to decommission the plant over the next 10 years at a cost of approximately $978 million. The City of Zion plans the future land use of this area to be single family residential.



© City of Waukegan

FIGURE 3.12 WAUKEGAN LAKEFRONT MASTER PLAN

The proximity of this site to Lake Michigan and the valuable natural resources of Illinois Beach State Park suggest that significant care should be taken to ensure that appropriate land use and stormwater management measures are used for the decommissioning and eventual redevelopment or restoration of this site.

Sources: Lake County, Illinois, Department of Planning Building and Development.

A 21st Century Vision for Waukegan's Downtown and Lakefront, City of Waukegan, 2003.

3.10 TRANSPORTATION

According to state and local transportation authorities, no significant roadway construction projects are planned in the watershed except for two highway resurfacing projects planned by the Illinois Department of Transportation. One is on Illinois Route 137 (Sheridan Road) from Russell Road to Greenwood Avenue (7.9 miles). The other is on Illinois Route 173 (Rosecrans Road / Bethlehem Avenue) from IL-131 (Green Bay Road) to IL-137 (Sheridan Road) (3.06 miles.) Stakeholders, however, suggested that discussions have occurred regarding the widening of Green Bay Road and narrowing Sheridan Road in the future.

The impact of streets and highways on the watershed, particularly water quality, is significant. Table 3.9 lists a number of water quality pollutants and their sources, all of which are associated with the transportation system. Rain water flowing over the surface of our streets can carry these pollutants into our wetlands, streams and Lake Michigan, where they can accumulate and impair the quality of these resources for aquatic life. Furthermore, Lake Michigan is the source of drinking water for millions of people, and removing these pollutants prior to consumption is an expensive process.

Source: Illinois Department of Transportation FY 2006-2011 Proposed Highway Improvement Program, Highway District 1 Lake County.
Watershed stakeholders, personal communication.

3.11 NATURAL RESOURCES

This section of the plan describes the natural areas within the Dead River watershed, including parks, preserves, plant and animal species concerns, ravines, wetlands, and recreational trails. These features make up some of the components of the watershed green infrastructure system, which is discussed in Section 3.12. The location of these resources are shown in Figures 3.13 and 3.17.

3.11.1 ILLINOIS BEACH STATE PARK AND PRESERVE

llinois Beach State Park (and Spring Bluff Nature Preserve in the Kellogg Creek watershed, which is included here as part of the Illinois Beach State Park description) is a 3000-acre biologically rich area in Illinois, containing approximately 2000 acres of Illinois Nature Preserves (Illinois North Dunes Nature Preserve and Illinois Beach Nature Preserve), and a very high concentration and diversity of threatened and endangered species and rare plant communities. Illinois Beach Nature Preserve was the first dedicated Nature Preserve in Illinois and is a National Natural Landmark. Illinois Beach is visited by an average 2.8 million people annually for a variety of pastimes including birdwatching, hiking, photography, and botany.

Together these natural areas support 14 different natural community types (unique assemblages of plants and animals), including 66 acres of the globally significant Lake Michigan panne, 111 acres of sand savanna (a regionally declining upland habitat with a sandy soil), sedge meadow (wetlands found along streams, floodplains, and upland depressions in the landscape that occassionally hold water), wet prairie (a wetland type with a specific set of plants), dune (sand ridge), and lakeshore. The palustrine (non-flowing or ponded) wetlands found here are considered nationally decreasing and of regional and local conservation concern. Over 500 species of plants and 300 species of animals are known to occur here, and the complex provides habitat for 160 migratory bird species. According to one report, Illinois Beach State Park is the highest quality natural area in the Lake Michigan watershed in Illinois. Studies also indicate that a dune remnant that is approximately one mile south of the Park contains amphibian species richness that exceeds two nearby nature preserves.

Over 6 miles of some of the last remaining undeveloped shoreline in the state exist here in a series of dry sand ridges, black oak sand savanna, dunes, and high quality wetland swales including sedge meadow, marsh, fen, and 66 acres of a globally-rare plant community called Lake Michigan panne. Pannes are shallow troughs of sand kept wet by the water table and/or springs within nearby dunes, which often

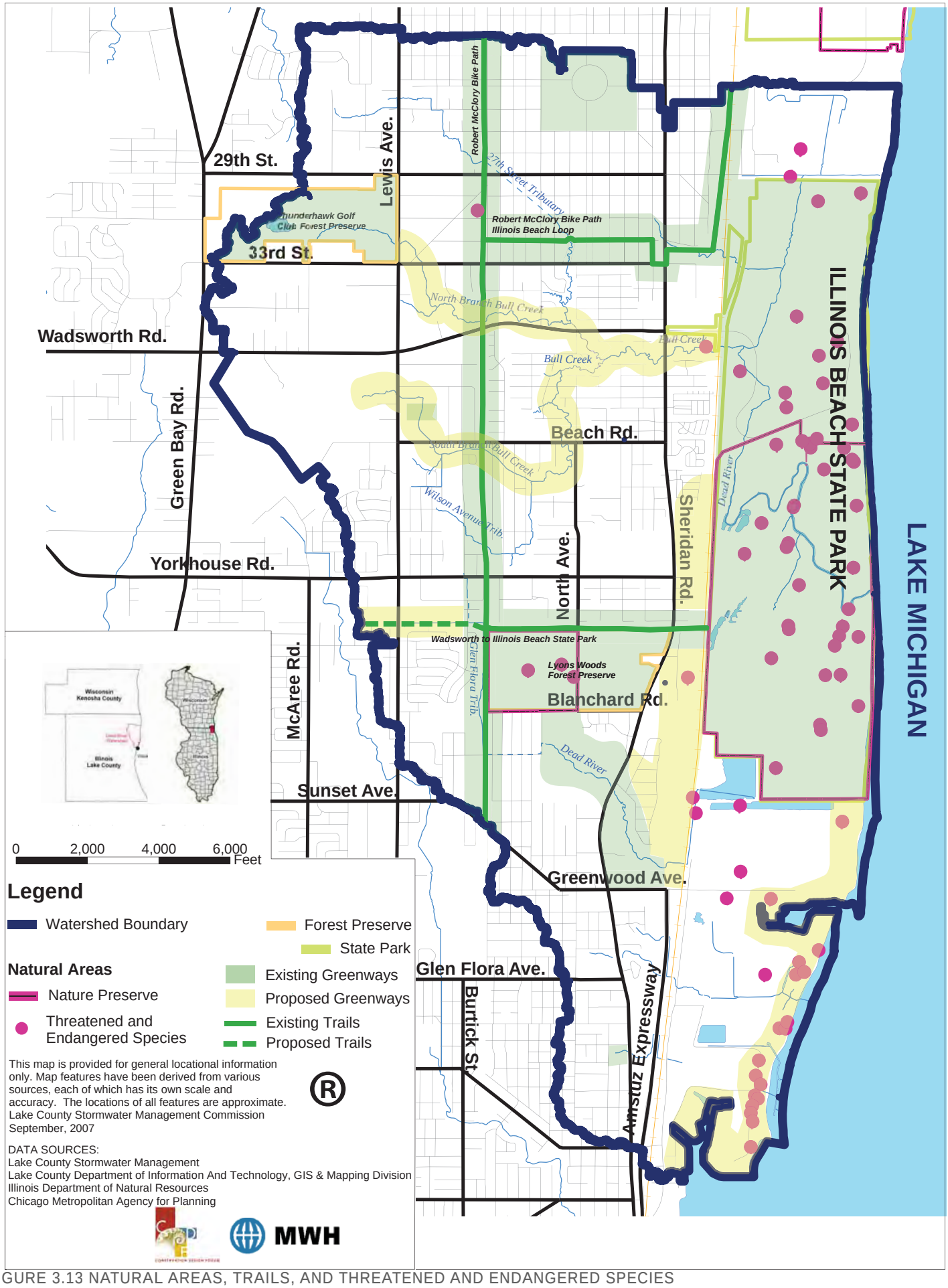


FIGURE 3.13 NATURAL AREAS, TRAILS, AND THREATENED AND ENDANGERED SPECIES

support uniques assemblages of plant species. Only a few hundred acres of this wetland community are believed to exist anywhere in the world.

These systems support a wide variety of species including a number of those listed in Appendix A, which are at risk of being lost forever. The Federally threatened Pitcher's (Dune) Thistle and Eastern Prairie Fringed Orchid are the subjects of a population recovery plan at Illinois Beach State Park, which is also being assessed for reintroduction of the Karner blue butterfly which feeds on the Wild lupine found there. Illinois Beach State Park provides both wetland and upland nesting habitats for the state endangered Blandings turtle, as well as a suite of wetland birds and rare insect species.

The water courses within the park provide important spawning and nursery habitat for yellow perch, northern pike, longnose sucker, blacknose shiner, and blackchin shiner. Restoration and creation of wetlands with a surface water linkage to the open waters of Lake Michigan, such as those in Illinois Beach State Park, may be critical shelter, spawning and feeding habitat necessary for the recovery of aquatic Great Lakes species. However, Dead River, one of the few remaining natural tributaries to Lake Michigan in Illinois, may be too small and shallow to function as substantial aquatic habitat for Great Lakes fish species.

Much of the shoreline of the park has been designated critical habitat for the federally endangered piping plover and other migratory bird species including the Caspian tern, common tern, oldsquaw, black scoter, willet, whimbrel, and sanderling. Due to the regionally important resting and foraging areas for migrating shorebirds and raptors, and breeding habitat for grassland and wetland birds, Illinois Beach State Park has also been designated an Important Bird Area by the National Audubon Society (2004).

State and Federally Listed Species

Illinois Beach State Park contains suitable habitat for 4 federally threatened or endangered species as well as a number of state-listed endangered and threatened plant and animal species, as listed in Appendix A. According to expert knowledge of the insect diversity of the area, out of 31 insect species identified as state imperiled (found at only 1 or 2 sites statewide), 20 are found only at Illinois Beach. An endangered species is one that is in danger of extinction throughout all or a significant portion of the area in which it lives. A threatened species is one that is likely to become

Table 3.9 Illinois Beach State Park Invasive and Exotic Species

Common Name	Scientific Name
Common Reed	Phragmites australis
Reed Canary Grass	Phalaris arundinacea
Narrow-leaved and Hybrid Cattails	Typha angustifolia and T. x glauca
Purple Loosestrife	Lythrum salicarea
Crown vetch	Corollia varia
Multiflora Rose	Rosa multiflora
Black Locust	Robinea psuedoacacia
Bush Honeysuckles	Lonicera spp
Glossy Buckthorn	Franula alnus
Sheep's Fescue	Festuca obtuse
Kentucky Blue Grass	Poa pretense
Cottonwood	Populus deltoids
Box elder	Acer negundo
Willow	Salix interior and Salix nigra
Weeping Willow	Salix babylonica
Cypress spurge	Euphporbia cyparissias
Sweet Clover	Melilotus spp.
Canada Thistle	Cirsuim arvense
Lyme Grass	Elymus arenarius

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Illinois Beach State Park dune and swale system is classified as ADID wetland #1650.

© Illinois Department of Natural Resources / Deb Nelson

Prairie white-fringed orchid

© Illinois Department of Natural Resources / Deb Nelson

Karner blue butterfly and pitcher's thistle

© Illinois Department of Natural Resources / Deb Nelson

Woodland management

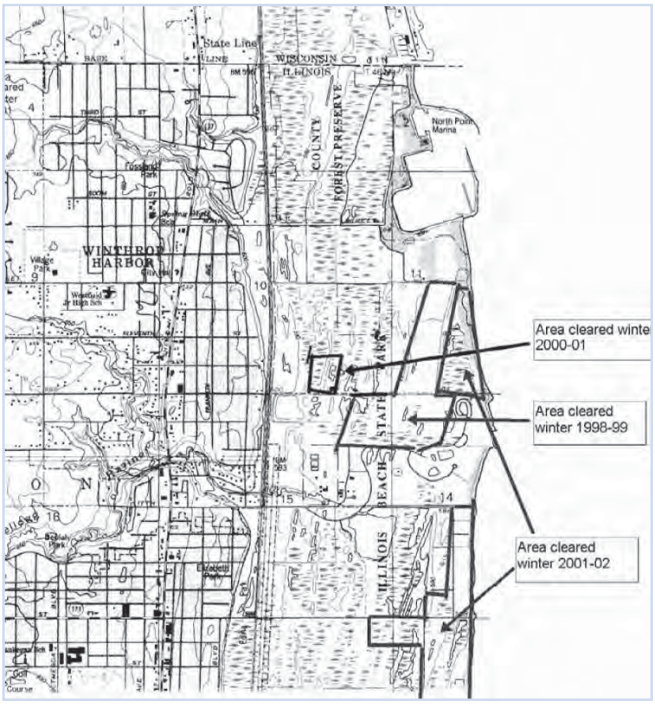

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FIGURE 3.14 ILLINOIS BEACH STATE PARK MAJOR RESTORATION AREAS

endangered in teh foreseeable future. The State of Illinois determines standards for listing species that live within the borders of the state regardless of how rare or common they are outside those borders. A Federally listed species must be threatened or endangered throughout all or a significant portion of the geographic range in which it lives.

Management and Restoration

Management plans for the Illinois Beach State Park Nature Preserves have been developed that focus on exotic species and their negative impacts to native communities, with some mention of the movement of sediment, exotic species seeds (reed canary grass, phragmites), and other water-borne pollutants into the park through stormwater runoff from the Dead River watershed. However, these plans are neither comprehensive nor highly detailed, and updated restoration and management plans should be developed.

Stewards are actively managing 20 invasive plant species at Illinois Beach using an integrated approach that includes mowing, hand pulling, brush clearing, prescribed burns, and carefully timed and targeted herbicide application. However, increases in sediment and nutrient loads in surface water flow from the entire watershed are associated with changes that favor invasive species and degrade the native plant community. Roads, culverts, ditching, fluctuating Lake Michigan levels, and beaver activity also have altered the hydrology in Illinois Beach State Park in complicated ways causing flooding in some places and drying of wetlands in others. Invasive species tend to do will in these areas where the presettlement conditions have been altered and destabilized. Invasive plant species move by a variety of methods, the most common being seed dispersion by wind, water, and animals eating and excreting or otherwise carrying and depositing seeds. Some invasive plants spread via underground roots. The most aggressive and invasive plant species that are degrading conditions at Illinois Beach State Park are included in Table 3.9.

Nearly $200,000 in grant supported restoration and habitat enhancement funds have been applied to improving conditions at the park. In early 2007, it was announced that a $350,000 federal National Coastal Wetland Conservation grant has been awarded to fund habitat restoration / invasive species removal projects on 240 acres at Illinois Beach State Park and Spring Bluff Nature Preserve, the latter in the adjacent Kellogg Creek watershed. Ongoing volunteer opportunities to help manage and restore the park include monthly workdays to conduct invasive species control, seed collection, brush cleariing, and monitoring of conditions. Major restoration areas are shown in Figure 3.14.

Shoreline Erosion

Sand movement along the Lake Michigan shoreline (also called littoral transport, see Figure 3.16) is a natural process driven by wind and currents that serves to regenerate and maintain the natural shoreline and the communities that depend on it. Some of the threatened and endangered species found in the park depend on this sand movement to maintain their habitat, such as the piping plover and Pitcher's thistle. However, beach erosion, driven by wind, water currents, and shoreline structures, is a major management issue for Illinois Beach State Park and has already caused the loss of a number of acres of beach and dune plant communities, including the unique Lake Michigan panne ecosystem type and habitat for threatened and endangered species. The area most affected by beach erosion extends generally from the marina south to the Zion Nuclear Power Station, but other areas may be more mildly affected. If this loss of beach continues, these species and the rare habitat that supports them, could be lost forever. Figure 3.15 shows the extent of erosion between 1967 and 2006.

Management measures have been attempted, such as pea gravel stabilization, sand replenishment, and armoring, yet these and other solutions are expensive and have not proved to be very successful. These and other solutions, such as the construction of structures to slow erosion, also can cause other problems such as the loss of aesthetic, recreational, and biological values. According to one stakeholder, sand replenishment from sources in the vicinity of Waukegan Harbor, which is known to be contaminated with a variety of substances, may pose the additional complications of moving contaminated materials into uncontaminated areas. The continued movement and loss of the Lake Michigan shoreline is an ongoing management issue that is complicated by the competing needs and desires of those who use the lakefront.

Potential Contamination Issue

Asbestos containing materials (ACM) and asbestos particles and fibers are also known to be present in Illinois Beach State Park. The degree of human health risk associated with asbestos, however, continues to be in dispute by the various public and private interests involved in the issue. Additional information can be found at the US Department of Health and

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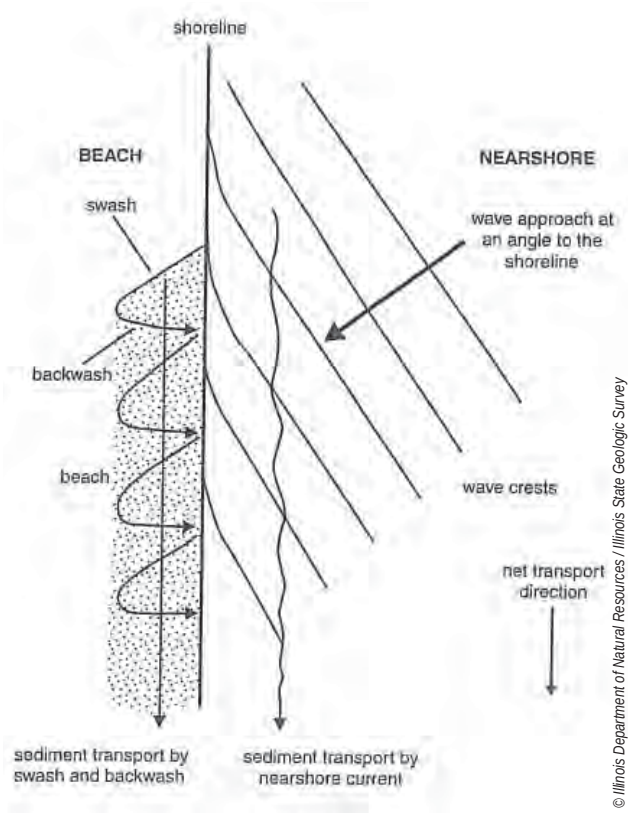
FIGURE 3.15 ILLINOIS BEACH STATE PARK SHORELINE EROSION



© Illinois Department of Natural Resources / Illinois State Geologic Survey

FIGURE 3.16 LITTORAL (SAND) TRANSPORT
Natural processes that contribute to the movement of sand and sediment along the lakeshore. Sediment can move in either direction depending on the direction of the wave approach, but the net direction predominates.

© Illinois Department of Natural Resources

Beach erosion has exposed this buried pipe from 11 feet in 2003 to over 20 feet in 2005, Illinois Beach State Park

Human Services Agency for Toxic Substances and Disease Registry (http://www.atsdr.cdc.gov/HAC/pha/illinoisbeach/ibp_toc.html) and the Illinois Dunesland Preservation Society (www.illinoisdunesland.org).

3.11.2 LYONS WOODS NATURE PRESERVE

The 264-acre Lyon's Woods preserve was assembled and acquired as a Forest Preserve due to its history and natural quality between 1976 and 1986 and lies within the Zion City Moraine geologic formation. It is a dedicated Nature Preserve and 'uses' are listed as threatened and endangered species preservation, wildlife habitat, wildlife viewing, and recreational trails. The diverse range of natural communities include an old pine nursery (planted by hand), wet prairie, oak savanna (savanna with dispersed oak trees), fen (a groundwater fed wetland), and oak woods containing white, bur, and black oaks, as well as a variety of bird species including the bluebird. Over 260 plant species and several threatened and endangered plant and animal species are found here, and a Floristic Quality Index of 76 indicates a good diversity of plant species and a high quality resource area. The Floristic Quality Index is a tool for measuring habitat quality based on a survey of existing vegetation. Areas with an FQI greater than 50 is extremely rare and found in less thean 5% of the land area in the Chicago region.

Former land use activities that have destroyed or degraded the presettlement condition of the preserve, such as clearing, farming, grazing, the pine plantation, invasive species, loss of savanna habitat, and possibly wetland drainage, have made management and restoration a challenge for preserve staff. Although a detailed management and restoration plan has not been developed for Lyons Woods, management activities are underway. The primary goal is to restore a landscape-scale savanna ecosystem with wet prairie and open woodland as secondary communities where present and appropriate. The following are the most pertinent restoration and management issues that have or need to be addressed.

- Continue ecological restoration to maintain and improve the native plant communities and unique natural diversity of Lyons Woods. This encompasses the savanna, open woodland, black oak savanna, and wet prairie that dominated the majority of the preserve.
- Investigate any potential artificial or disturbed hydrologic conditions that may be negatively impacting Lyons Woods. This may include removing drain tiles and working with watershed stakeholders to reduce erosion and increase stormwater infiltration within the Dead River watershed to help reduce sedimentation and surface water inputs into Lyons Woods.
- Continue to implement prescribed fire to restore and maintain wet prairie, savanna, and woodland communities and reduce densities of invasive species.
- Continue control of invasive species such as reed canary grass and buckthorn.
- Continue monitoring plant and wildlife populations to assess any changes in quality, diversity and habitat use over time and adapt management and restoration activities based on responses of plant and wildlife communities.

In 2005, 565 trees and shrubs were planted to help restore savanna habitat. In 2006 and 2007, invasive woody plant species were cleared on 136 of the preserve 264 acres.

3.11.3 RAVINES

Lake Michigan ravines have been found to contain unique assemblages of plant and animal communities, including some species that are locally rare. Due to their proximity to Lake Michigan, ravines may exhibit a cooler climate regime than the surrounding lands and natural communities that are normally found further north can be found within the ravines. Species that may be found there include paper birch (Betula papyrifera), white pine (Pinus strobus), arbor vitae (Thuja occidentalis), Canadian buffalo-berry (Shephardia Canadensis) and star flower (Trientalis borealis). In some locations, ravines intersect the groundwater table, causing percolation of groundwater to the surface and the formation of a 'seep' or 'fen'. This unique environment supports plants not found elsewhere, and a few of these have been found along Bull Creek. Unfortunately, due to changes in the watershed and its runoff characteristics, these unique systems are in danger of being lost if they are not preserved and managed.

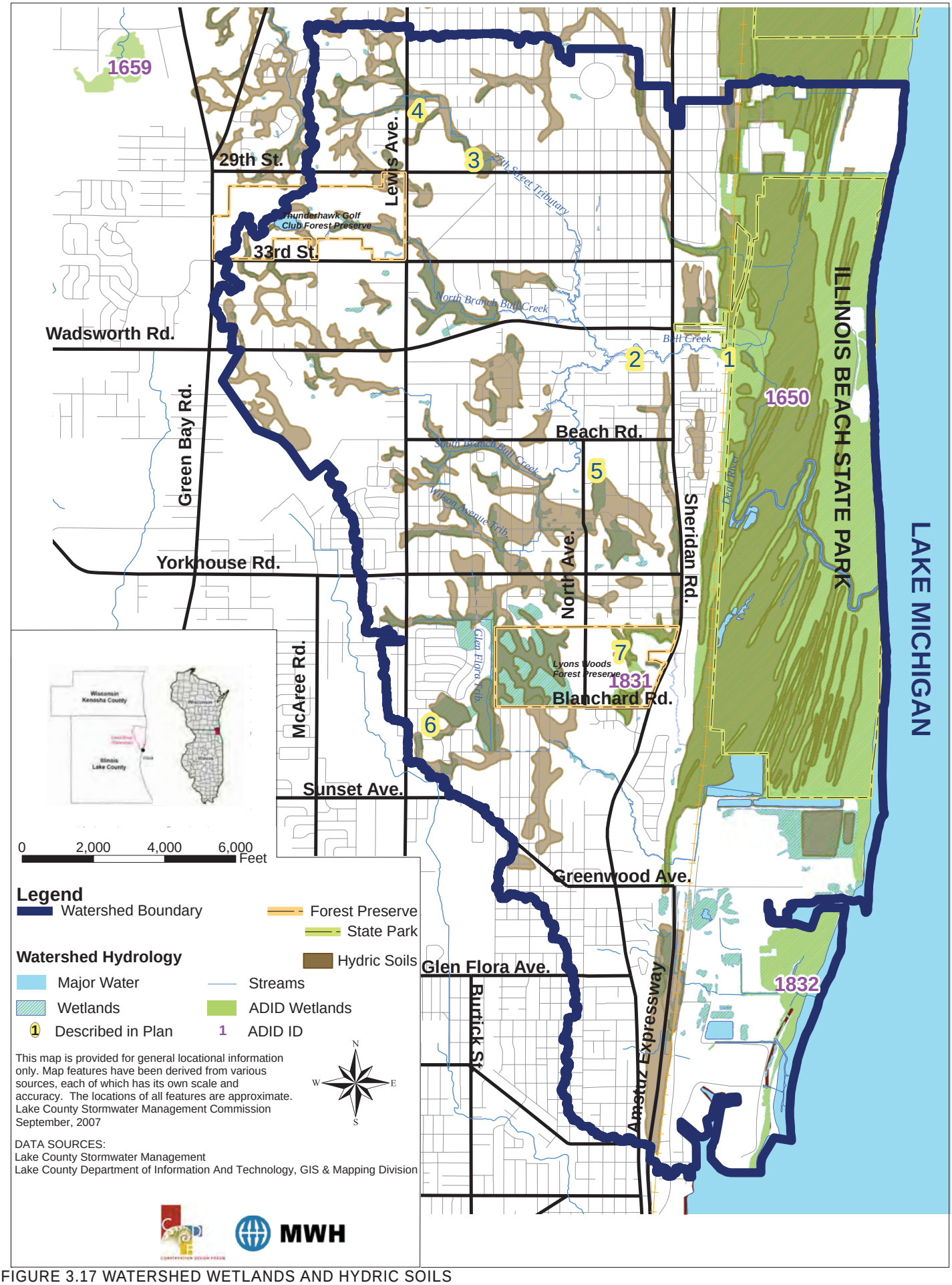


FIGURE 3.17 WATERSHED WETLANDS AND HYDRIC SOILS

3.11.4 WETLANDS

Wetlands, once prevalent within northeastern Illinois, have continued to decline in area and quality. Wetlands are of interest to watershed studies of this sort due to the benefits they provide. These benefits include absorbing and moderating the flow of runoff from the landscape, reducing the risk and damage of flooding by providing space for excess water to go, filtration and cleansing pollutants from runoff, and as important habitat for watershed wildlife.

Currently, approximately 3106 acres (31% of the entire watershed area) of wetlands exist within the Dead River watershed, including 1831 acres of wetlands (59% of the total wetland acreage) within Illinois Beach State Park. This 3106 acres is 946 acres less than an estimated original 4052 acres of wetlands, a loss of approximately 23% of the original wetland acreage, indicating that 946 acres of wetlands are potentially restorable. The number of acres of wetland lost was estimated by calculating the area of hydric soil not classified as wetland, assuming that these areas were once wetlands and have since been drained and/ or developed. The majority of these losses have occurred in SMUs 3B, 3C, and 5. Wetlands and hydris soils are shown in Figure 3.17. Potential wetland restoration sites are shown in Figure 3.18

During a rapid watershed assessment in 2006, Conservation Design Forum observed seven wetlands within the Dead River watershed using a rapid assessment of wetland vegetation. Due to time and resource constraints, the site reconnaissance of these wetlands was very limited and several of the areas were only assessed from the road. Thus, the information presented here should not be considered representative of the watershed as a whole, but only as observations. As a result, this information is not used in the Action Plan to make specific recommendations about specific management measures for wetlands, but to make more general statements about the need for wetland restoration. Nonetheless, those wetlands that were observed were of marginal vegetative quality, however, it is probable that they can continue to provide some water quality benefits for the watershed.

Locations of the seven wetlands observed are provided in Figure 3.17. A summary of the observed wetlands, as well as the reported conditions of Advanced Identification of Aquatic Resources (or ADID) Wetland 1650 and 1831, follows. ADID is a cooperative effort between federal, state, and local agencies to inventory, evaluate, and map high quality wetland and stream resources. Overall, these wetlands demonstrated the following characteristics:

- Limited vegetative wetland quality and invasive species of Cattails, Reed Canary Grass, and Phragmites are present in some combination at almost all the wetland areas assessed by CDF.
- Open water areas and cattail marshes may still provide some water quality improvement and runoff retention.
- Larger wetland complexes and shrub thickets may provide some wildlife habitat opportunities.
- Some wetland seeps were noted along Bull Creek.

Map Location 1
Small, backwater wetland within Bull Creek probably formed due to fallen trees within creek. Vegetation consisted of sedges and Green Ash saplings. Due to the wetland's size, limited functions would be provided.

Map Location 2
Wetland seep area. Skunk Cabbage was noted along the north slope of Bull Creek. Otherwise the ground plain was mostly devoid of vegetation within this immediate area. Mature trees of Sugar Maple dominate the area. Occasional seeps were noted along the N. B. Bull Creek.

Map Location 3
Wetland associated with the 27th Street Tributary is dominated by Reed Canary Grass and consists of a shrubby area that is predominantly Multi-flora Rose and Gray Dogwood. Other invasive species of buckthorn and honeysuckle are present along the upland edge. This area provides some habitat and water quality functions.

Map Location 4
Wetland associated with tributary located east and west of Lewis Avenue. Wetland is a cattail marsh that is dominated by Hybrid x cattail and Reed Canary Grass. Other vegetation noted included Green Bulrush, Redtop, Grass-leaved Goldenrod, bidens, and willow. The marsh on the west side of Lewis Avenue is surrounded by thicket. This wetland provides some wildlife and water quality functions.

Map Location 5
Mapped wetland habitat is not present. Given the size of the existing trees, it does not appear that this area had been filled within the past several years.

Map Location 6
A large portion of the wetland habitat is cattail marsh; this area was inundated during the November site visit. Reed Canary Grass is also prevalent amongst the cattails. Phragmites dominates an extensive portion of the wetland area surrounding the cattail marsh. It appears that Phragmites has been there for a while since no other plant species except for occasional Field Thistle plants were present within that portion of the Phragmites colony that was traversed. Given the size of this wetland system and its placement within the watershed, this area provides water quality benefits and stormwater retention.

Map Location 7 / ADID Wetland 1831
This mapped ADID wetland near Blanchard Road in Lyons Woods is characterized as a 42-acre wetland that has functional value of habitat and water quality. Site characteristics include the presence of threatened/ endangered species, stormwater retention, and shoreline/bank stabilization.

ADID Wetland 1650
This complex within Illinois Beach State Park consists of approximately 4,073 acres most of which are Illinois Beach State Park. Based on the ADID Wetland Report data sheet, this wetland complex provides functional value of habitat and water quality. It is characterized as a high quality plant community with threatened/endangered species. The wetland system also provides water quality benefits of sediment/ toxicant retention and nutrient removal/ transformation. Illinois Beach State Park is a listed Illinois Natural Area site.

Wetland restoration and management recommendations, including existing wetlands and restoration of former wetlands (areas of hydric soils that are no longer wetlands), are identified within the Action Plan included in Chapter 5. It is possible

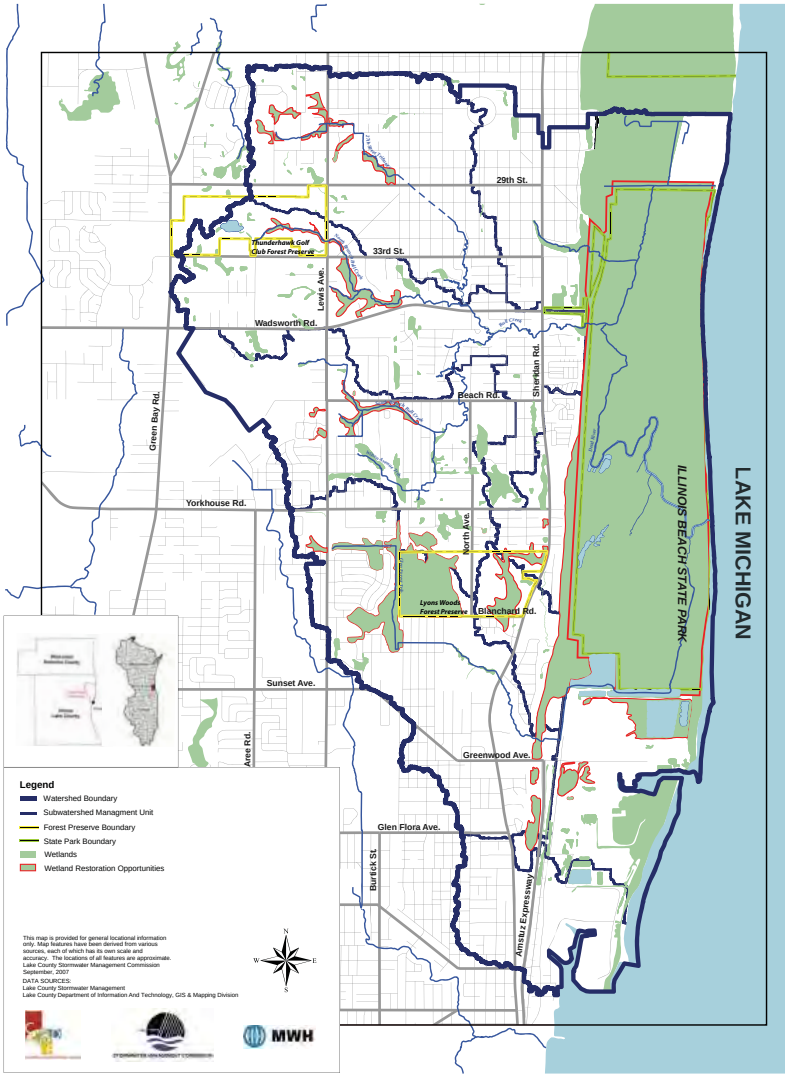


FIGURE 3.18 POTENTIAL WETLAND RESTORATION SITES

that former wetland areas that are undeveloped can be restored. (By 'undeveloped' we refer to those that remain in an agricultural, forest and grassland, vacant, or open space land use category.) However, this is typically a more difficult task than managing and restoring existing wetlands, and resources may be best spent on improving the remaining wetlands.

It is the opinion of the consultant team that all wetlands within the watershed are in need of some sort of restoration and management. Without a proper wetland assessment, it is difficult to determine the causes and sources of wetland degradation and the specific management needs. However, it is highly likely that without stabilizing the hydrology of areas upstream of each wetland, by controling the quantity and quality of stormwater runoff entering these wetlands, restoration of these wetlands will prove to be a significantly difficult uphill battle due to the negative impacts of hydrology and water quality on wetland quality.

3.11.5 GREENWAYS AND RECREATION

Some recreational elements in the watershed are found within Illinois Beach State Park and along the Lake Michigan shoreline, where there are hiking trails and water-based recreational opportunities such as swimming, fishing, camping, and boating. More passive recreational pursuits include bird watching, botany, and wildlife observation. Other recreational opportunities, such as golf, soccer, softball, and similar sporting activities, are found distributed throughout the watershed.

The Robert McClory Bike Path follows a former north-south railroad grade paralleling and east of Lewis Avenue. Hiking paths are also present within Shiloh Park (Zion), Hermon Park, and Lyons Woods Forest Preserve. Figure 3.13 depicts the trails within the watershed, though some of those shown, such as that following the east-west utility corridor just north of Lyons Woods between Green Bay Road and Illinois Beach State Park, are proposed and are not currently trails.

Sources: Conservation Design Forum Stream Inventory (2006).

Debbie Maurer, Lake County Forest Preserve District, Deb Nelson, Illinois Department of Natural Resources, and Don Wilson, personal communication.

Ravine Systems in the Lake Michigan Watershed, Illinois. Illinois Coastal Management Program Issue Paper – TAG D. Illinois Department of Natural Resources, August 8, 2007.

Table 3.10 Green Infrastructure Parcel Ownership Categories

Public Owners	Private Owners
Department of Natural Resources	Bank
Department of Conservation	Homeowner / Business Association
Department of Transportation	Landfill
Federal	Private
Forest Preserve	Private Club
Lake County	Religious Institution
Municipality	Trust / Trustee
Park District	Utility
Sanitary District	
School District	
State	
Waukegan Port District	

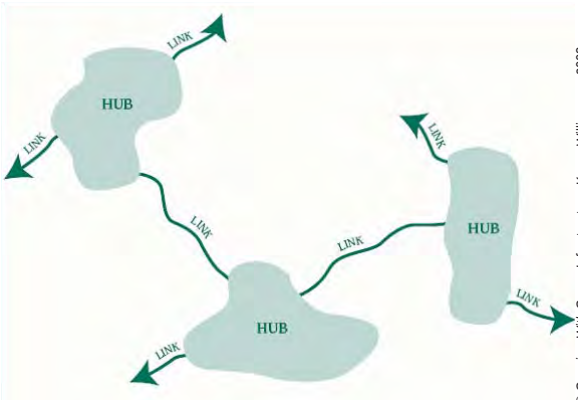
Community Enhancement of Illinois' Northeastern Coastal Natural Areas, proposal to the US Fish and Wildlife Service for the National Coastal Wetland Conservation Grant Program, 2006, IDNR.

Lake Michigan Lakewide Management Plan

Lake Michigan Action Plan DRAFT, June, 2006.

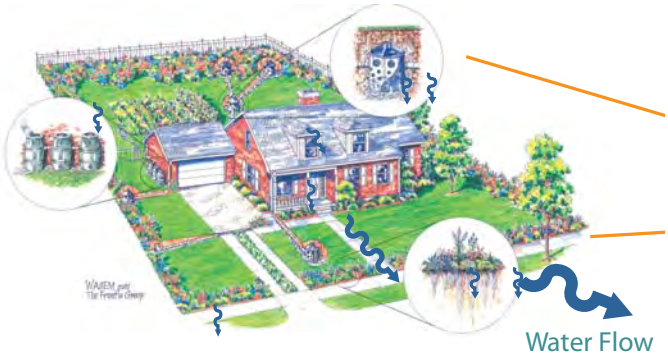
3.12 GREEN INFRASTRUCTURE INVENTORY

One of the primary goals of the watershed planning process is to identify green infrastructure that is important and should be preserved as a functional part of the natural drainage system, contributes to maintaining watershed hydrology, and may be a good location for local best management practices. The inventory is designed to assess, prioritize, and plan the watershed green infrastructure, the system of open space, greenways, streams, forest preserves, wetlands, and natural areas that form an interconnected support system for natural functions and processes, particularly natural hydrologic functions and the aquatic environment. Some definitions of green infrastructure, such as that of the US Environmental Protection Agency, include stormwater management as a component or benefit.Green infrastructure, as it is used in this plan, is defined as follows and illustrated in Figures 3.19 through 3.21.



© *Growing With Green Infrastructure*, Karen Williamson, 2003

FIGURE 3.19 CONCEPTUAL GREEN INFRASTRUCTURE HUBS AND CONNECTING LINKS



© *Conservation Design Forum*

FIGURE 3.20 LOCAL GREEN INFRASTRUCTURE AT THE SITE SCALE

© *Graphic Conservation Design Forum, aerial photograph Lake County*

FIGURE 3.21 GREEN INFRASTRUCTURE HUBS (FOSSLAND PARK AND ILLINOIS BEACH STATE PARK) AND LINK (DEAD DOG CREEK)(KELLOGG CREEK WATESHED)

Green infrastructure represents a new approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure techniques utilize natural systems, or engineered systems that mimic natural landscapes, to capture, cleanse and reduce stormwater runoff using plants, soils and microbes.

On the regional scale, green infrastructure consists of the interconnected network of open spaces and natural areas (such as forested areas, floodplains and wetlands) that improve water quality while providing recreational opportunities and wildlife habitat.

On the local scale, green infrastructure consists of site-specific management practices (such as rain gardens, porous pavements, and green roofs) that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls.

Appropriate preservation and management of a green infrastructure system can help 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, water quality benefits, streambank stabilization and restoration, natural resource preservation, wetlands, and habitat. Green infrastructure network elements typically include hubs (large, intact blocks of natural areas that support a diversity of habitats and wildlife and provide space for recreation and stormwater management) and links (natural corridors and greenways that link larger natural areas). Hubs and links may be composed of:

- Lakes, ponds, and wetlands.
- Stream corridors and waterways.
- Parks, recreational areas, greenways, and trails.
- Public and private conservation lands.
- Other nature preserves, natural areas, and wildlife habitat (woodlands, savannas, and prairies).
- “Open space” and vacant lands.
- “Working lands” such as forests, farms, and ranches.

3.12.1 INVENTORY METHODOLOGY AND RESULTS

As part of the effort to connect and expand existing green infrastructure elements, such as creek corridors or forest preserve districts, the green infrastructure inventory identified parcels of land with the potential to contribute to the watershed green infrastructure system. Using Lake County parcel data, the inventory first identified open and partially open parcels. Open parcels are those listed in the Lake County parcel data as “unimproved” meaning they do not have built structures, utilities, or other man made improvements. Partially open parcels are improved parcels (having structures or improvements), but also contain significant unimproved acreage. For example, a 5 acre parcel with a single family home is considered by this analysis as partially open. Figure 3.22 shows the location of these parcels in various shades of green (open parcels) and blue (partially open parcels.) This figure shows not only the location of these parcels, but the location of publicly- and privately-owned green infrastructure parcels, as defined by Lake County and shown in Table 3.10, and the prioritization of these parcels, as described below. Table 3.12 shows summary results of the analysis of open and partially open parcels.

Some of the publicly-owned green infrastructure parcels are protected status, meaning that there is very low risk that they could be converted to other land uses. Protected status parcels include those owned by the IDNR, Forest Preserves, Park Districts, and Land Conservatory of Lake County. Some publicly-owned parcels are not protected and, along with privately-owned parcels, are considered available for development or conversion to a different land use.

3.12.2 GREEN INFRASTRUCTURE PRIORITIZATION

In order to help identify and plan the green infrastructure system for Dead River, the watershed planning committee developed a methodology and prioritization process to help sort the open and partially open parcels into their relative importance for the green infrastructure system. The prioritized parcels are shown in Figure 3.22.

The green infrastructure inventory and prioritization process is comprised of five steps:

1. Identify open (unimproved) and partially open (improved with significant undeveloped acreage) parcels using GIS (described above).

Table 3.11 Green Infrastructure Parcel Prioritization Criteria and Impairment Categories Addressed

Criteria	Flooding, Floodplains, & Hydrology	Water Quality	Stream & Streambank Restoration / Stabilization	Natural Resources & Habitat
1. Parcels that intersect 100-year floodplain	X	X	X	X
2. Parcels within .5-miles of the headwaters	X	X		X
3. Parcels that intersect with a wetland	X	X		X
4. Parcels that are adjacent to or include at least 2.5 acres of drained hydric soils	X	X		X
5. Parcels with highly erodible soils		X	X	
6. Parcels in a SMU where less than 10% of the SMU is existing wetland	X	X		X
7. Parcels within .5-mile radius of Lake County Stormwater Management Commission Flood Problem Area Inventory site	X			
8. Parcels that are within 100 feet of a watercourse	X	X	X	X
9. Parcels intersecting with non-point source pollutant (NPSP) hotspot Subwatershed Management Unit.		X		
10. Parcels intersecting with or adjacent to a NPDES permitted point source		X		
11. Parcels adjacent to or including forest preserves, land trust holdings (for conservation), and privately and publicly preserved open space	X	X		X
12. Parcels adjacent to or including Illinois Natural Areas Inventory (INAI), nature preserve (NP), high quality natural areas, high quality wetlands (ADID), or T&E sites	X	X		X
13. Parcels that connect existing open space areas				X
14. Parcels that contain a depressional area.	X			

Table 3.12 Green Infrastructure Inventory Results

		parcels	acres	% of open / partially open parcels	% of watershed area
Total Watershed Area			10,115	-	-
	Public ownership		4,472	-	44%
	Illinois Beach State Park		1,284	-	13%
	Private ownership		5,644	-	56%
Open parcels	# of parcels	1,397		-	-
	Area		3,443	-	34%
	Parcel size (maximum / average)		321 / 2.5	-	-
	Public ownership		2,369	68%	23%
	Private ownership		1,094	32%	11%
	Protected status		2,151	62%	21%
	Unprotected status		1,311	38%	13%
Partially open parcels	# of parcels	80		-	-
	Area		843	-	8%
	Parcel size (maximum / average)		65.8 / 10.5	-	-
	Public ownership (area)		484	59%	5%
	Private ownership (area)		340	41%	3%
	Protected status (area)		289	35%	3%
	Unprotected status (area)		535	65%	5%

2. Establish prioritization criteria for ranking the relative importance of each parcel to the green infrastructure network.
3. Apply the prioritization criteria to the parcels identified in step 1 giving each parcel one point for each criteria met.
4. Give each parcel a total score; parcels with the highest scores meet the most criteria, and, are the highest-priority for consideration in the green infrastructure network.
5. Propose a green infrastructure network that connects priority open spaces.

As a starting point, prioritization criteria used in other watershed planning processes were considered for the Dead River/Bull Creek watershed. Watershed stakeholders reviewed, modified, and agreed on the following criteria that they viewed as appropriate for this watershed. Table 3.11 shows the relationship between the 14 criteria used to prioritize green infrastructure and the watershed issues identified by stakeholders. A brief rationale for including these criteria is included in parentheses.

1. Parcels that intersect with the 100-year floodplain. (These areas at risk of flooding are part of the natural drainage system for storing and conveying floodwaters. They function as stream buffers protecting water quality and channel stability, and also provide riparian habitat.)
2. Parcels within 0.5-miles of the headwaters (the upper reaches of the watershed; the source and upstream waters of a stream). (Headwater streams are often more sensitive to disturbance from urban and agricultural activities than reaches with larger drainage areas. They help absorb rainwater and protect the stream from the impacts of heavy stormwater runoff and its associated pollutants. Headwater areas often provide a broad range of habitat as they progress from upland, to wetland, to stream.)
3. Parcels that intersect with a wetland. (Wetlands provide habitat and help clean, filter, and retain stormwater.)
4. Parcels that are adjacent to or include at least 2.5 acres of hydric soils. (These areas, which were once wetland before being drained, are identified as potential wetland restoration sites and thus have the potential to provide similar benefits as wetlands.)

Table 3.13 Green Infrastructure Parcel Prioritization Results

Priority Score (14 possible)	Category	# of Parcels	Total Area (acres)
0	3	82	27
1	3	157	88
2	3	377	150
3	2	240	304
4	2	227	566
5	2	195	839
6	2	114	973
7	1	64	752
8	1	39	221
9	1	5	29
10	1	2	15
11	-	0	0
12	-	0	0
13	-	0	0
14	-	0	0

5. Parcels with highly erodible soils. (Areas of highly erodible soils are less stable and have the potential to produce proportionately large sediment loads when disturbed. In this watershed, many of these areas are steep bluff ravines that may be unsuitable for development.)
6. Parcels in a Subwatershed Management Unit (SMU) where less than 10% of the SMU is existing wetland. (Previous studies have found that stream systems are more impaired when the percentage of wetland in the watershed is below 10%. Where formerly wetlands provided benefits, open and partially open parcels may be used to replace those wetland benefits.)
7. Parcels within 0.5-mile radius of a Lake County Stormwater Management Commission Flood Problem Area Inventory site. (Potential locations for best management practices to address the flooding problem.)
8. Parcels that are within 100 feet of a watercourse. (A good riparian corridor to buffer the waterway can mitigate some of the water quality, flooding and stream stability impacts associated with impervious cover in the watershed in addition to providing habitat.)
9. Parcels intersecting with a subbasin identified as a non-point source pollution hotspot. (Potential locations for best management practices to mitigate (reduce or filter) heavy pollutant loads.)

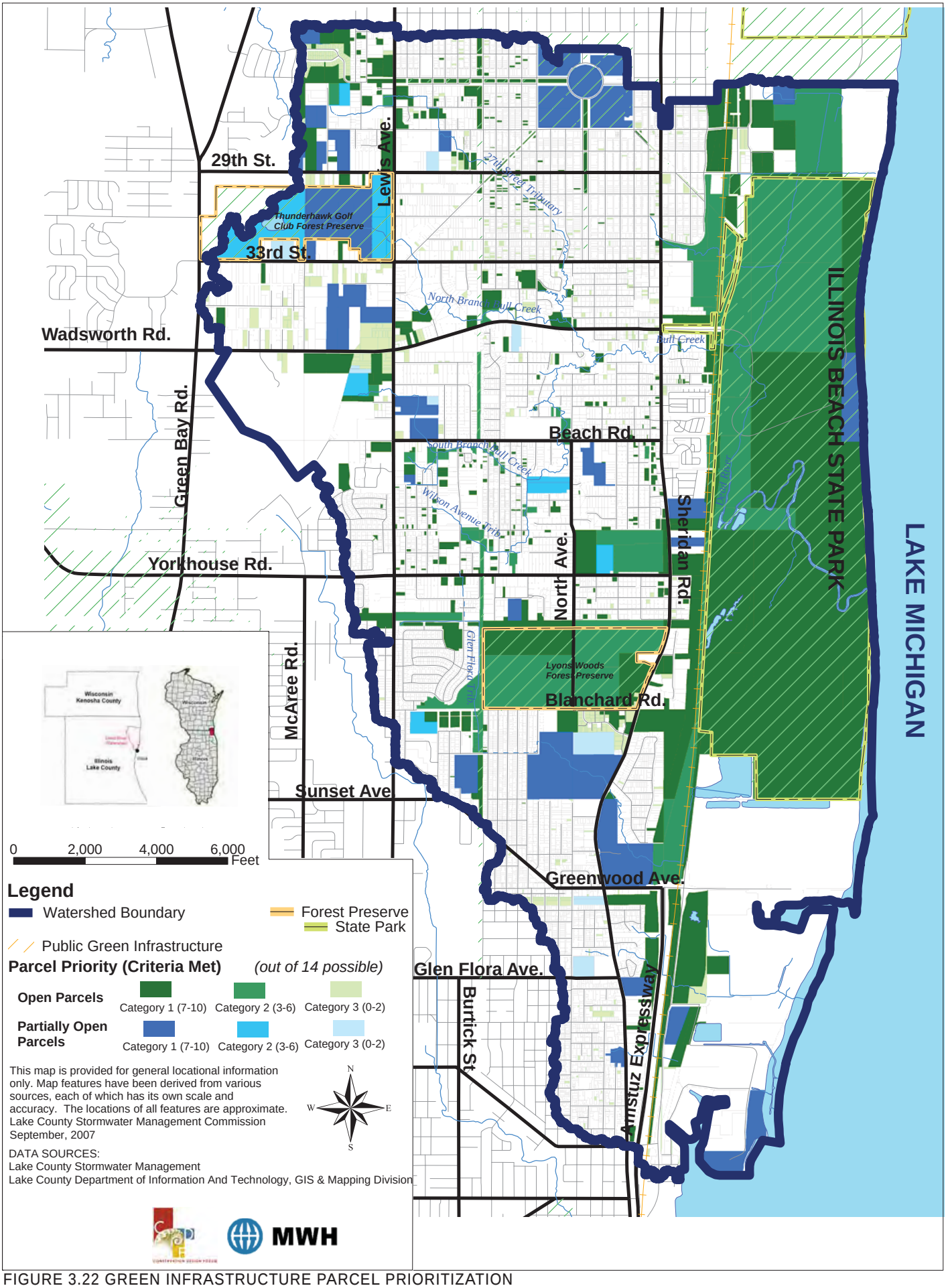


FIGURE 3.22 GREEN INFRASTRUCTURE PARCEL PRIORITIZATION

10. Parcels intersecting with or adjacent to a permitted point source discharge location. (These locations may present opportunities to install best management practices to help control the pollution these points are permitted to discharge.)
11. Parcels adjacent to or including forest preserves, land trust holdings (for conservation), and privately and publicly preserved open space. (Opportunities to expand existing protected open space areas and creating larger "hubs" that help absorb stormwater.)
12. Parcels adjacent to or including Illinois Natural Areas Inventory and Illinois Nature Preserve sites (high quality natural communities that qualify for formal protection by the State of Illinois), high quality natural areas, high quality or high function wetlands, or sites known to harbor or support state or federal threatened and endangered species. (Opportunities to expand existing open space areas and creating larger "hubs," and opportunities to provide greater buffers for sensitive natural areas.)
13. Parcels that connect existing open space areas. (Opportunities to expand and protect the greenway links that connect natural resource hubs and serve as corridors creating "links".)
14. Parcels that contain a depressional area. (Potential runoff storage area that could be used for regional detention or water quality management.)

The results of the Green Infrastructure prioritization process are summarized in Table 3.13 and Figure 3.22. The prioritization allowed watershed stakeholders and planners to develop a Green Infrastructure Plan, which is based on the prioritization of parcels as well as the best judgement of the watershed planning team. In summary, while some opportunities to expand and connect the hubs and links of the watershed's Green Infrastructure system remain, many of the stream channels, which would form logical connections between hubs, are no longer an option for preservation. In fact, few options remain for creating an integrated Green Infrastructure system. Nonetheless, action recommendations for implementing the Green Infrastructure Plan, and the location of the prioritized parcels, have been incorporated into the Action Plan in Chapter 5.

3.13 NATURAL DRAINAGE SYSTEM

This section describes the conditions and characteristics of the natural drainage system of the Dead River watershed. Results of the hydrology and hydraulic modeling and floodplain mapping study completed in 2007 are found in Section 3.15 Flooding.

3.13.1 GENERAL WATERSHED DRAINAGE

The Dead River watershed contains approximately 12.6 total stream miles and 1719 acres of wetlands, which is approximately 17 percent of the toal watershed area. Most of these wetlands are within the coastal plain and Illinois Beach State Park. The Dead River Watershed contains three main tributaries: an unnamed tributary to the north, the Dead River / Bull Creek system, and the Glen Flora Tributary and its unnamed tributary. The Dead River is located entirely in Illinois Beach State Park and discharges to Lake Michigan. Bull Creek flow splits north and south after entering Illinois Beach State Park. The north flow path is a virtually indistinguishable channel, while the south flows through a series of constructed ponds before entering the Dead River. Upstream of Illinois Beach State Park, Bull Creek is composed of three tributaries: the South Branch, the North Branch, and the 27th Street tributary, which are shown in Figure 3.23 and described below. Approximately 5.3 stream miles are within Zion's jurisdiction, 8.3 within Beach Park, 7.3 miles in Waukegan, 5.8 miles within unincorporated Lake County. These figures are approximate.

Historically, the Dead River and Glen Flora Tributary followed somewhat different flow paths than they do today. As shown in Figure 3.24, the Little Dead River, which included part of the downstream end of the Glen Flora Tributary, used to flow into Lake Michigan (1907). Over the years, this channel has been gradually filled and no longer exists.

According to local knowledge, there are some interesting characteristics with regard to hydrology in and around Illinois Beach State Park.

- a small drainage channel positioned between the Dead River and the Johns Manville lagoons exhibits some uncertainties with regard to direction of flow. Anecdotal evidence suggests that during rain events the channel, which normally flows in a southerly direction, may reverse flow due to the minor gradient, and back up to the north, possibly

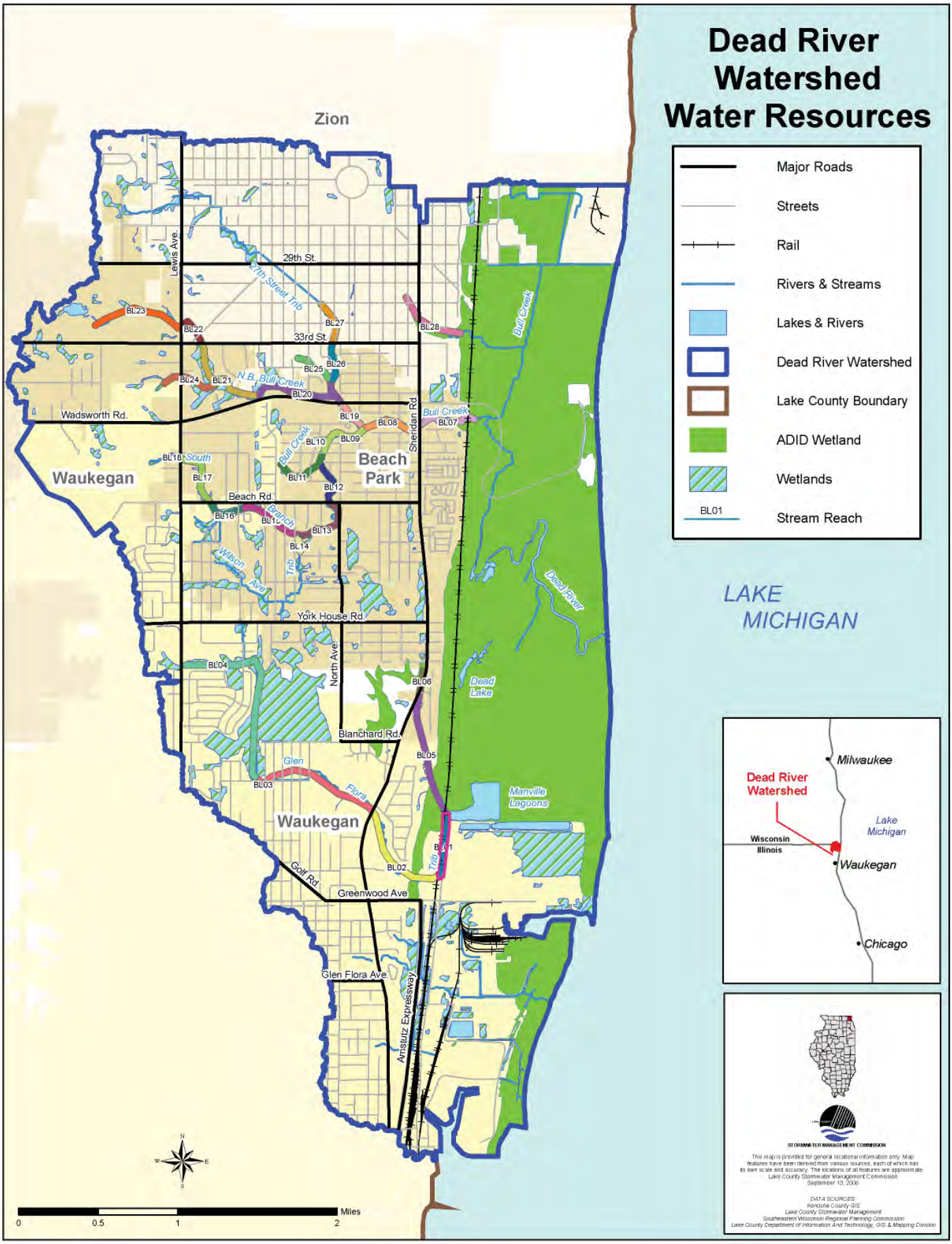


FIGURE 3.23 WATER RESOURCES

carrying asbestos-laden material from Johns Manville into Illinois Beach State Park.

- The downstream segment of the Glen Flora Tributary, formerly known as the Little Dead River, used to discharge south of Midwest Generation into a ditch. Current alignment of the Glen Flora Trib is under the rail tracks, north into ponds and then east through ponds, into a pipe which then discharges east to the Lake.

- Dead River is intermittently hydrologically connected to Lake Michigan and at other times this connection is obstructed by a sand bar dam created by littoral drift, which is broken during high river flows. This situation complicates the hydrologic picture as well as the habitat connection between Dead River / Bull Creek and Lake Michigan.

The Dead River watershed is one of the few remaining Illinois tributaries that drain to Lake Michigan. The importance of its hydrologic connection to the lake, whether intermittent or constant, is important not only for implications of spawning and feeding habitat for Lake Michigan fish species, but also for its contribution to water quality impairments in the coastal wetlands and the lake itself. Former and current land uses along the lakefront, such as Johns Manville and Outboard Marine Corporation, are likely greater contributors to water quality impairment in Lake Michigan itself.

In general, fluctuations in groundwater levels correspond to precipitation, evapotranspiration, infiltration, and Lake Michigan water level changes. Lake Michigan levels, which were at near-record lows in 1999 and 2000, directly impact groundwater levels in the park coastal wetlands, which were historically fed by groundwater discharge. Today, the wetlands receive a much different flow regime, with increased discharge volume and degraded quality of surface runoff from the upstream watershed area. As a further consideration, groundwater pumpage near the Lake Michigan shore and inland areas could interfere with natural groundwater flow and discharge into Lake Michigan.

This watershed assessment does not examine Lake Michigan water quality impairment, but it does review Lake Michigan beach closure data. The number of closures in a year for Waukegan South and North beaches is strongly correlated with the ranking of number of closures by year (year with most, second most, etc.) being the same for both beaches. Thus, these closures may very well have been

© City of Waukegan

FIGURE 3.24 LITTLE DEAD RIVER

The Little Dead River, shown in these graphics, has gradually been filled in over the years.

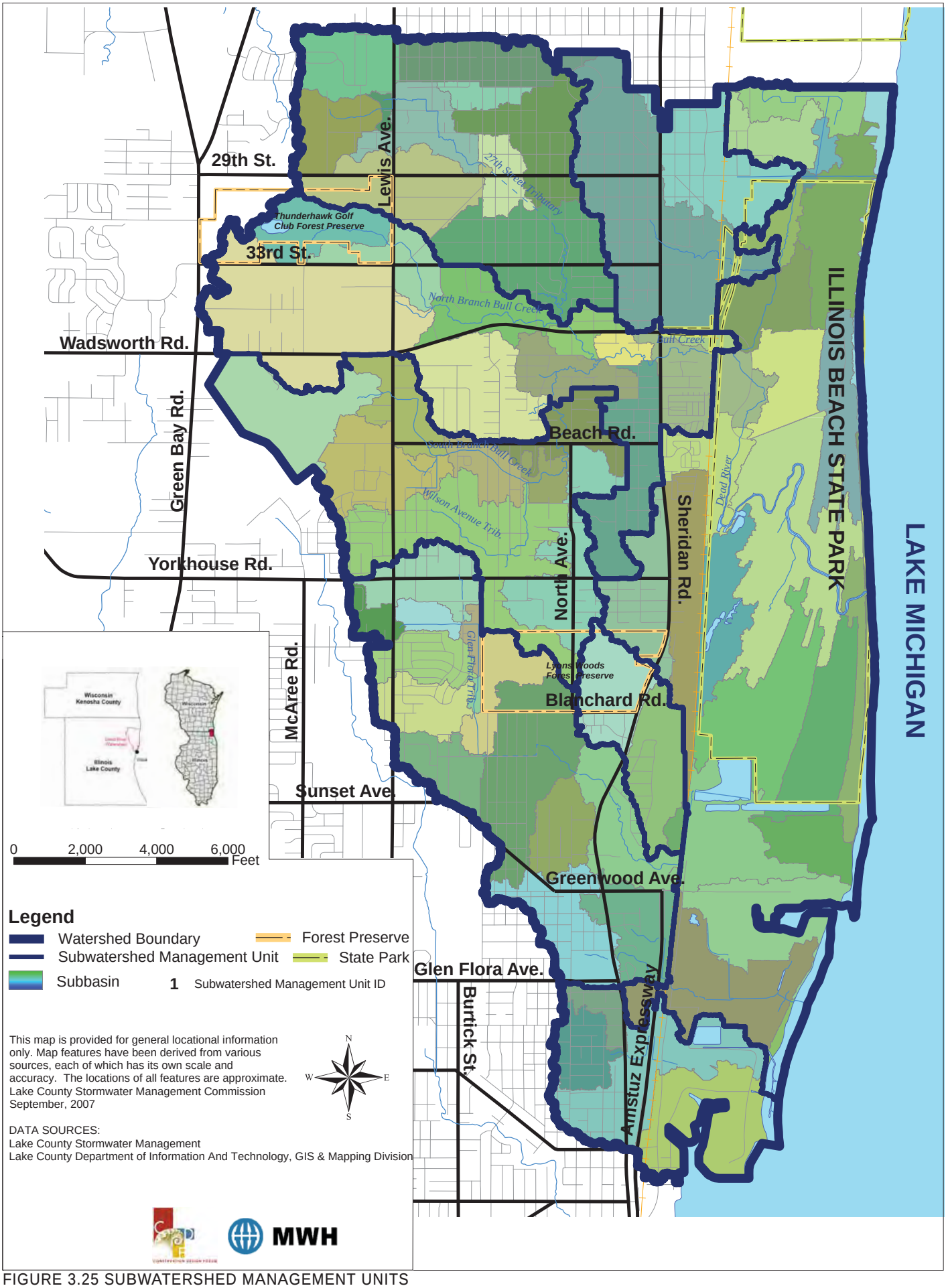


FIGURE 3.25 SUBWATERSHED MANAGEMENT UNITS

related to storm events or wave action.

Streamflow
Streams in this area exhibit a rapid rise and fall of water level, flow and velocity (termed "flashiness") as a result of rain events. In 2006, Bull Creek exhibited a median flow of 6.65 ft3/second and a maximum flow of 124.73 ft3/second, and median velocity of 0.58 ft/second and maximum of 3.16 ft/second. In 2007, Bull Creek exhibited a median flow of 11.29 ft3/second and a maximum flow of 688.08 ft3/second, and median velocity of 0.70 ft/second and maximum of 4.06 ft/second. The higher median and maximum flows in 2007 were the results of greater frequency and volume of precipitation that year.

3.13.2 DELINEATING SUBWATERSHED MANAGEMENT UNITS

The Dead River watershed has been subdivided into 77 subbasins and eight Subwatershed Management Units (SMU) based on major stream tributaries, as shown in Table 3.14 and Figure 3.25. This organizational structure allows the planning effort to examine the watershed at a variety of scales. For instance, the non-point source pollution loading assessment, discussed in Section 3.14.4, uses the 77 subbasins to model pollutant loading and locate hotspots. SMUs are groups of subbasins that all drain to a single point, the most downstream point in the SMU. These eight SMU's form the management units within which the action recommendations are organized, which simplifies the management structure of the plan.

SMU 1 includes the watershed area east of Sheridan Road, including Illinois Beach State Park. SMU 1 also includes a portion of the watershed west of Sheridan Road near York House Road.

SMU 2 includes the unnamed tributary at the northern boundary of the watershed.

SMU 3 is the Bull Creek drainage system. SMU3 is subdivided into SMU 3a, the 27th Street Tributary, SMU3b, the South Branch of Bull Creek and the Wilson Avenue Tributary, and SMU 3c, the North Branch of Bull Creek.

SMU 4 is a watershed area tributary to Glen Flora Tributary.

SMU 5 is the Glen Flora Tributary.

SMU 6 is an unnamed drainage area and includes the industrial area north of Waukegan Harbor.

Table 3.14 Subwatershed Management Units

Subwatershed Management Unit	# of Subbasins	Acres
1	24	3236
2	3	773
3a	10	1251
3b	8	1246
3c	11	1573
4	3	295
5	14	1414
6	4	612

3.13.3 DEAD RIVER / BULL CREEK STREAM INVENTORY

Bull Creek, the Glen Flora Tributary, and the unnamed tributaries were comprehensively inventoried by Lake County SMC in 2001 and rapidly assessed by Conservation Design Forum staff over two days in 2006. During the SMC effort, the stream system was divided into 28 reaches (a segment of a river or stream) with reach lengths varying between 1770 and 4000 feet (see Figure 3.23). Each reach was characterized using standard Lake County SMC methodology that is reflected in the stream data forms that are included in Appendix P. Since the coastal plain was not inventoried, all stream reach information refers only to areas upstream of Illinois Beach State Park. Measurements, photos, locations, and qualitative characteristics were recorded. The major stream characteristics inventoried included physical channel condition, discharge points (pipes or open channels that discharge flow to the stream), hydraulic structures (bridges, culverts, or other structures that contain or convey the stream), riparian corridor (strip of land bordering streams, lakes, rivers, and other watercourses) characteristics, and aquatic habitat conditions (whether there are characteristics of the stream that support fish and other animals living in the stream). Results of these inventories follow.

3.13.4 GENERAL DESCRIPTION / FLOW

© Lake County Stormwater Management Commission

A channelized reach of the Glen Flora Tributary within Illinois Beach State Park

© Conservation Design Forum

Streambanks in Hermon Park (Zion) with turf grass edges east of 27th Street and Lewis Avenue along a reach upstream of BL28 that was not visited during the 2001 stream inventory. These turf grass edges should be converted to native plants to improve water quality and riparian habitat.

PATHWAYS

Unnamed Tributary (BL28)
North of the intersection of Sheridan Road and 33rd Street, a small, unnamed tributary flows from underground pipes under the residential area to the northwest, through Ophir Park and Carmel Park, and finally discharges to Illinois Beach State Park. The reach within Ophir Park is fairly channelized and surrounded by turf grass to the stream banks, which are eroding. Within Carmel Park, the stream meanders through fairly dense forest and appears to have fairly healthy channel substrates, such as sand and gravels, and moderate erosion of the streambanks.

Dead River / Bull Creek within Illinois Beach State Park
Within Illinois Beach State Park, the Dead River and Bull Creek are very low gradient. Dead River meanders through the dune and swale morphology of the Park. Although the banks are relatively steep in many locations, they are not high and are generally stable. The channel bottom is believed to be sand and, in some locations, mucky with low stability substrates. It is likely that this condition is caused by sediments eroded from upstream portions of the watershed settling out or collecting here in the low gradient Illinois Beach State Park. The overbank area is generally open with some trees and shrubs.

Bull Creek (BL07-BL08)
West of Illinois Beach State Park, the stream channels are generally located within wooded ravine-type valleys, many of which are wide enough to allow the stream to meander. Where the stream runs adjacent to the ravine slopes, erosion of the bluff can be quite severe. This erosion is also causing the failure of some stormwater outfalls. When these break or fail, the discharge point moves closer to the stream bank and continues to cause erosion and loss of the ravine slopes, which should be a major concern to those living on the ravine edges. These failures are identified in Section XX of this report. On the positive side, there are a number of seep areas within this reach with skunk cabbage and marsh marigolds growing along the stream corridor, which are indicators of potentially rare natural communities.

Natural Areas Ecosystem Management conducted two studies of channel conditions on this reach Bull Creek upstream of the Union Pacific Railroad in XXXX. Their findings conclude that erosion was a significant problem along Bull Creek. There were 46 major erosion sites totaling approximately 6900 feet of streambank requiring bioengineering solutions such as grade stabilization using artificial riffles, coir fiber rolls and/or mattresses and A-Jacks structures with vegetated geogrids to stabilize the banks and ravine walls. The problems generally revolve around accelerated stream channel downcutting and widening resulting in undercut banks. Further, the report suggests the creation of new floodplain on the inside bends of the stream channel and the softening of slopes on the outside bends of the stream channel can benefit the stream. The inside bend floodplain terrace allows the flow to spill out of the channel and reduce the erosive velocity of the water on the outside bends. Creating gentler slopes on the outside bends allows for long term plant stabilization of the banks.

Within this reach, the Lake County Stormwater Management Commission, U.S. Army Corps of Engineers, and Bull Creek Stakeholders Association collaborated on a streambank stabilization project. The project used bioengineering stabilization measures, such artificial riffles, floodplain terraces, coir fiber rolls, rock toe stabilization, vegetated geogrid lifts, and the creation of a riparian buffer using native shrubs, grasses, and wildflowers. However, the project located near the railroad east of Sheridan Road has experienced some loss of plantings on the low side of the channel.

In 2004, the North Shore Sanitary District and the United States Corps of Engineers implemented an emergency sanitary line stabilization project in reach BL08, where sanitary sewer manholes and sanitary sewers had been exposed by channel and bank erosion. This project was viewed by CDF staff during its inventory (2006) and found to be holding up well. Four additional NSSD projects have been installed in the Dead River / Bull Creek watershed to stabilize streambanks and help protect sanitary sewers. Those viewed by CDF staff appeared to be holding up well, though one was found to be causing erosion on the opposite bank from where the stabilization measure was installed.

A number of seeps also occurred along reach BL08, with one location appearing to support vegetation (skunk cabbage) typical of seeps. Evidence of beaver activity also was apparent on some of the trees in the area. Sump pump / footing / roof drains were seen leading from residential properties, which may be aggravating erosion processes where they occur on steep slopes or on lawn areas adjacent to high, steep slopes. Yard waste dumping was also seen.

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Relatively stable streambanks resulting from the Bull Creek stabilization project. (BL07)

© Lake County Stormwater Management Commission

Exposed sanitary sewer manhole exposed by eroding streambank and streambed (BL08).

© Conservation Design Forum

Soil lifts stabilizing the streamank, Bull Creek restoration project (BL07)

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Structural, hard-edge protection for sewer infrastructure (BL08) protects the sewer but does not provide a natural stream habitat condition.

© Lake County Stormwater Management Commission

Artificial riffle installed in the downstream reach of Bull Creek to provide grade stabilization (BL07).

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Erosion of the streambank opposite the sewer stabilization project (BL08).

Some stream channel substrates appeared fairly good quality, with sand and cobbles and stones in more than a few occurrences.

27th Street Tributary (BL25-BL27)
The 27th Street Tributary (approximately 1.6 stream miles broken into 4 reaches) exhibited varying degrees of eroded banks, debris jams, and instances of rock walls and other improvised erosion control measures, turf grass to the edge of the streambank, and fencing along residential lots. Some reaches have fairly generous natural vegetation buffers along the stream edge. At 31st Street the stream flows for approximately 2700 feet through an underground culvert and emerges west of the McClory Bike Path north of 29th in Hermon Park and its pond. Upstream of this park the stream exhibits low flow and a flat channel with very shallow stream banks. Just east of Lewis there is a manmade levee, apparently to protect the property at Lewis and 26th from flooding. Black colored water was seen in this tributary as well, which should be investigated further. Another sanitary sewer stabilization project installed along this tributary appears to be holding up well and is not exhibiting the erosional problems of the downstream project. A stormsewer and manhole near 33rd, which has not been stabilized, appears to be at risk of failure and should be addressed.

North Branch of Bull Creek (BL19-BL24)
The North Branch of Bull Creek is approximately 3 stream miles broken into 6 reaches. Just upstream of its confluence with the 27th Street Tributary the stream corridor (BL20) exhibits mown turf grass to the streambank edge. Some yard waste dumping and concrete lined or otherwise hard-armored channels were also seen along this reach. Yard waste dumping within the stream channel adds pollutants (such as pesticides and fertilizers) to the water and can smother vegetation along the streambanks that is helping to stabilize the bank soils and prevent erosion.

Upstream of the McClory Bike Trail (BL21), the stream exhibits a fairly shallow wooded channel with a few locations of eroded banks and stormsewer blowouts. However, it is not terribly encroached by residences and there appears to be sufficient room for natural stream meandering to occur. At Lewis Avenue the North Branch flows from Thunderhawk Golf Course, which demonstrated overall healthy stream channel and riparian corridor conditions.

On the day the rapid assessment was conducted by Conservation Design Forum, reach BL19 approximately 0.5 miles upstream of Sheridan Road exhibited water that appeared black in color, and although the cause could not be determined, it was assumed the black water was coming from the 27th Street Tributary (BL26-BL27) since black water was not observed in BL25.

South Branch of Bull Creek (BL09-BL18)
The South Branch of Bull Creek upstream of the North Branch confluence (BL09) meanders fairly sharply through a forested valley, though not too dense in canopy. In fact, this ravine is fairly open in character and clean stream substrates were observed suggesting limited hillside erosion. At least one side ravine was filled with yard debris (leaves) and a number of residential runoff discharge drains have been snaked to

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Severely impacted stream channel and armoring where reach BL15 crosses Wilson Street near Howard Street.

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Armoring such as this wood retaining wall helps stabilize the streambanks but reduces the quality of the stream habitat for aquatic plants and animals (BL11).

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Severe streambank armoring and channelization improves flow but has significant detrimental effects on channel health and habitat quality (convergence of BL13, BL14, and BL15)

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Cement-lined stream channel armoring is often used to stabilize and erodiing channel and improve drainage, but it destroys the natural channel and is not supportive of a healthy stream condition. (BL15)

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Streambank armoring helps stabilize the streambank but reduces the natural structure and function of the stream (BL26)

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The bare dirt in this photo appears to have been recently deposited on the slope of this ravine, and the plastic residential drain installed so that it discharges runoff onto the slope, which causes erosion, rather than into the bottom of the ravine, which is the preferred discharge location for these types of drains (BL12).

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This new home on Hart Road north of the Pineview Cemetery is built very close to the ravine edge (BL12).

the bottom of the ravine. Stream bank armoring was present in a number of locations, some of wood and others of broken concrete, and some silt fence has been installed across the slope in some locations. A few bare banks were seen. As is fairly typical for this watershed, stormsewer blowouts, culvert erosion, and debris jams were found. There is some new development occurring very near the stream channel around Hart Road north of the Pineview Cemetery (BL12), and some dirt fill on the opposite (east) streambank, both of which may be in violation of local regulations that prohibit dumping dirt or other fill material within the floodplain and floodway. A concrete dam at this location has failed and water flows around and through it.

Just upstream of Beach Road (BL13), the reach is fairly natural in character except for one location where it appears that excess concrete from the adjacent land use has been disposed of along the stream channel. A little further upstream is where a number of stormsewers and two streams, the South Branch of Bull Creek (BL15) and the Wilson Avenue Tributary (BL14), come together to create the South Branch of Bull Creek (BL13). At the time of the investigation, this open concrete stormwater channel (BL15) was failing in some places and appears to be used for yard waste and leaf burning. Beneath the concrete channel there is a second, deeper CMP culvert, which is partially blocked by sediment and/or debris and partially filled with water. Upstream of this spot, along BL15, the South Branch of Bull Creek reportedly flows through old railroad tank cars that were installed by a developer to create more developable land.

Reach BL15 is day lit again near Manor and continues through a residential area and a partially collapsed culvert under the McClory Bike Trail. Below Beach Road, the stream flows through a channelized, eroding reach surrounded by turf grass. The Beach Road culvert is experiencing erosion behind and around the headwall and flow is bypassing the culvert altogether and undermining the structure. It appears that at times there is significant flow volume in this reach, presumably runoff from Waukegan Airport, where the stream originates.

Wilson Avenue Tributary (BL14)
The Wilson Avenue Tributary, which according to stream maps joins Bull Creek just downstream of the tank car culvert, was very difficult to locate and track. It apparently originates somewhere east of Lewis Avenue near Edgewood, flows in and out of culverts with a few daylit areas, and shows little or no flow in some locations. There were two large storm vaults along Wilson Avenue, and it was suggested that a number of flow paths converge here.

Unnamed Tributary to Glen Flora Tributary (BL05-BL06)
An unnamed tributary to Glen Flora Tributary flows from near Lyons Woods Forest Preserve into Illinois Beach State Park from the north and joins Bull Creek to create the Dead River. This tributary flows out of Ophir Park where it is small and mildly incised and surrounded by turf grass. Below Sheridan Road the stream exhibits fairly good substrate conditions, though oil slicks were detected, likely from a Sheridan Road discharge.

Glen Flora Tributary (BL01-BL04)
The downstream end of the Glen Flora Tributary (approximately 3 stream miles broken into 4 reaches), before crossing under the rail tracks and into the Johns Manville property lagoons, flows through the steep and deep ravines of Bowen Park. Within this park, a number of interesting things were seen, including a long, mud packed beaver dam that created a large long pool at the bottom of the valley. Incised gullies drain into Glen Flora Tributary from the upland areas, some filled with debris. Moving upstream, the stream flows along and through some residential properties, where armoring and other improvised erosion control projects have been installed. Some yard debris dumping was observed, areas of turf grass to the channel edge, and fences criss-cross the stream channel in a couple of locations. The Sheridan Road outfall is directed at the streambank, which has been attempted to be stabilized with concrete armoring. Good rock and cobble substrates were found in some locations.

Upstream of Sheridan Road, the stream flows for approximately 3000 feet through the Glen Flora Country Club and three ponds, which are created by dams across the stream. The stream and pond edges are armored with rip-rap in some locations and planted to the edge with turf grass in other locations. While the rip rap may help reduce erosion of the stream and pond edges, rip rap and turf grass do little to improve water quality in the stream or improve the stream habitat for aquatic plants and animals. Upstream of the Glen Flora County Club, the Glen Flora Tributary enters a culvert at Poplar and emerges west of the McClory Bike Path where it has been channelized for the rest of its upstream reaches until it disappears into an undefined channel near Lewis Avenue.

3.13.5 CHANNEL CONDITIONS

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Yard waste dumping into ravine (BL02) contributes nutrients to the stream and smothers ground vegetation that helps hold the slope in place. Yard waste should be composted, applied as mulch, or disposed of in yard waste collection facilities.

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Severe streambank erosion causes sedimentation in the stream and loss of property (BL19).

© Lake County Stormwater Management Commission

The turf grass and rock stream edges in Glen Flora Country Club should be converted to native plant edges to help hold the banks in place and filter runoff from the golf course, thereby improving water quality (BL03).

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Streambank erosion and bank slumping (BL16) illustrates the effects of stormwater runoff.

© Lake County Stormwater Management Commission

Stormwater outfall stabilized with rock rip rap (BL04).

© Lake County Stormwater Management Commission

Dense vegetation naturally stabilize the streambanks due to the deep root systems that hold soil in place (BL04).

Urban development in the watershed is reducing the amount of land available for the natural infiltration of precipitation into the ground, where it can be intercepted and absorbed by vegetation or stored in depressional wetlands and floodplains of the watershed. With increasing amounts of impervious surface and an extensive network of stormsewers that convey the increased volume of runoff to the stream channel faster, a stream channel experiences what is called "flashy" hydrology. A "flashy" hydrology means that the water level in the stream rises very quickly during a storm and falls quickly afterward. Since less water is infiltrating into the ground and constantly seeping out and creating a steady baseflow within the stream, low flows are considerably lower. Likewise, because less water is absorbed by the ground and more water is flowing into the streams, high flows are considerably higher. High flows can result in damage to property of watershed residents, erosion, flooding, and pollution. Decreased or low flows degrade aquatic habitat because low flows have low levels of dissolved oxygen necessary for aquatic animals and because, in extreme cases, the stream can dry up completely for periods of time.

A number of factors were inventoried to better describe the condition of the Dead River/Bull Creek Watershed. Channelization, sinuosity, pool/riffle development, bank erosion, sediment accumulation and debris loads (defined at right and explained more fully below) are all measures of the health and condition of a river or stream. (A pool is a location in an active stream channel usually located on the outside bend of a meander, where the water is deepest and has reduced current velocities. A riffle is a shallow rapid, usually located at the crossover in the meander of an active channel. See Figure 3.26.) Physical measurements such as bank height, channel width, bank slope, and water depth reflect the shape of the channel and the amount of water that is or can be conveyed by the stream under both high and low flow conditions. Streambank vegetation and canopy coverage (the amount of tree shading) affect the stability of streambanks and the quality of habitat.

Channelization

Channelization alters the natural flow of streams and rivers that have a tendency to meander. The natural meander geometry of a stream will dissipate the energy of water as it flows through bends in the channel, and creates pool/riffle complexes in the streambed that provide habitat for aquatic plants and animals. Channelization tends to eliminate pools, riffles and meanders. Instead, a large volume of water is directed into a straight, confined channel, which increases the energy of the flow. The increase in energy flow results in the erosion of the streambed and/or streambanks. As the streambed erodes over time, the channel deepens becoming more entrenched. This process is referred to as downcutting. If the streambed is composed of materials that are more resistant to erosion such as gravel or stone, then the flow will tend to widen the channel by eroding the streambanks, rather than deepening it. This process is generally the result of the channel reshaping itself to accommodate new geometry or increased flows until it finds a new equilibrium.

In the Dead River/Bull Creek Watershed, channelization was

Table 3.15 Useful Definitions

Term	Definition
channelization	straightening or ditching of a stream channel
sinuosity	degree of stream channel turns and bends
pool and riffle	alternating series of deep pools and shallow rapids
bank erosion	the loss of streambanks due to scouring by water flow
sediment accumulation	build-up of soil, sand, and gravel in the streambed
debris load	natural and man-made debris including leaves, sticks, logs, lumber, and trash

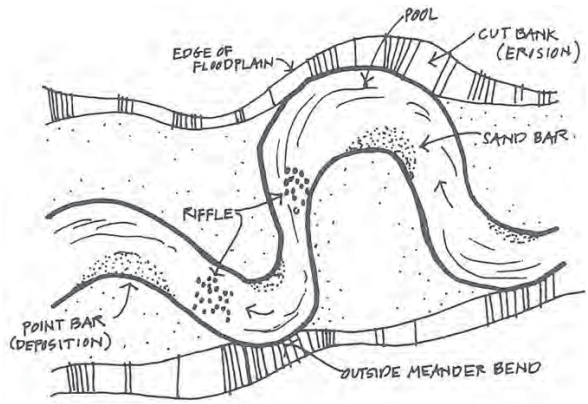

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FIGURE 3.26 PLAN (OVERHEAD) VIEW OF NATURAL STREAM MORPHOLOGY

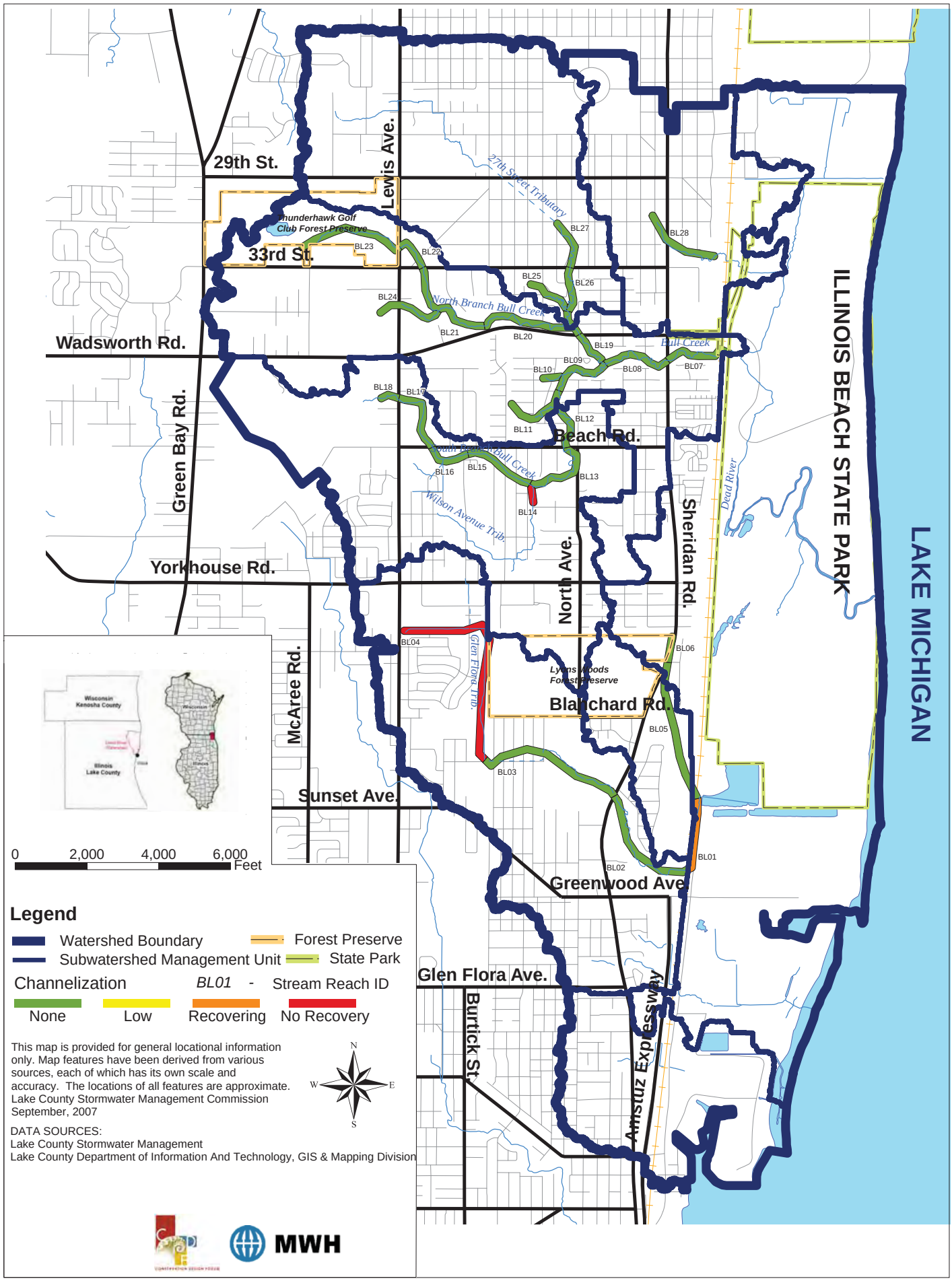

FIGURE 3.27 CHANNELIZATION

found in only 3 of 28 reaches (11%), with BL04 and BL14 exhibiting channelization with no recovery occurring, and BL01 in recovery, as shown in Figure 3.27. "Recovery from channelization" means that a channel is beginning to regain natural characteristics such as pools, riffles and meanders. Channelization is not considered to be a significant problem in this watershed.

Pool/Riffle Development

A pool is a location in an active stream channel usually located on the outside bend of a meander, where the water is deepest and has reduced current velocities. A riffle is a shallow rapid, usually located at the crossover in the meander of an active channel. The development of a pool/riffle complex is associated with the natural meandering of stream channels. The pool/riffle sequences benefit fish and macroinvertebrates by aerating the water during low flow conditions and providing more diverse bottom conditions. Pool/riffle complexes also offer streambank erosion relief by directing stream flow through the center of the channel and away from the banks. The characteristics of pool/riffle development are usually lost when a stream is channelized, though flashy runoff may also destroy natural pools and riffles.

Seventy-one percent of the reaches in the Dead River/Bull Creek Watershed had low or no pools and riffles, as shown in Figure 3.28. The North Branch of Bull Creek had the lowest percentage of reaches with moderate to high pool/riffle development (16%), while 83% of its reaches were characterized by low or no pool/riffle development. Bull Creek had a total of six reaches (27%) having moderate levels of pool/riffle complexes. Pool and riffle installation, as well as other habitat improvements, should be considered for most stream reaches in the Dead River watershed, as reflected in the Action Plan in Chapter 5.

A number of man-made riffles were noted in the inventory. Two were installed by the US Army Corps of Engineers, and 13 others were installed by the Lake County Stormwater Management Commission and its partners. The Corps of Engineers original plan was to install gabions (rocks contained within wire baskets) to protect exposed sanitary lines, but agreed to install riffles based on the work that LCSMC and its partners were doing in this reach.

Streambank Erosion

Erosion of the streambed or streambanks results in heavier loads of sediment being transported and settling out of the water column and into the channel, which reduces the capacity of the channel to convey water and makes the streambed less habitable for aquatic plants and animals.

© Lake County Stormwater Management Commission

Rock riffle installed over exposed sanitary line to protect it.

Streambank erosion in the Dead River/Bull Creek Watershed appears to be limited to specific problem areas, though some degree of erosion was present along most stream reaches and bank height in upper reaches was low. The most significant problem areas are those along the bluffs of the ravine that threatened buildings and infrastructure. Other erosion problems are found around point discharges and hydraulic structures that are either poorly constructed or maintained, and along the meandered reaches within ravines. Erosion problems near point discharges and hydraulic structures are important, but generally not as costly or difficult to remedy as bluff and ravine erosion. In most cases, streambank erosion was not threatening property damage except where the bank was coincident with the ravine wall. Erosion can also be caused by bank slumping in areas where water seeps laterally out of the sides of the slope. Some of the channel banks have a severe slope ranging from .25/1 to 1/1, which does not allow vegetation to root close to the channel, which would provide a more stable streambank. In reaches where the channels flow through developed areas, the streambank was sometimes armored with rock, concrete, or wood, and in other locations the bank was stabilized by installing a vegetated buffer strip, with deep plant roots to help hold the soil in place.

The streambank erosion map shown in Figure 3.30 reflects

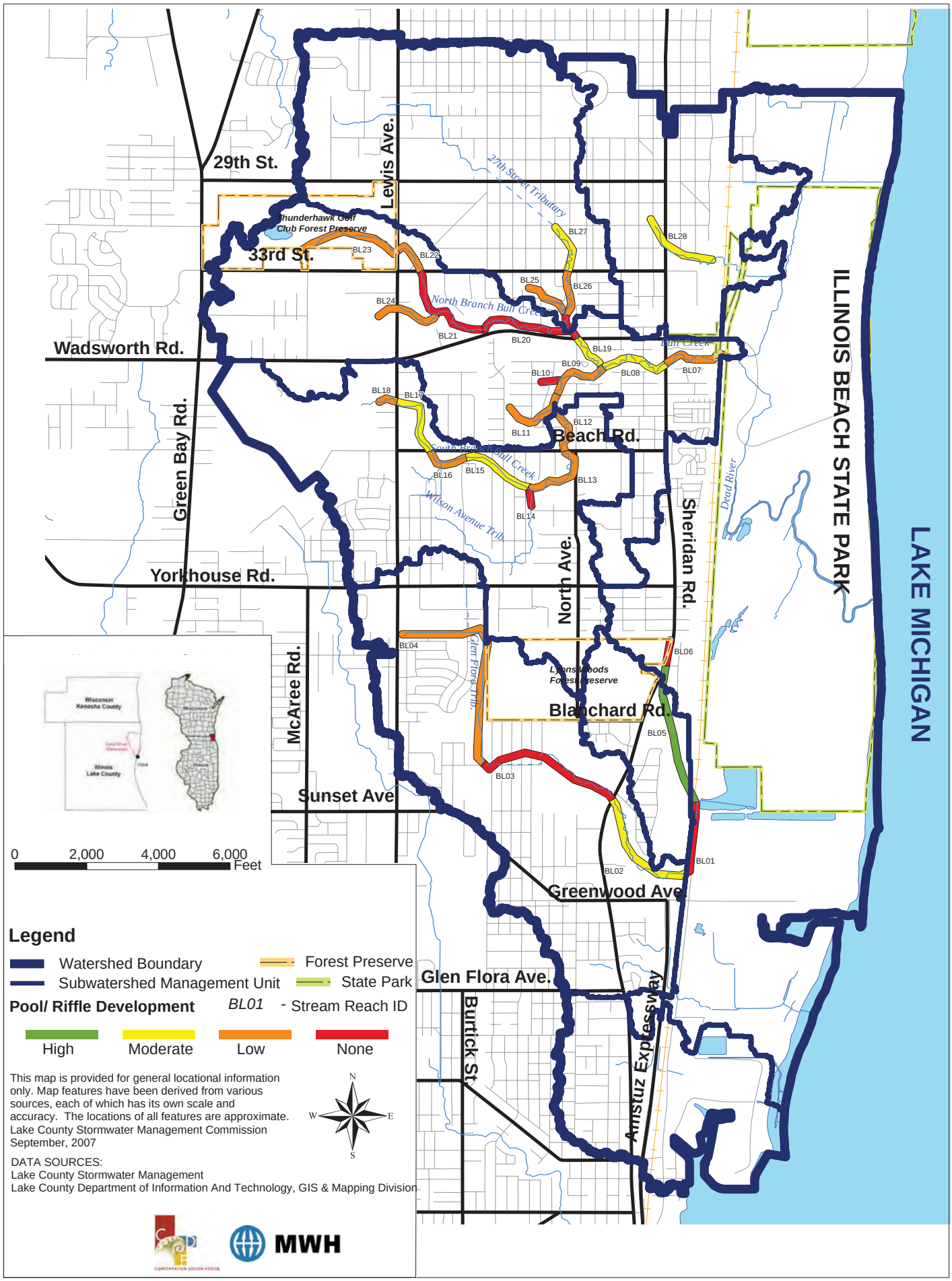

FIGURE 3.28 POOL AND RIFFLE DEVELOPMENT

the prevalence of erosion – the proportion of the reach length exhibiting significant streambank erosion. Erosion is characterized as follows:

None: Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems; less than 5% of bank affected.

Low: Moderately stable; infrequent, small areas of erosion mostly healed over; 5-33% bank has areas of erosion.

Moderate: Moderately unstable; 33-66% of bank has areas of erosion; high erosion potential during high runoff events.

Severe: Unstable; many eroded areas; “raw” areas frequent along straight sections and bends; obvious bank sloughing; 66-100% of bank with erosional scars.

In the Dead River/Bull Creek Watershed, 9 of the 28 reaches (32% or 25,300 feet) were characterized as having low or no streambank erosion problems. However, 10 of the 28 reaches (36% or 25,300 feet) fall into the moderate range. Nine (32% or 19,300 feet) of the Bull Creek stream reaches exhibited high streambank erosion. The most severe cases of erosion occurred in Bull Creek along the main stem and the South Branch. This is likely due to the presence of ravine-like banks that are not stabilized by ground level vegetation and the high incidence of stormwater discharge points along these reaches. More stormwater discharge points mean greater discharge of stormwater runoff and more frequency and severity of erosion. In some cases, sediment had accumulated at the bottom of the ravine, creating a lower bank near the stream. But the ravine walls showed high levels of erosion that could be problematic. Other severe cases of erosion were noted on the 27th Street Tributary and North Branch. These areas also had ravine-like banks and high numbers of discharge points and/or debris that indicate a "flashy" hydrology, which would cause erosion. Figure 3.29 is provided to illustrate the correspondence between the location of ravines and the location of erosion.

Streambank armoring was present in a few areas, some protecting sanitary manholes and other significant infrastructure, and others appear to be do-it-yourself approaches to slow or stop erosion of the channel or stream

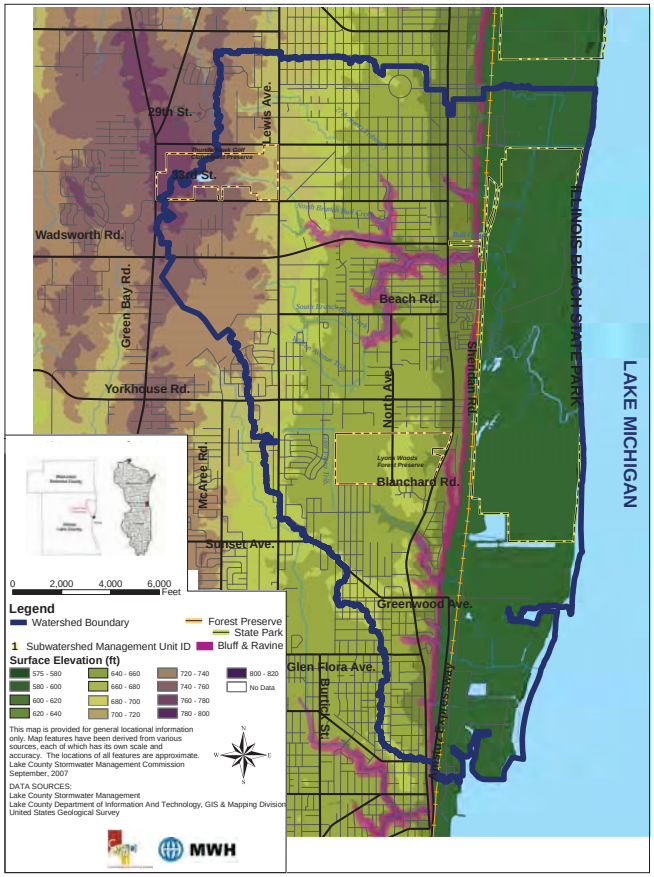

FIGURE 3.29 TOPOGRAPHY

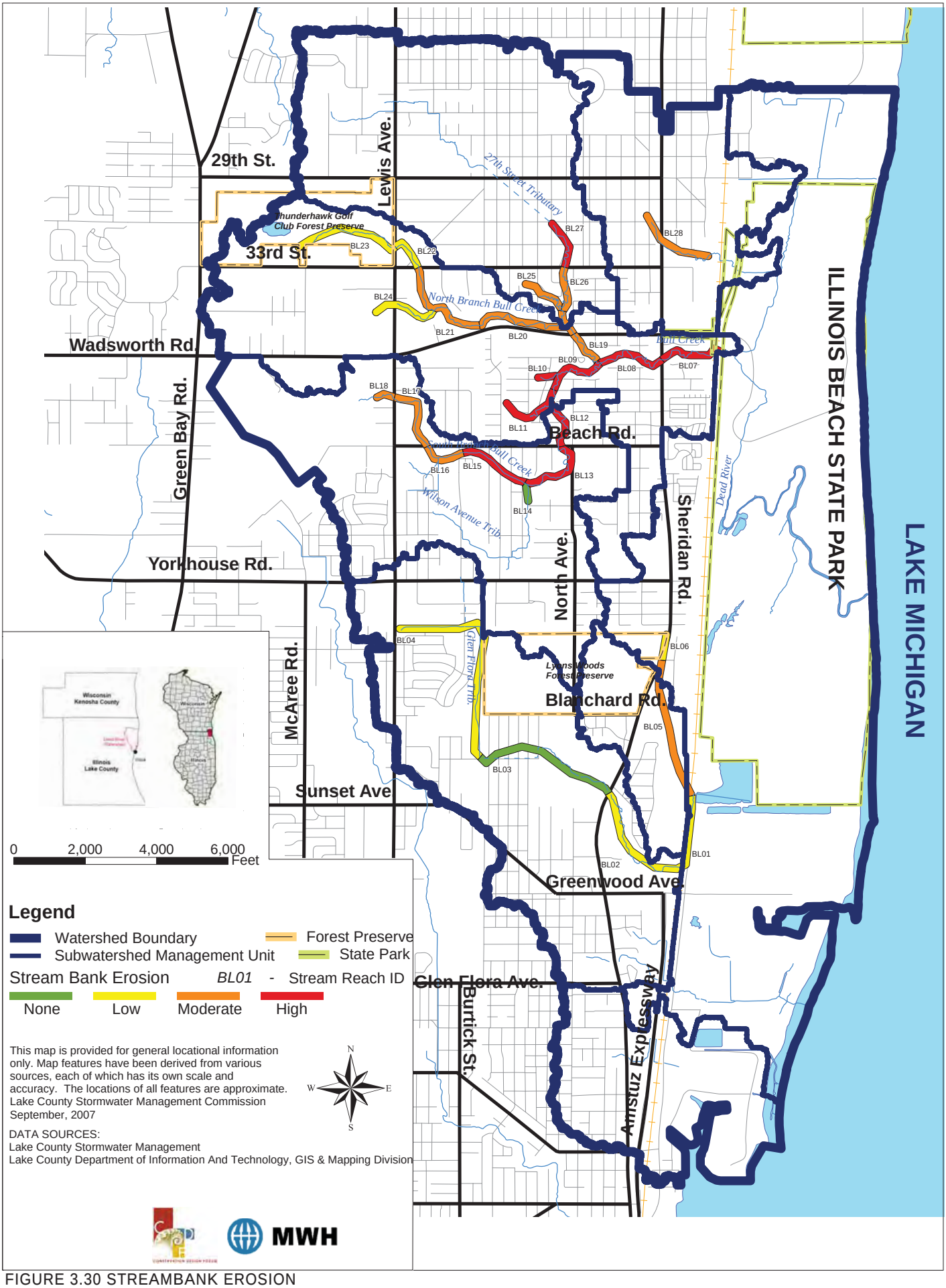

FIGURE 3.30 STREAMBANK EROSION

banks. Armoring included poured concrete, broken concrete slab, rock and brick walls, rip rap, gabion baskets filled with rock, cinder blocks strung over rebar, railroad ties, and wood retaining walls. It is unclear what proportion of the armoring projects are stable and how many are failing. However, it is important to recognize that armoring, when improperly designed and installed, can fail and cause problems to worsen.

As indicated, streambank erosion is a significant problem on a number of stream reaches, causing loss of property, water quality problems, and sedimentation downstream. Erosion deserves prioritized attention by watershed stakeholders.

Stream Bed Erosion

As a complicating factor that can hasten stream bank erosion, stream beds also are being eroded by high stormwater runoff flows, a process called downcutting. Heavy volumes of water moving quickly through a stream channel can scour the bottom of the channel and transport the substrate materials downstream, which also leads to sedimentation of downstream reaches (see below). This process deepens the stream channel and thereby exposes more of the stream bank to the erosive forces of water flow. Until a very stable rock or clay substrate is exposed, this process deepens and widens stream channels, erodes away natural pools and riffles, and transports many tons of sediment downstream. As documented in Bull Creek, sanitary sewer lines that were installed 2.5 feet underground were exposed by 12-18 inches above ground before the stabilization work done by the North Shore Sanitary District and US Army Corps of Engineers in 2003 and 2004. Stream bed erosion is an ongoing problem needing attention in the Dead River watershed.

Sediment Accumulation

The accumulation of sediment in a streambed is directly related to the degree of streambank and stream bed erosion that occurs within a channel and to the stream gradient. Ordinarily, sediments that are generated in the channel are conveyed through the steeper gradient reaches and deposited in areas where the stream velocity is decreased due to shallower stream gradient or by debris blockages or impoundments. Bull Creek has a low to moderate accumulation of sediment in spite of its moderate to high erosion problems in the watershed because of the ravine stream banks and steeper gradient. It is likely that sediment is being deposited in the low-gradient reaches of Illinois Beach State Park. The wide streambed area in these ravines is typically large enough where the sediment settles at the bottom of the ravine, leaving enough room for the stream to meander around it. Sediment tends to accumulate on the inside of a bend in the stream, where water is flowing slower, and pools tend to develop on the outside of a bend, where water is flowing faster. Sediment can also become lodged or trapped around and inside of culverts and other hydraulic structures, resulting in obstruction of water flow where sediment accumulation is very high or takes place over a long period of time.

As reported following the 2001 SMC Stream Inventory, the Dead River/Bull Creek Watershed had a total of 13 out of 28 reaches (46%) with low sediment accumulation. Moderate or high sediment accumulation was found in eleven reaches (39%), with nine of these reaches falling into the moderate range and two reaches in the high range. Bull Creek had only one reach (4%) with high accumulation and six reaches (27%) with moderate accumulations of sediment, as opposed to the Glen Flora and the unnamed tributary to the north, in which the reaches with moderate accumulations of sediment made up 50% of the streams. Sedimentation is a moderate problem within upper and middle stream reaches, but is likely a more significant problem in lower reaches where the gradient is shallow and sediment settles out. Figure 3.31 illustrates the location of areas with sedimentation.

The Lake County Health Department monitoring of Bull Creek, however, indicates that sedimentation, at least at

© Lake County Stormwater Management Commission

Relatively stable reach of Bull Creek (BL07) channel shows gravel and sediment that have been transported from upstream by water flow and deposited here where the stream gradient is fairly flat.

© Lake County Stormwater Management Commission

This severe streambank erosion (BL07) was remodeled and stabilized in the bioengineering stabilization project done by SMC and its partners (see photo below).

© Conservation Design Forum

Low to Moderate streambank erosion (BL08) has destabilized the bank and exposed these tree roots, which hold the tree in place.

© Conservation Design Forum

Failed stormwater outfall pipe and erosion (BL08)

© Lake County Stormwater Management Commission

Streambank armoring (BL15) creates unsupportive aquatic habitat conditions.

© Lake County Stormwater Management Commission

Severely impacted stream channel

© Lake County Stormwater Management Commission

Sediment-filled culvert, Illinois Beach State Park

the sampling points on this stream, is a problem and caused the in-stream sampling equipment to be buried by sediment, which prevented the collection of data during a few time periods. Turbidity data is reported in the water quality section below.

Debris Loads

Debris load refers to the instream and overbank accumulation of debris, both natural and human-made. An assessment was made of the extent to which instream and overbank debris was causing problems in the channel or on the streambanks. Although the naturally occurring debris can provide good habitat for a variety of wildlife, problems such as streamflow obstruction can cause backwater flooding upstream and flow deflection into banks causing erosion. Reaches that failed the instream or overbank test were characterized by large accumulations of lodged and partially compacted debris across the stream channel or on the banks. High debris loads may be the result of high stormwater discharges to the stream, which causes erosion of the streambanks and undercutting of tree roots, causing trees to fall into the stream and create log jams. Removing large debris jams without stabilizing the channel and grade, however, can lead to greater erosion, especially downcutting, and removal should be done with caution.

Debris load was high along most of the ravine reaches. In the entire Dead River/Bull Creek Watershed, 9 reaches (32%) failed the test for instream debris load; zero reaches failed the test for overbank debris load, though inventory photos show lodged debris 4-5 feet above the water level. Alone, Bull Creek had eight reaches (36%) that failed the instream debris load test. For the Glen Flora and Unnamed Tributaries combined, only one reach failed the instream debris load test.

© Lake County Stormwater Management Commission

Debris jam

© Lake County Stormwater Management Commission

Too much sediment can cause culverts to clog, which impedes the flow of water.

3.13.6 HYDRAULIC STRUCTURES

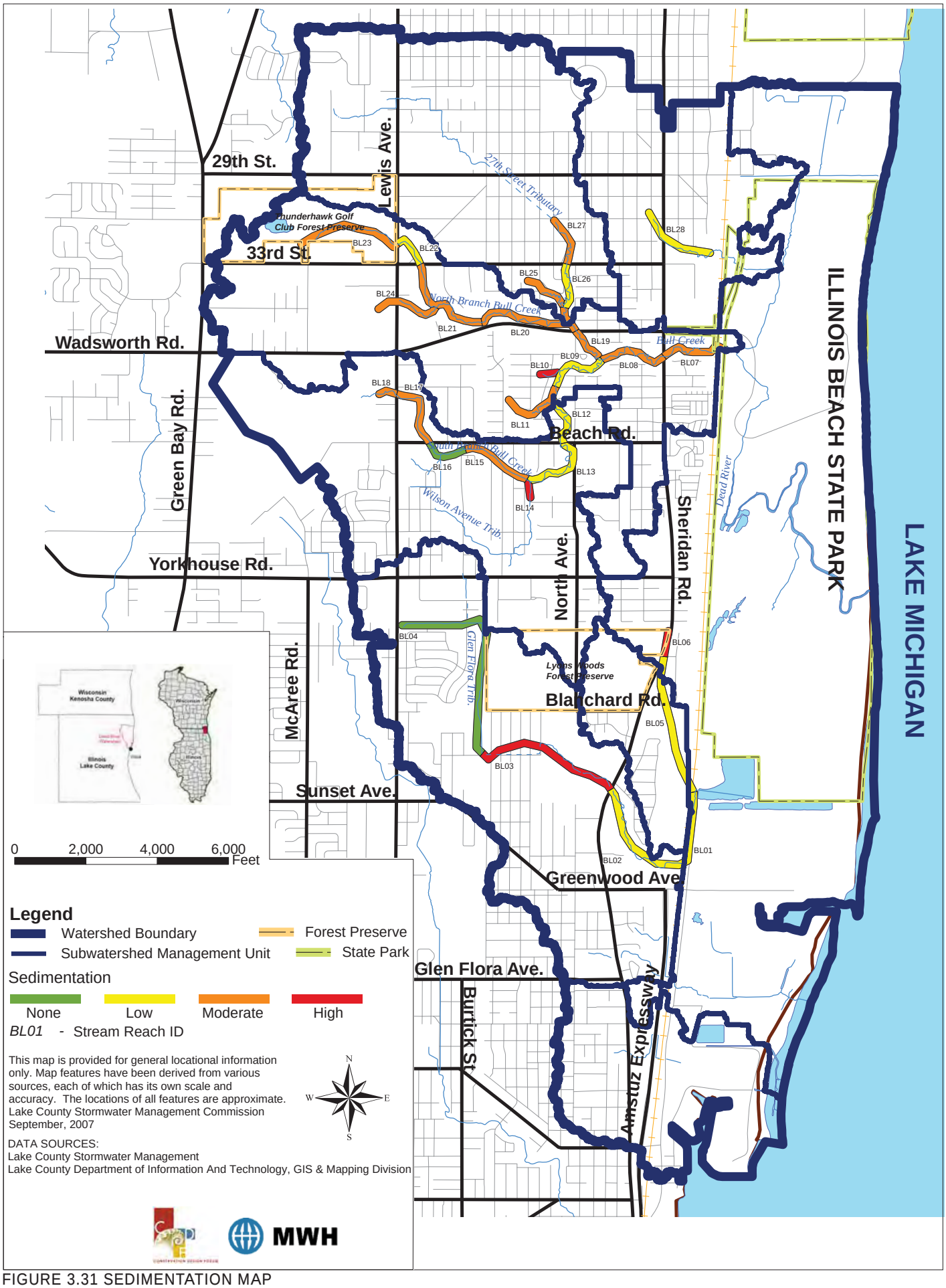

FIGURE 3.31 SEDIMENTATION MAP

Hydraulic structures are categorized as bridges, culverts, levees, weirs, dams, fencing and any other human made structures located in or over the channel along the course of the river. The stream inventory includes hydraulic structures in the assessment of a stream reach because of the possible constrictions in conveying river flow, the potential for backwater flooding problems, and the potential to impede the movement of fish and other aquatic species up and down the stream.

Foot bridges were fairly commonly found along the stream corridor (46 were identified during the 2001 stream inventory), some of them having been dislodged by heavy water flow and others rest on stable concrete and rock wall footings. Bridges can inhibit stream flow if not adequately sized to pass stream flow and where debris may become lodged beneath the platform or against the footing in the channel.

Dams can serve as potential barriers to the movement and dispersal of aquatic organisms and may limit available habitat for breeding, feeding, and instream cover. Five dams are present in the Glen Flora Country Club golf course (and 12 bridges). A couple of instances of small rock dams (or possibly artificial riffles) placed across the stream channel were noted from the inventory photographs, though their purpose was unknown. The status of dams along the stream was not investigated, nor the impact of dams on sedimentation buildup behind them.

Culverts are metal, plastic, or concrete pipes that transport water, most commonly used under roadways or driveways. Culverts may be round, oval, rectangular, or other shapes, and they can be open or closed on the bottom. A number of these within the watershed are exhibiting clogging, wear and tear, erosion, and near failure in some locations.

Figure 3.32 shows the location of all hydraulic structures and identification numbers and colored dots for those found to have problems that need attention. The tables supporting this map are found in Appendix D. Associated with some of these problem culverts, erosion and failure of the edges of some roadways along stream crossings has been noted and are included in the action plan. According to one stakeholder, there is a transite culvert that conveys water through the underground portion of BL15. Transite produced prior to the 1980s contained asbestos, and it is possible that this material is being broken apart and suspended in the water column due to the erosive action of the water flow.

© Lake County Stormwater Management Commission

Low head dam, Glen Flora Country Club

This supposition, however, has not been substantiated by research or investigation.

Bull Creek contains the greatest number of hydraulic structures (116) in the Dead River/Bull Creek Watershed. It also has a very high density of hydraulic structures per stream mile, though the Glen Flora Tributary within the Glen Flora County Club also has a very high density of hydraulic structures. There are two problem structures on the North Branch, two on the 27th Street Tributary, 11 on the South Branch, five on the unnamed tributary to the north, and four on the Glen Flora Tributary system. Five of the hydraulic structures on the Glen Flora Tributary are concrete dams and weirs, which impound the many water features throughout the golf course, though these were not identified as problems.

3.13.7 POINT DISCHARGES

Inventoried discharge points include open channels and pipe outfalls, which ranged in size from four-inch diameter pipes to 9-foot open channels. The Dead River/Bull Creek watershed contained 193 total discharge points, 52 of which were open channel / swale discharges. Sixty-five (34%) were categorized as open channels/tributaries and 128 (66%) were pipes. Bull Creek contained considerably more point discharges with a total of 151, and an average of 17.5 discharges per stream mile. The South Branch of Bull Creek has significantly more point discharges (and consequently, more observed problem areas) than either the 27th Street

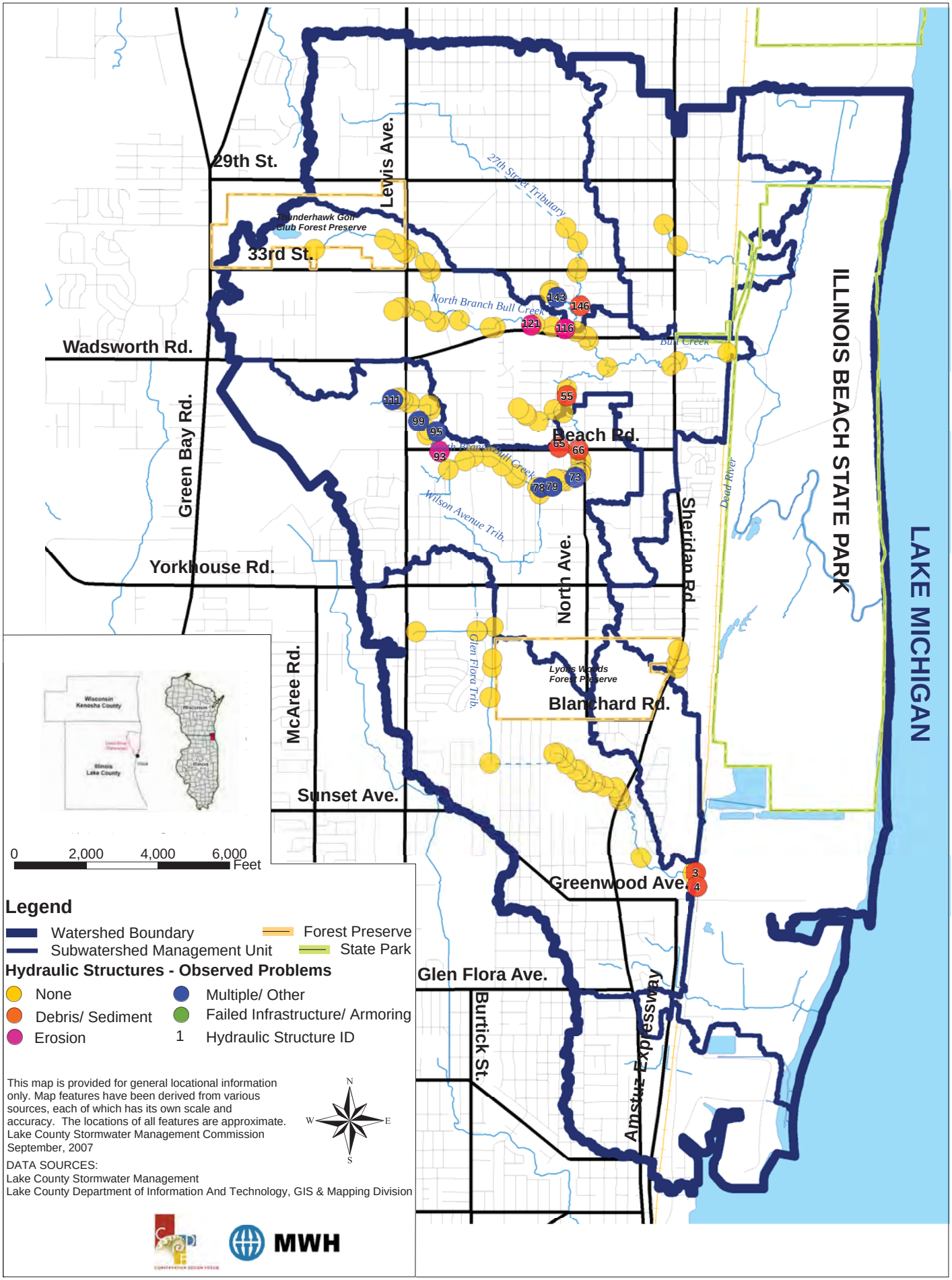

FIGURE 3.32 HYDRAULIC STRUCTURES

Tributary or the North Branch of Bull Creek. In comparison, the smaller Glen Flora and Unnamed Tributaries had 42 point discharges with a density of 10.5 per stream mile. See Figure 3.33 and Appendix D, which show the location and details of the problem discharge points, respectively.

Concentrated stormwater discharges greatly contribute to the degradation of water quality in a stream. During a rain event, pollutants that collect on parking lots, roadways, lawns and driveways are transported via roadside ditches and stormsewers through outfalls into the stream, diminishing the quality of the water. A number of headwalls and pipes are dislodged, blown out, or otherwise failing. In addition to transporting pollutants from urban runoff, the concentrated discharge of runoff from these points causes erosion around them, thereby causing further sedimentation of the channel.

Flexible corrugated plastic pipe was seen in a number of locations, some running over ground and snaking down ravine slopes or stream banks, and others discharging far from the stream channel. These plastic pipes are typically installed by a landowner as a means of disposing of unwanted excess water from rooftops, sump pumps, or other areas. These pipes discharge concentrated stormwater runoff into the stream, causing erosion and 'flashy', destructive flows in the stream channel. Rain gardens and other infiltration measures (discussed later in this plan) are better controlled by directing flow into rain gardens or other infiltration practices that help reduce the runoff volume and improve water quality. Where these infiltration is not feasible, these pipes should extend all the way to the stream channel rather than discharging flow to the steep side slopes of the ravine, causing erosion.

Erosion is common around many discharge pipes and channels, due to the concentrated stormwater discharge that flows from them. The responsibility for these issues and for maintaining and repairing these discharges fall to the owner of the pipe: metal and clay pipes are typically owned by a municipality, which is responsible for maintaining them. Flexible plastic pipes are the responsibility of the landowner from which they drain water. Open channel / swale discharges are the responsibility of the party that owns the land through which the swale passes.

In Bull Creek, thirty outfalls, or 20% of all discharge points, were noted as problematic, eleven of these were outfall

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Residential roof and sump pump runoff is better handled by rain gardens or other infiltration measures installed on the property than by these plastic pipes, which can cause erosion and contribute to stream degradation.

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The lower end of this ravine is an open channel stormwater discharge point, and increasing stormwater runoff can deepen and widen this channel and threaten the homes on its edges (BL08).

© Lake County Stormwater Management Commission

Erosion around this stormwater discharge point removed the soil that once held this pipe in place, causing it to fail.

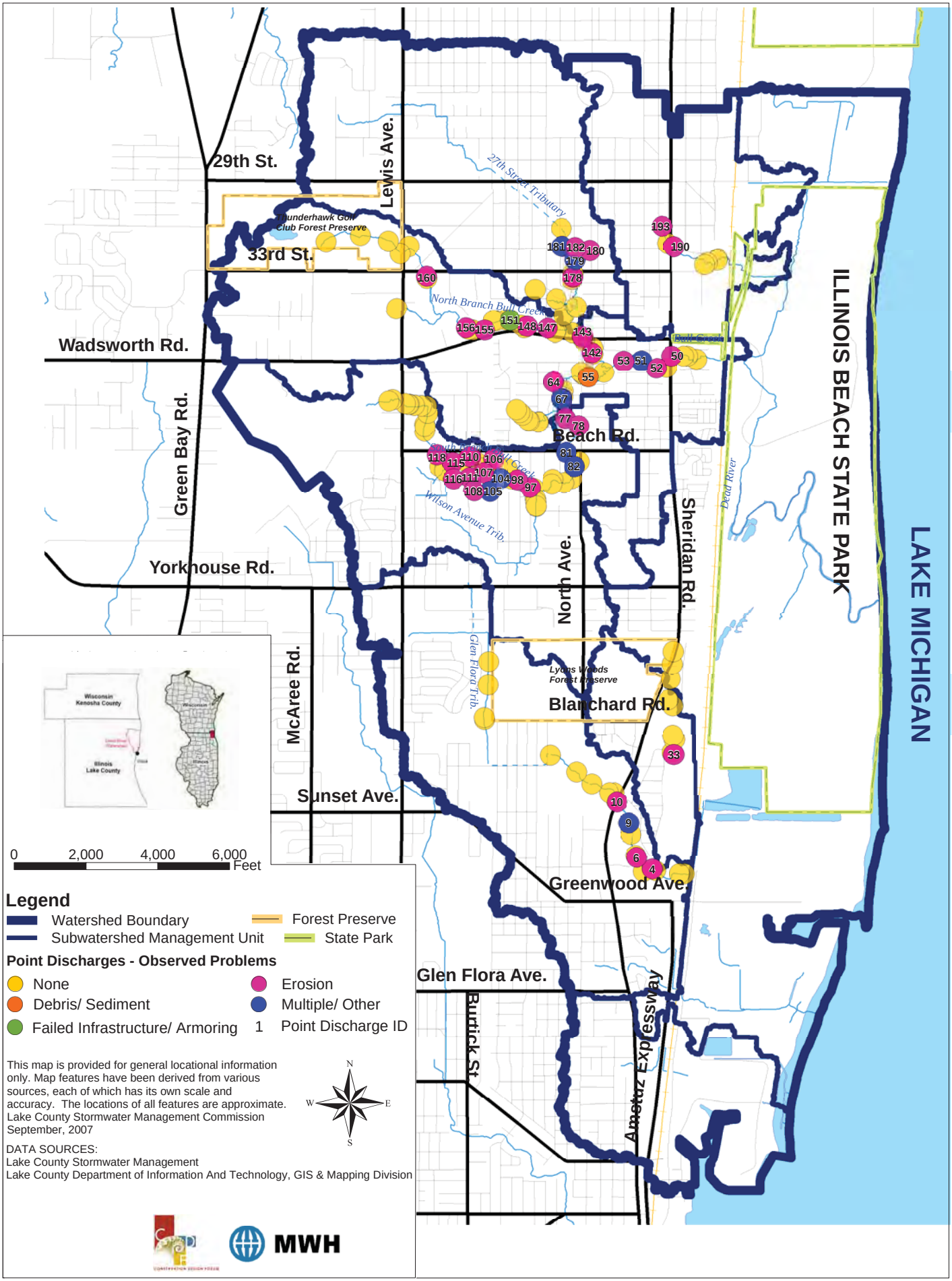

FIGURE 3.33 POINT DISCHARGES

erosion problems. The South Branch of Bull Creek had the largest concentration of discharge problems. Twelve discharge points (28%) of Glen Flora and the unnamed tributary were noted as problematic, two were due to erosion problems. The outfall pipes in the Bull Creek Watershed ranged in size from 4 to 48 inches, with 56% of them less than 12 inches in diameter. The swales and gullies flowing into the channel range in size from 4 inches to 9 feet across the top of the channel, many exhibiting erosion and some exhibiting headcutting. Recommendations for addressing the 30 problem outfalls are included in the Action Plan in Chapter 5.

3.13.8 OTHER INSTREAM PROBLEM AREAS

Instream problem areas include those identified during an examination of the 2001 stream inventory photos, the 2006 planning team site visit, and from anecdotal information provided by watershed stakeholders. Instream problem areas are defined in this plan as specific points within the stream corridor where the following 'problems' were identified: failed infrastructure and problems with stream channel armoring; debris and sediment buildup; streambank erosion; and multiple problems (a combination of the above) / other. These 62 points are shown on Figure 3.34 and supported by the data in Appendix D. Recommendations for addressing these areas are included in the Action Plan in Chapter 5.

3.13.9 RIPARIAN CORRIDOR / FLOODPLAIN

Included in the stream inventory was an assessment of land use within 100 ft. on either side of the stream channel, which can significantly impact the condition of the stream itself, perhaps more than land use and cover further away. Land use within the 200 foot riparian corridor was categorized in the stream inventory into six classifications: agricultural, recreational, residential, vacant/open space (includes forest, grassland, and wetland), commercial/industrial, and other. The percent of land in each land use classification was estimated through visual observation while assessing the characteristics of the channel during the stream inventory. Vacant/ open space and residential areas make up 83% of the total riparian corridor land use, indicating a need to educate these landowners about riparian area management.

The predominant vegetation types within ten feet of either side of the streambanks (bank vegetation) were also noted in the stream inventory. The dominant vegetation type along the streambanks was divided into six classifications. Trees and shrubs dominated the streambank vegetation for almost all tributaries in the watershed. However, the Glen Flora Tributary was dominated by wetland plants in its vegetated ditches and mowed lawn in the golf course. While trees and shrubs are more desirable than turf grass as a vegetative cover, a mix of trees and deep rooted vegetation, such as grasses and sedges, are better for stabilizing the streambanks and reducing streambank erosion.

3.13.10 INSTREAM AND RIPARIAN HABITAT ASSESSMENT

Information collected during the Lake County Stormwater Management Commission 2001 stream inventory was used to develop ranking of instream and riparian habitat for those reaches surveyed. Assessed instream habitat criteria include: channelization, pool & riffle development, armoring, sediment accumulation, substrate, instream cover, and bank erosion. According to this assessment, 14% of stream reaches have excellent instream habitat, 46% have good habitat, 14% have fair habitat, and 25% have poor habitat. Assessed riparian habitat criteria include: bank vegetation, land use, and buffer width (described above). According to this assessment, 29% of stream reaches have excellent riparian habitat, 29% have good riparian habitat, 39% have fair riparian habitat, and 4% have poor riparian habitat. The results of the assessment are presented in Figures 3.35 and 3.36. Instream habitat rankings were then used as part of the Vulnerability Analysis described in Section 3.16.

It is clear from the habitat maps that instream and riparian habitat conditions in the Dead River watershed are in need of improvement. A restored hydrologic regime that resembles pre-settlement conditions would have a very positive impact on habitat conditions. However, understanding that restoring hydrologic conditions is a long term goal that is difficult to achieve, a number of actions can help restore habitat conditions. Generally, recommendations include restoring stream channel habitat (channelization, pool & riffle development, stream bank armoring, sediment accumulation, substrate composition, instream cover, and bank erosion) and stream riparian conditions (bank vegetation, land use, and buffer width). The American Fisheries Society has published a number of books and other resources to help

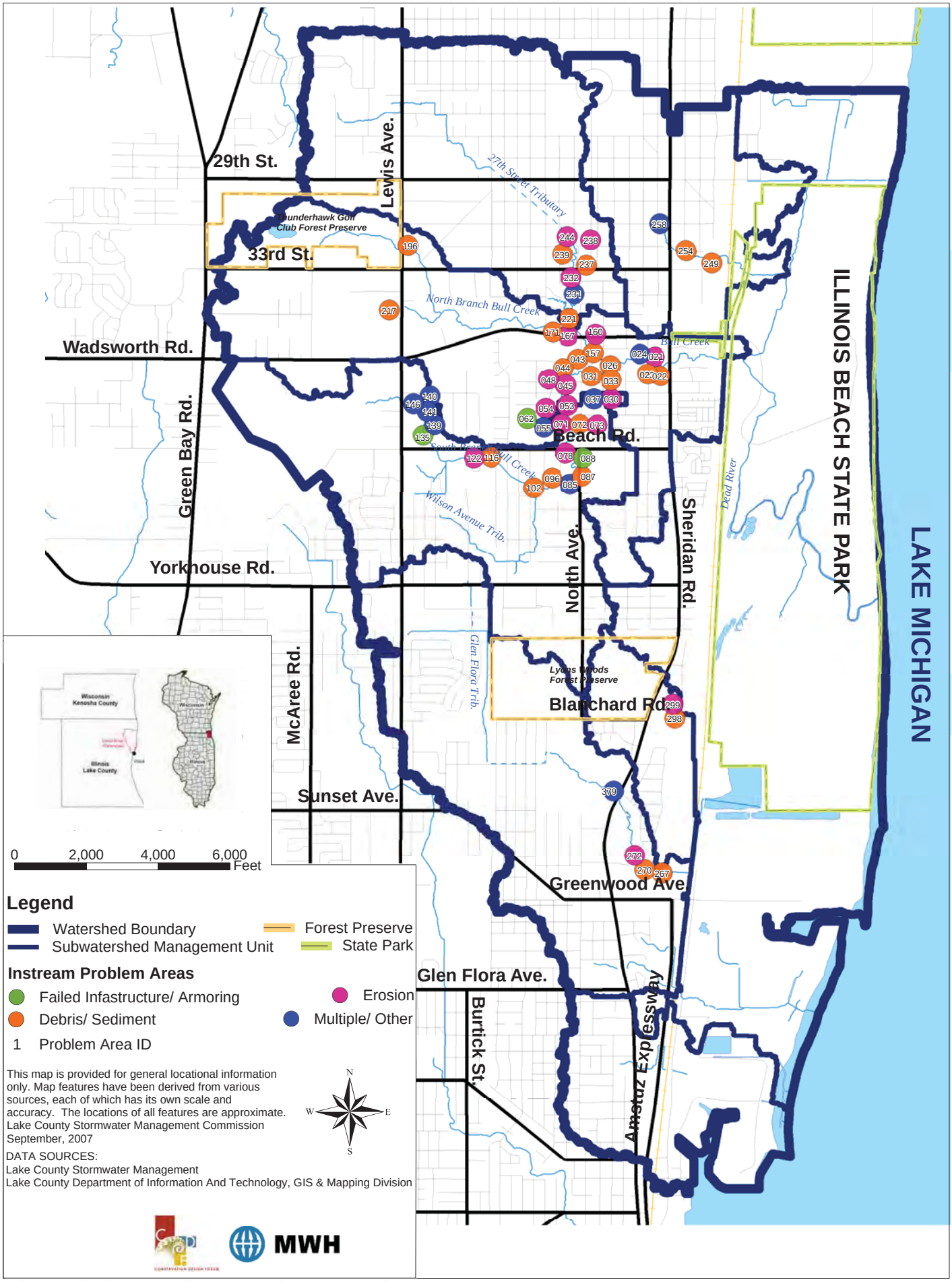

FIGURE 3.34 OTHER INSTREAM PROBLEM AREAS

guide stream and riparian habitat restoration projects.

In May 2007 the Illinois Environmental Protection Agency collected habitat data on Bull Creek at Sheridan Road in Zion. Data collected on substrate, instream cover, channel morphology, riparian zone, streambank erosion, pools and riffles, and stream gradient are translated into an overall Qualitative Habitat Evaluation Index (QHEI), which is an indicator of habitat quality at the sampling point. QHEI scores rank habitat quality as follows: Excellent (75 or greater), Good (60-74), Fair (45-59), Poor (30-44), and Very Poor (less than 30). In Bull Creek, the QHEI of 70 indicates Good habitat quality, but only for this single location. The IEPA reports that these figures are consistent with expectations for these streams, that stream quality is limited by low habitat and substrate diversity, and that they do not indicate an impaired condition that would trigger a detailed investigation into water quality impairment. However, the planning team assessment concludes that habitat is indeed in need of improvement, and the action recommendations in Chapter 5 reflect this conclusion.

Most of the categories of data mentioned above are described elsewhere in this chapter. Stream substrate composition (cobble, gravel, sand, or silt), instream fish cover, and aquatic and terrestrial organisms are described below.

Substrate Composition
The composition of the stream substrate was recorded as an estimate of the percent of the stream bottom that was made up of gravel, sand, cobble, silt, organic matter, boulder, claypan or concrete. The substrate of the streambed is a significant determinant in the number and species richness of the aquatic invertebrates in the stream. Since macroinvertebrates are the main food source for a variety of other animals (fish, amphibians, birds and small mammals), a healthy stream ecosystem is heavily dependent on the stream substrate.

Stream substrate composition was divided into two main categories: sand and silt; cobble and gravel. As shown in Table 3.16, one quarter of the total reaches in the Dead River watershed have a substrate composition of over 50% sand and silt. A total of 89% of the total reaches has 25% or more sand and silt substrate composition. Another quarter of the total reaches had a substrate composition of over 50% cobble and gravel. A total of 71% of the total reaches has 25% or more cobble and gravel substrate composition.

© Conservation Design Forum

Gravel and cobble substrates provide good stream habitat.

Table 3.16 Substrate Composition

% of Reaches	Substrate Composition
25%	50% or more sand and silt
89%	25% or more sand and silt
25%	50% or more cobble and gravel
71%	25% or more cobble and gravel

Mucky sediments were also found in a few locations.

When compared to silt, gravel, sand and cobble provide better habitat variety for benthic macroinvertebrates (bottom dwelling insects). In addition to differences in habitat, a sand and gravel substrate is more resistant to downcutting and the channel is more prone to widen in response to increases in runoff volume to the stream.

Instream Fish Cover
Instream fish cover was classified into eight categories based on the presence of the following features in each stream reach: undercut banks; pools; macrophytes; logs; overhanging vegetation; rootwads; boulders; and backwaters. These features contribute to the habitat available for the survival of aquatic organisms by providing a food source and secure living places. For this reason, it is important to maintain some of this material in the stream when doing stream cleanup and debris removal projects.

In the Dead River/Bull Creek Watershed, almost all cover types were common. Undercut banks, logs, overhanging vegetation, and rootwads were found in nearly all of the reaches sampled. The least common type of cover found

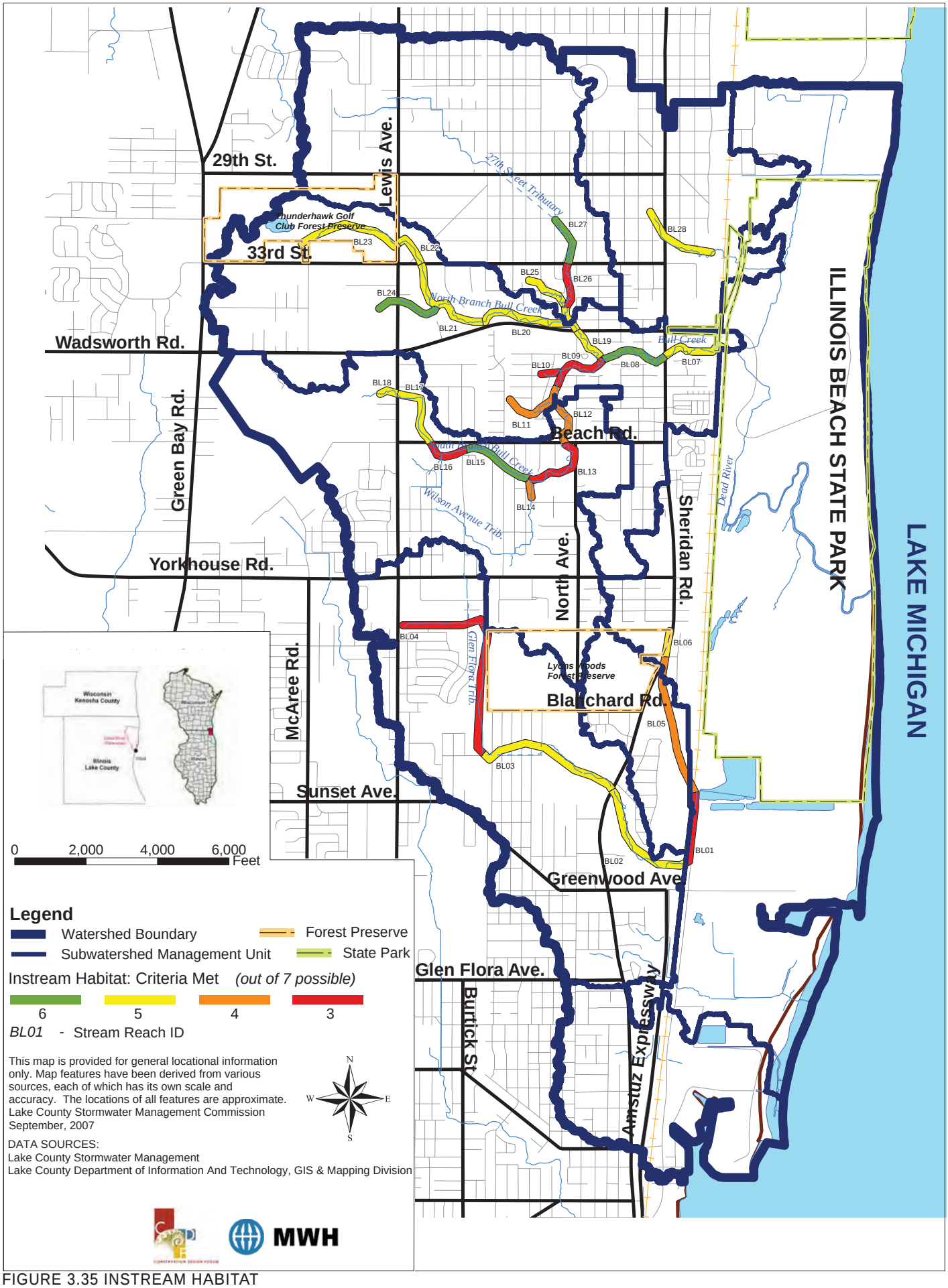

FIGURE 3.35 INSTREAM HABITAT

in the watershed was pools, macrophytes, boulders, and backwaters. Overall, instream fish cover types in the Dead River/Bull Creek Watershed had an average of 5.14 cover types per stream reach. In comparison, Bull Creek had 5.05 cover types per stream reach, while Glen Flora and its tributary had a higher average of 5.88 cover types/ stream reach. The differences in these figures are not sufficient to conclude that one or another of these streams demonstrated better habitat quality.

Aquatic and Terrestrial Organisms
Although organisms such as invertebrates (insects) and fish were not specifically sampled during the stream inventory, the following animals were observed in the stream or riparian corridor: mosquitoes, dragonflies, snails, green sunfish, largemouth bass, flathead minnows, frogs, turtles, ducks, geese and other unidentified fish.

In cooperation with the Lake County Stormwater Management Commission, Lake County Health Department, and Bull Creek Stakeholders Association, the Illinois Department of Natural Resources performed a fish community survey in 2005 on Bull Creek (BL07) at Paxton Drive near Wadsworth in Zion. The Bull Creek survey resulted in 107 fish from five species. This fish survey was translated into an Index of Biotic Integrity (IBI), a measure of the quality of a stream based on the living things present. The IBI ranges from 0–60, with 60 representing the "best" conditions. Bull Creek had an IBI of 8.0, a very low value, which may be explained by the fact that it was sampled soon after a major streambank restoration project and the fish community may not have recovered by the time of the sampling. There also was a sanitary sewer overflow discharge to the creek that resulted in a fish kill in July of 2005, and the fish population may not have recovered yet. It is also possible that low water or drought conditions affected the local fish community. The Illinois Department of Natural Resources will conduct a follow-up survey in 2008 to re-evaluate the fishery.

The Illinois EPA collected macroinveertebrate (insect) data on Bull Creek at Sheridan Road in Zion in May 2007. The collection quantity, species, and diversity of aquatic insects can be translated into a Macroinvertebrate Index of Biotic Integrity (mIBI), an indicator of the quality of habitat based on the aquatic insects found there. The MIBI scores and rank is as follows: Good (41.8 or greater), Fair (20.9-41.8), and Poor (20.9 or less). This survey resulted in an mIBI score of 29.7 for Bull Creek indicating Fair habitat quality.

Wildlife such as this kingfisher depend on healthy aquatic resources

A summary of habitat quality and impairment is included at the end of this chapter.

Sources: Lake County Stream Inventory (2001).
Conservation Design Forum Stream Inventory (2006).

3.14 WATER QUALITY (LAKES AND STREAMS)

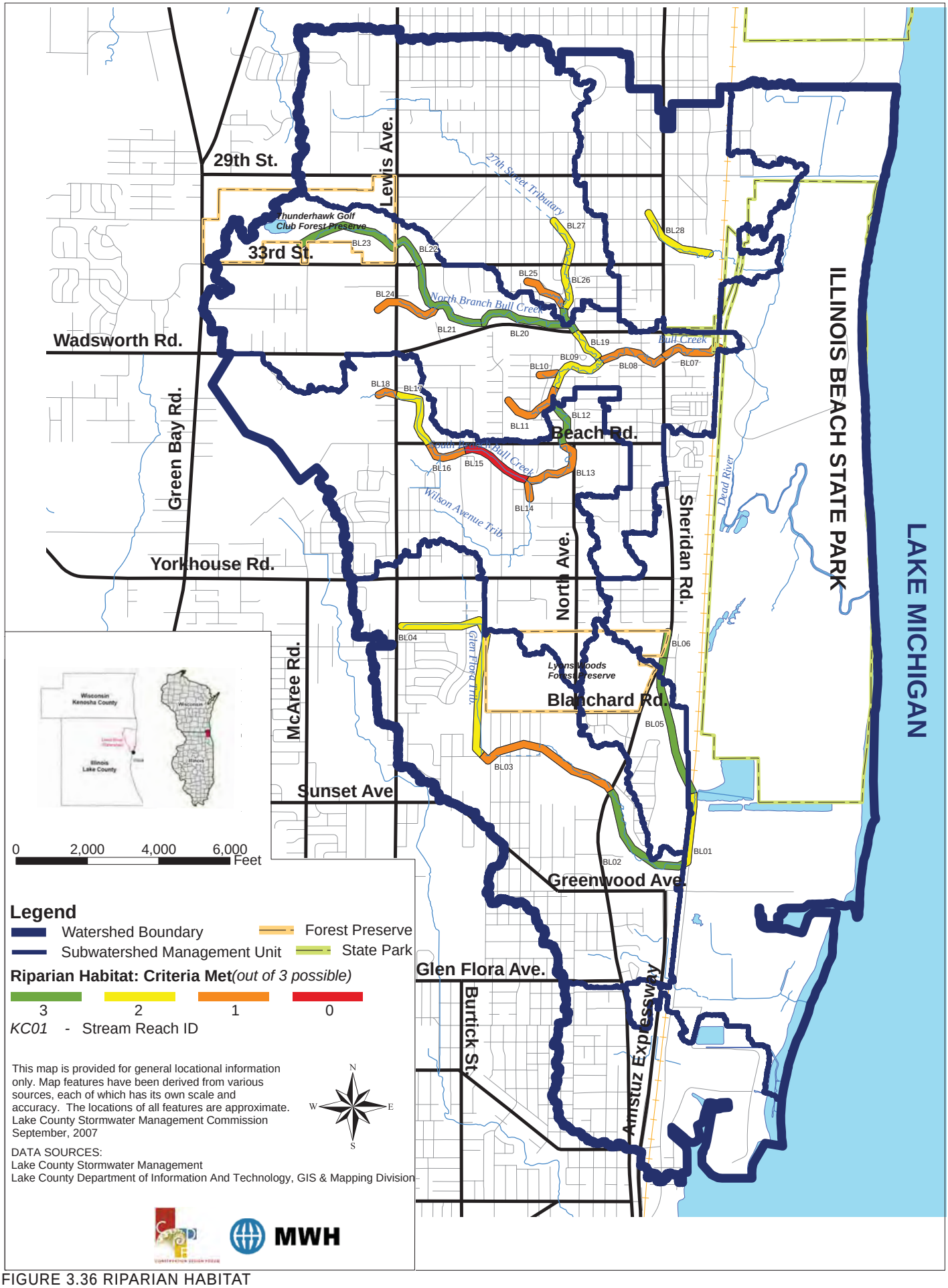

FIGURE 3.36 RIPARIAN HABITAT

Water pollution reduces the health of aquatic ecosystems, including Lake Michigan, and may be harmful to human health. Water quality is impacted by pollutants from a number of point and non-point sources. Point sources are discharges from a single source such as a pipe conveying wastewater from a wastewater treatment facility into the stream. Nonpoint sources contribute pollutants to the water system from across the landscape including runoff from yards, rooftops, roads, parking lots, and other urban and non-urban surfaces. During storms, pollutants on the landscape are washed from the ground and impervious surfaces into stormsewers and roadside drainage ditches, and ultimately into the Dead River / Bull Creek stream system. Physical changes in the watershed, such as stream channelization and the loss of riparian vegetation and wetlands, impact water quality and aquatic habitat.

The causes and sources of water quality problems in the Dead River watershed are primarily urban in nature. These problems are the result of many years of modification of the watershed landscape as it changed from natural to agricultural to urban. These changes have included modification of the stream channel, floodplain, wetlands, and other water resource-related landscape features. Other changes are the result of the increased watershed impervious cover (e.g., paving, concrete, rooftops) that has led to an increase in the volume and rate of runoff in the watershed. The increased quantity of runoff has caused problems such as excessive stream bank erosion and the deepening of the stream channel due to channel erosion. In addition to increasing surface runoff, impervious surfaces reduce the amount of rainwater that infiltrates into the ground to recharge groundwater sources.

This water quality summary includes information from water quality reports, data from stream inventories and recent water quality monitoring, non-point source pollution loading modeling, and information from Areas of Concern (contaminated sites).

3.14.1 STATE OF ILLINOIS AGENCY REPORTING

The Illinois Environmental Protection Agency produces a state water quality report every two years that summarize the condition of state water bodies based on a variety of sources of information and data. The report also identifies whether the water bodies are impaired from providing for their designated use, as well as the causes and sources of that impairment. Designated uses are the use categories that IEPA assigns to water bodies and that dictate the water quality standards that that particular water body must meet. Examples of designated uses include the following:

- aquatic life (supports aquatic life including fish and other organisms)
- fishing (fish are safe for human consumption)
- secondary contact (boating)
- primary contact (swimming)
- drinking water supply.
- general or overall use (includes protection of aquatic life, primary and secondary contact recreation, and agricultural and industrial uses.

The Dead River and Bull Creek are listed in the Illinois Environmental Protection Agency 2002 and 2004 State Water Quality (305(b)) reports as having been “evaluated” without identification of the source of the assessment information (i.e., the assessment is not based on monitoring data but on evaluation of other watershed characteristics). Designated uses are listed as ‘not assessed’ for overall use and for aquatic life, and no impairment, or causes and sources of impairment, were identified. The 2004 report lists aquatic life as the designated use, and was again “evaluated” without identification of the source of information, and no impairment, or causes, or sources of pollution were identified. Dead River and Bull Creek were not listed in the Illinois Environmental Protection Agency’s 2006 303(d) list of impaired waters.

According to the IEPA, Bull Creek has been listed in the draft 2008 303(d) list of impaired waters for low dissolved oxygen levels based on continuous monitoring by the North Shore Sanitary District. The sources of low dissolved oxygen are habitat alteration (for example, the lack of pools and riffles and debris buildup, which causes water to slow down and pool behind the blockages) and hydrologic disturbance / low flow conditions.

The Illinois Environmental Protection Agency attempted to sample water quality in the Dead River watershed in summer

2006. There was little to no flow at the Dead River sampling site, and no biology or water chemistry data was collected. The Illinois Department of Natural Resources also attempted to sample the Dead River fish community in July 2006, but too much vegetation in the stream prevented the collection of good data. In summer of 2007 the Illinois Environmental Protection Agency sampled Bull Creek May, July, and August, including field and laboratory analaysis. According to the IEPA, the results of these samples do not indicate water quality concerns in these streams.

3.14.2 LOCAL WATER QUALITY MONITORING

A limited amount of water quality related information (turbidity, filamentous algae, and the presence of grease and oil) was collected as part of the 2001 Lake County Stormwater Management Commission stream inventory. Since there was no additional existing water quality data available to evaluate water quality in the watershed tributary streams in advance of this planning effort, the Lake County Stormwater Management Commission contracted with the Lake County Health Department and the Lake County Forest Preserve District to collect data over a period of 2 years as part of this study.

In addition to these data sources,the North Shore Sanitary District contributed to this study by collecting grab samples of water from the Bull Creek in May and September 2007 that were tested in their laboratory for pollutants sampling. The results for water quality constituents of interest are shown in Table 3.17, indicating that water quality parameters are largely within acceptable limits, save for a spike in fecal coliform levels in the September sample. The Lake County Forest Preserve District, United States Geologic Survey, and Illinois State Water Survey are collecting water quality data via grab samples and automatic samplers, as well as monitoring groundwater levels and plant communities downstream of the sample sites in Illinois Beach State Park. The North Shore Sanitary District has also begun collecting grab samples several times per year. Information gleaned from these sampling programs and from reports and surveys is summarized below.

In 2006 the Lake County Health Department began water quality and flow monitoring in Bull Creek downstream of Sheridan Road, near Illinois Beach State Park. An automatic sampler was used to collect water quality data for temperature, turbidity, pH (a measure of alkalinity / acidity), dissolved oxygen, and conductivity at 15-minute intervals from approximately August to November 2006 and from March to November 2007. Data collected from April to August is reflected in this assessment and in Table 3.18.

Temperature

Water temperatures fluctuated with daily air temperatures as well as with seasonal changes, i.e., water temperatures were higher in summer and cooler in spring and fall. In 2006, Bull Creek recorded a high of 23°C (73°F) on August 12 and a median temperature of 15°C (59°F). In 2007, the high was 25°C (77°F) and the median 17°C (63°F). Maximum water temperatures over 20°C may preclude most Lake Michigan fish from using Bull Creek for habitat. Rainbow trout can tolerate temperatures up to 28°C, though poor habitat conditions may preclude these fish from using the stream.

Dissolved Oxygen

Algae and aquatic plants in the creek elevate dissolved oxygen (DO) concentrations during the day (due to photosynthesis) and lower DO concentrations at night (due to respiration). Low DO conditions typically exist in mid to late summer when air and water temperatures are high and water levels are low. DO concentrations below the Illinois Environmental Protection Agency standard of 5.0 mg/L can stress many fish species, and concentrations below 1.0 mg/L (hypoxic conditions) can be detrimental to aquatic life.

In 2006, Bull Creek DO samples fell below the Illinois EPA standard of 5.0 mg/L on 23 days in July, August, and September of 2006. Bull Creek exhibited a median of 7.19 mg/L and significant DO fluctuations (1.8 –13.5 mg/L in August), which may be due to the open nature of the sampling location and the consequent variability of temperature, which is closely correlated with DO. In 2007, Bull Creek exhibited similar response as in 2006: a median of 7.85 mg/L, significant fluctuations in DO concentration, and seven days in July and August below the IEPA standard. Approximately 8% of samples fell below the IEPA standard of 5.0 mg/L during both years, and at no time did Bull Creek fall below 1.0 mg/L (anoxic conditions). Data collected by the Illinois Environmental Protection Agency in 2007 indicated DO levels above 7.8. As mentioned above, the Illinois Environmental Protection Agency has listed Bull Creek in the draft 2008 303(d) list of impaired waters for low dissolved

oxygen levels based on continuous monitoring by the North Shore Sanitary District.

Bull Creek also demonstrated a higher mean DO concentratioin in 2007 when the median flow rate was significantly higher than in 2006, indicating that higher flows can result in higher DO concentrations, likely due to greater aeration of the water and less opportunity for algae to grow in the flowing water. Low dissolved oxygen conditions can lead to fish kills although no such reports were discovered during this inventory. Low dissolved oxygen levels also create conditions that only some fish and aquatic organisms can tolerate, causing the diversity of species to be reduced, which is an indicator of an impaired system.

Conductivity

Specific conductivity indirectly measures the concentration of chemical ions or dissolved salts in the water, and may be an indicator of salt as a pollutant. The more chemical ions or dissolved salts a body of water contains, the higher the conductivity will be. High chloride concentrations following salt applications for snow melting in winter can led to high conductivity readings, as can the leaching of effluent from a sanitary sewer line into a stream. Low water levels tend to increase concentrations of ions in the water column, while rain events tended to temporarily flush ions out of the stream system. In lakes, chloride concentrations over 250 mg/L (equivalent to ~1.2 mS conductivity) are a concern, and anything over 500 mg/L Cl (~2.0 mS) will lead a waterbody to be considered impaired. However, there is not enough stream conductivity data to make the same conclusions in streams.

Median conductivity readings in Bull Creek for 2006 and 2007 were 0.95 and 0.91 mS/cm with highs of 1.532 and 3.22 mS/cm in August. The Illinois EPA found similar figures in 2007: Bull Creek ranged from 0.511 to 1.479 mS/cm. High summer flow events tend to correspond to a decrease in conductivity, but conductivity would be expected to increase during periods following heavy snowfall. The Lake County Health Department used these conductivity figures to generate equivalent chloride concentrations in the stream. Bull Creek chloride concentrations were found to have a median of 188 mg/L and maximum of 919 mg/L, indicating that these streams may be impacted by high chloride concentrations and it is important to keep the use of road salts to a minimum within the watershed.

pH

Normal pH (a measure of hydrogen ions in the water) values in streams should range from 6.5 to 8.5, good conditions for aquatic life. Bull Creek exhibited a median pH of 7.83 (2006) and 7.87 (2007). The Illinois EPA also found normal pH levels between 7.9 and 8.0 in May, July, and September of 2007. This slightly alkaline condition provides adequate buffering against shifts in pH that may occur due to stormwater or point source inputs, which is a good condition for habitat.

Total Suspended Solids / Turbidity / Sedimentation

Turbidity, a measurement of the 'cloudiness' of water, is caused by suspended particles, or TSS (total suspended solids), and may indicate erosion or sedimentation problems. Turbidity tends to increase after rain events when runoff carries particles into the stream, when high flows erode streambanks and/or the streambed, and when the increased volume of water in the channel stirs the sediment in the bottom of the channel. This is supported by Lake County Health Department data collected in 2006 and 2007.

Lake County Health Department data shows that Bull Creek exhibited a median turbidity of 11.4 NTU and a range of 2.5 to 1149.7 in 2006, and a median of 17.3 NTU and a range of 0.0 to 1084.9 NTU. Turbidity values increased as a result of high flow events, and the higher median turbidity is due to greater precipitation in 2007. In 2007, the Illinois EPA found turbidity to be low for Bull Creek, measuring between 8.0 and 31.0. According to the North Shore Sanitary District sampling, Bull Creek exhibited Total Suspended Solids concentrations of 156 mg/L and 31 mg/L in May and September of 2007.

According to the 2001 SMC stream inventory, none of the reaches in the Bull Creek Watershed were highly turbid under baseflow conditions. Twelve of the twenty-eight total reaches of the Dead River/Bull Creek Watershed were characterized as having low turbidity. Eleven reaches were characterized as moderately turbid. Only three reaches, two in the South Branch of Bull Creek and one in the Glen Flora Tributary, were characterized as having high turbidity, but it is likely that these were inventoried during or following rain events, which increase turbidity.

Filamentous Algae

Filamentous algae are good indicators of elevated nutrient levels, particularly phosphorous. Filamentous algae are not only aesthetically displeasing, but also form mat like blooms that can cause substantial swings in water oxygen levels throughout the day (dissolved oxygen levels can get very

Table 3.17 Water Monitoring Data, North Shore Sanitary District

Water quality constituent	IL water quality standard	Bull Creek May 2007	Bull Creek Sept 2007
Total chloride (mg/l)	500	118	242
Dissolved oxygen (mg/l)	5.0 min	8.1	7.0
E. coli (col/100ml)	--	236	365
Fecal coliforms (col/100ml)	200 (may-oct)	NA	410
Total dissolved solids (mg/l)	1000	544	900
Total phosphorus (mg/l)	--	<0.25	<0.25
Total suspended solids (mg/l)	--	156	31
*chronic standards were used			

Table 3.18 Water Quality Monitoring Data, Lake County Health Department

Parameter		Bull Creek Aug-Nov 2006	Bull Creek Mar-Nov 2007
Dissolved Oxygen (mg/L)	Max	13.50	13.78
	Min	1.79	1.17
	Median	7.19	7.85
	Mean	6.78	8.37
Conductivity (mS/cm)	Max	1.53	3.22
	Min	0.17	0.18
	Median	0.95	0.91
	Mean	0.91	0.94
Turbidity (NTU)	Max	1149.70	1084.90
	Min	2.50	0.00
	Median	11.40	17.30
	Mean	25.00	49.69
Temperature (°C)	Max	22.74	25.28
	Min	3.20	1.60
	Median	15.47	16.81
	Mean	14.50	15.41
pH	Max	8.11	8.30
	Min	7.54	7.42
	Median	7.83	7.87
	Mean	7.83	7.89
Level (ft)	Max	2.71	7.56
	Min	0.30	0.54
	Median	0.68	0.88
	Mean	0.64	0.79
Velocity (ft/s)	Max	3.16	4.06
	Min	0.04	0.00
	Median	0.58	0.70
	Mean	0.42	0.46
Flow Rate (cfs)	Max	124.73	688.08
	Min	0.02	0.54
	Median	6.65	11.29
	Mean	3.40	4.68

low during the night). This fluctuation can limit the available habitat of many aquatic animals, because they depend on high dissolved oxygen levels in the stream to survive. Although filamentous algae were found in many of the reaches in the Bull Creek/Dead River Watershed during the 2001 stream inventory, a majority were in the low to moderate range and not considered a serious problem. In Bull Creek, all 22 reaches were evaluated to be in the low to no algae range. The Glen Flora Tributary had two reaches in the high range and two in the low range. The unnamed tributary had low to no algae.

Grease & Oil
The presence of grease and oil in the sediment and/or water column was also noted in the stream assessment based on visual observations during the 2001 stream inventory. Bull Creek had seven reaches (32%) with grease and oil present in the water column, none was noticed in the sediment. The Glen Flora and Unnamed Tributaries had 3 reaches (50%) with grease and oil both in the sediment and in the water column. The source is most likely nearby roads, which are drained into the channel by pipe outfalls.

Lake Michigan Beaches
Based on data from the Lake County Health Department Lakes Management Unit, all four of the public beaches on Lake Michigan in the Dead River watershed were closed numerous times from 2002–2006 due to high E. coli levels, as shown in Table 3.19 and Figure 3.37. E. coli bacteria are used as an indicator of fecal contamination. Beaches are closed when E. coli concentrations reach 235 MPN/100 mL (MPN refers to Most Probable Number, an estimate rather than an actual count of E. coli). Common causes of fecal contamination are sewer overflows resulting from significant rain events and cross-connections of sanitary sewers to storm sewers. However, in this watershed, the high concentrations were determined to be caused by the waste excretions from gull populations, as illustrated in the genetic assessment results in Figure 3.38. Of the four beaches in the Dead River watershed (Waukegan South Beach, Waukegan North Beach, Illinois Beach State Park Resort Beach, and Illinois Beach State Park South Beach) Waukegan South Beach had the greatest number of closures in one year (54 in 2002) and the highest average number of closures per year (24.8 closures/year). Waukegan North Beach had the least number of closures in one year (6 in 2005) and the lowest average number of closures per year (18.2 closures per year). It is important to note that Illinois Beach State Park Resort Beach was not sampled from 2002–2003.

Three of the four Lake Michigan beaches within the Dead River / Bull Creek watershed were assessed for the IEPA 2002 and 2004 Water Quality (305(b)) report: Waukegan North, Waukegan South, and Illinois Beach State Park South. According to this report, monitoring data included water column survey data less than 5 years old from “other agencies / organizations”, most likely the Lake County Health Department data referenced above. Beaches were assessed as Nonsupport for Primary Contact (Swimming) as the designated use. The cause of impairment was identified as pathogens / fecal coliform, and sources included urban runoff / stormsewers and an unlisted / unidentified source. In the IEPA 2006 303(d) list of impaired waters, the same three beaches were listed as impaired for both Fish Consumption and Primary Contact Recreation, with Polychlorinated biphenyls (PCBs) and Escherichia Coli (E. coli) the respective potential causes. Sources were unknown.

3.14.3 POINT SOURCES OF POLLUTION

Point sources of pollution are discharges from a single

Table 3.19 Lake Michigan Beach Closures

Beach	2002	2003	2004	2005	2006	Avg/yr
Waukegan South	54	24	19	12	15	24.8
Waukegan North Beach	33	23	19	6	10	18.2
Illinois Beach State Park Resort Beach	NA	NA	20	23	17	20.0
Illinois Beach State Park South Beach	18	20	23	21	22	20.8
Total	105	67	81	62	44	72

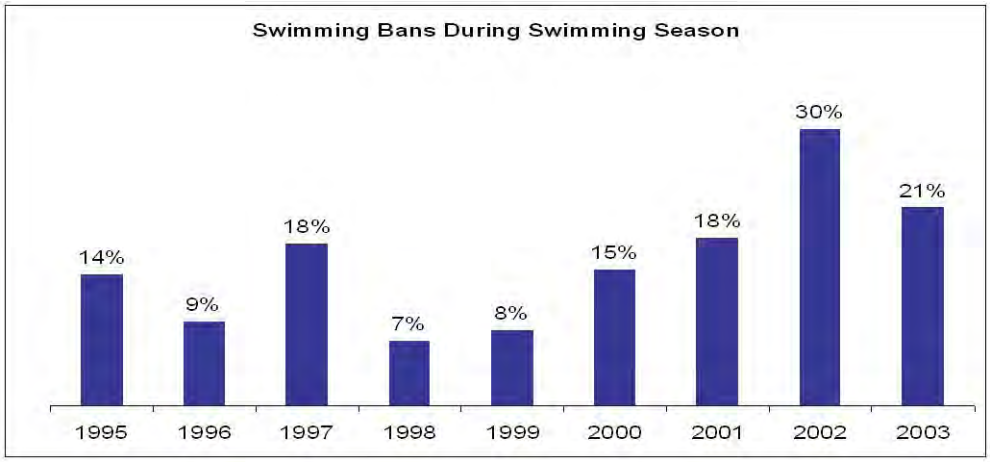

FIGURE 3.37 LAKE MICHIGAN SWIMMING BANS (LAKE COUNTY HEALTH DEPT.)

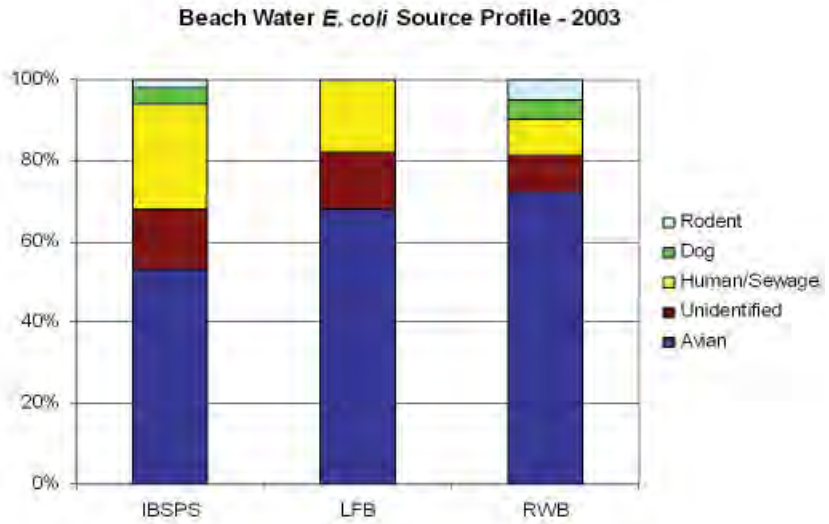

FIGURE 3.38 BEACH WATER E.COLI SOURCE STUDY RESULTS (LAKE COUNTY HEALTH DEPT.)

source such as a pipe conveying wastewater from an industrial process or a wastewater treatment facility into the stream. Point sources are regulated and monitored by the United States Environmental Protection Agency under the Clean Water Act of 1972. Point sources include those that are permitted to discharge pollution under the National Pollutant Discharge Elimination System (NPDES) program. This program, administered by the Illinois Environmental Protection Agency, was developed under the federal Clean Water Act to reduce pollutants in industrial and wastewater discharges into the nation's waterways. NPDES Phase 2, enacted into law in 1999, builds upon the existing Phase I program by requiring smaller communities and public entities that own and operate an a stormwater management system to apply and obtain an NPDES permit for stormwater discharges.

The NPDES permits shown in Table 3.20 and Figure 3.39 were found within the Dead River watershed. All of these permits are for stormwater discharges and are not required to report the concentrations of pollutants being discharged. The contributionis of these outfalls to the non-point source pollutant load modeliing assessment described below has been considered within that assessment.

Also included here is a summary of another potential source of pollution within the watershed, the Waukegan Harbor Area of Concern. Although this is not technically a point source of pollution since there is no longer a point discharge, there is a significant amount of contamination associated with this site that it considered here as a potential point source because it can be specifically located in the watershed area around Waukegan Harbor.

Waukegan Harbor Area of Concern

Waukegan Harbor contains recreational boating slips for sailing and motorized boats, a yacht clubs, and a full-service marina. It once served as a port for passenger steamships and large ships for moving goods throughout the Great Lakes. The harbor currently and historically also supported a number of industrial processes, some of them related to boating such as Larson Marine and Outboard Marine, and others locating near the port for easy transportation access.

The Waukegan Harbor Area of Concern (AOC), identified in 1981 as one of 43 Areas of Concern (severely degraded geographic areas, often due to toxic compounds or other hazardous pollution) located within the Great Lakes Basin, includes Waukegan Harbor and the two branches of the Waukegan River that flow into Lake Michigan south of the Harbor. It includes the north branch west to Yeoman Park and the south branch west to Lincoln Avenue. An Expanded Study Area (ESA) bounded by the Dead River on the north, a bluff line which parallels Sheridan Road on the west, the U.S. Steel property on the south, and the nearshore waters of Lake Michigan on the east was added to explore additional concerns of the citizens beyond the AOC. This ESA includes part of the Dead River watershed. See Figures 3.40 and 3.41.

A Remedial Action Plan (RAP) outlines a specific program leading to the remediation (cleanup) of a contaminated site. The Remedial Action Plan for the Waukegan Harbor AOC is being coordinated by the United States Environmental Protection Agency Region 5, the Illinois Environmental Protection Agency, and the Waukegan Harbor Citizens Advisory Group, the local representative.

Six of 14 use impairments have been identified for the Waukegan ESA. These include restrictions on fish and wildlife consumption, degradation of benthos (bottom dwelling organisms), restrictions on dredging, beach closings, degradation of phytoplankton populations and loss of fish and wildlife habitat. The ESA area contains a number of current and former industries including Johns-Manville Corporation, Outboard Marine Corporation, Waukegan Manufactured Gas and Coke, Waukegan Paint and Lacquer, North Shore Gas North Plant, and the Waukegan Tar Pit, which may have contributed to the reasons for listing the AOC and the ESA. Figure 3.41 shows the general locations of a number of the industries mentioned above; those not shown are former industries that are no longer in operation.

Approximately 15 cubic meters of paints, solvents and flammable solids were removed from weathered tanks on the Waukegan Paint and Lacquer property before it could leak into sandy soil next to Lake Michigan. Approximately 1,600 cubic yards of contaminated soils and tars were removed from the Waukegan Tar Pit. The Johns-Manville and Outboard Marine sites, which have been the subject of detailed contamination and remediation studies by the United States Environmental Protection Agency, are described below.

Johns Manville Corporation

Located south of Illinois Beach State Park in Waukegan, the Johns Manville Corporation site (300 acres) was an

Table 3.20 National Pollutant Discharge Elimination System Permits

NPDES ID Number	Receiving Water	Facility Name	Discharge Type	Type of Facility	Permit Expiration Date
ILR10I110	N Branch Bull Creek	Townhome development	Stormwater	Townhome development	5-31-08
ILR400164	Bull Creek	Village of Beach Park	Stormwater	Municipal	2-29-08
ILR002977	S Branch Bull Creek	Waukegan Regional Airport	Stormwater	Airport	not listed
ILR006558	S Branch Bull Creek	Jones School Bus Service	Stormwater	School bus service	5-31-08
ILR10H540	Unnamed tributary to Lake Michigan	Bowen Park	Stormwater	Park	5-31-08
ILR000130	Lake Michigan	Al Hansen Manufacturing Co.	Stormwater	Manufacturing	6-01-08
IL0002763	Lake Michigan	Exelon Generation Co	Wastewater, stormwater, cooling water	Electric utility	2-29-12
IL0069809	Lake Michigan	Johns-Manville	Industrial discharge	Manufacturing	9-01-96
ILR001924	Lake Michigan	Larsen Marine Service	Stormwater	Marina	6-01-08
ILR000113	Lake Michigan	New National Gypsum Company Inc.	Stormwater	Gypsum manufacturing	6-01-08
IL0030244	Lake Michigan	North Shore Sanitary District	Wastewater	Wastewater treatment plant	4-30-12
IL0002267	Lake Michigan	Outboard Marine Corp	Stormwater and cooling water	Manufacturing	6-01-92
IL0002259	Lake Michigan	Waukegan Electric Generating Station	Cooling and wastewater	Electric utility	6-31-05
ILR005427	Lake Michigan	Waukegan Harbor	Stormwater	Port district / marina	6-01-08
ILR10J385	Lake Michigan	City of Waukegan – Sheridan Road	Stormwater	Municipal	5-31-08
ILR006288	No info	BC Automotive	Stormwater	Automotive	No info

asbestos manufacturing facility from 1928 to 1998. The site includes a 150-acre asbestos waste disposal area containing approximately three million cubic yards of contaminated material (debris, sludge, and soil) on the site containing asbestos, lead, chromium, arsenic, thiram, xylene, and 'cement kiln dust.' The threats and contaminants found were asbestos fibers in the air and asbestos, arsenic, and several volatile organic compounds (VOCs) in the groundwater, of which inhalation of airborne asbestos was deemed the most significant risk. Inhalation of asbestos fibers has been shown to increase the risk of lung disorders and lung cancer. Inhalation, ingestion, and skin contact with arsenic is known to cause health impacts in humans, ranging from mild irritation to skin lesions to death from high exposure. Arsenic is also suspected to increase the risk of certain types of cancer. Volatile organic compounds can evaporate to the atmosphere and contribute to air pollution and health problems such as asthma. Nearby Illinois Beach State Park and Lake Michigan are both used for recreation, presenting potential risks to human health. There may be risks associated with contaminated drinking water for those communities that use Lake Michigan as for water supply. It is also possible that these contaminants are present and causing health problems in fish and wildlife. Initial federal investigation of the site began in 1982; manufacturing operations at the site ceased in 1998 and all manufacturing buildings were demolished in 2000-01, including closure of the wastewater treatment system.

To safeguard against potential risk to human health, 24-inches of soil with vegetation was placed over the dry waste areas, two contaminated parking lots and roadways were paved to contain soil contaminants on site, and rip-rap was installed in all operating wastewater treatment ponds (in 1991) to reduce the potential release of asbestos to the air. This occurs when asbestos containing materials are broken down or when water contaminated with asbestos fibers evaporates and leaves the dried fibers exposed to wind. Subsequently, five-year and ten-year reviews of the remediation were completed, and the next five-year review will be done in 2008. These reviews declared that the remediation techniques were sufficient and protective of human health and the environment, and that potential or actual human exposures and contaminated groundwater migration are under control. Several additional off-site areas of contamination have been identified in the watershed, and remediation is on-going. Nonetheless, approximately 101 acres are reportedly ready for redevelopment as non-residential reuse, such as commercial, industrial, or recreational land. The United States Environmental Protection Agency has since required closure of the wastewater treatment ponds and a miscellaneous disposal pit, which is on-going. The waste water treatment system ponds, which Johns Manville has continued to keep full of water to prevent drying and potential release of asbestos fibers, have been maintained and have not been provided with a final, long-term remedy and must now be addressed, possibly with draining and soil cover/ cap.

Monitoring of the air, ground water, and surface water, including monitoring wells to determine whether asbestos is migrating from the Johns Manville site to Lake Michigan, will continue for 30 years. This monitoring indicates that the trend for all contaminants at the site has been downward or stable between the first and second five-year review. According to studies, groundwater sampling has shown that, "with respect to migration of contaminants through the ground water, the analytical results demonstrate that there is no constituent migrating from the site in excess of any applicable standard." Presumably, this includes any applicable water quality standard.

As mentioned previously, issues with asbestos-containing materials (ACMs) and asbestos particles and fibers have arisen at Illinois Beach State Park and Lake Michigan. The degree of human health risk, however, are still being reviewed.

Outboard Marine Corporation

Prior to use by the Outboard Marine Corporation, Inc. (OMC), a wood treating plant, manufactured gas plant, and coke oven gas plant operated on this site, which is located in the northern Waukegan Harbor area in the City of Waukegan. Some or all of these operations may have contributed to the contamination situation that exists on and around the OMC site today, which contains four cleanup parcels, as follows.

1. Waukegan Harbor. Hydraulic fluid containing poly chlorinated Biphenyls (PCBs) was used in the outboard motor manufacturing process between 1961 and 1972 and discharged to a tributary draining to Waukegan Harbor. PCBs cause cancer in animals and are probably carcinogenic in humans. Recent evidence suggests that PCBs might also have adverse reproductive, developmental, and endocrine effects. Approximately 300,000 pounds of PCBs (and other fluids) were believed to be present in Waukegan Harbor sediments.

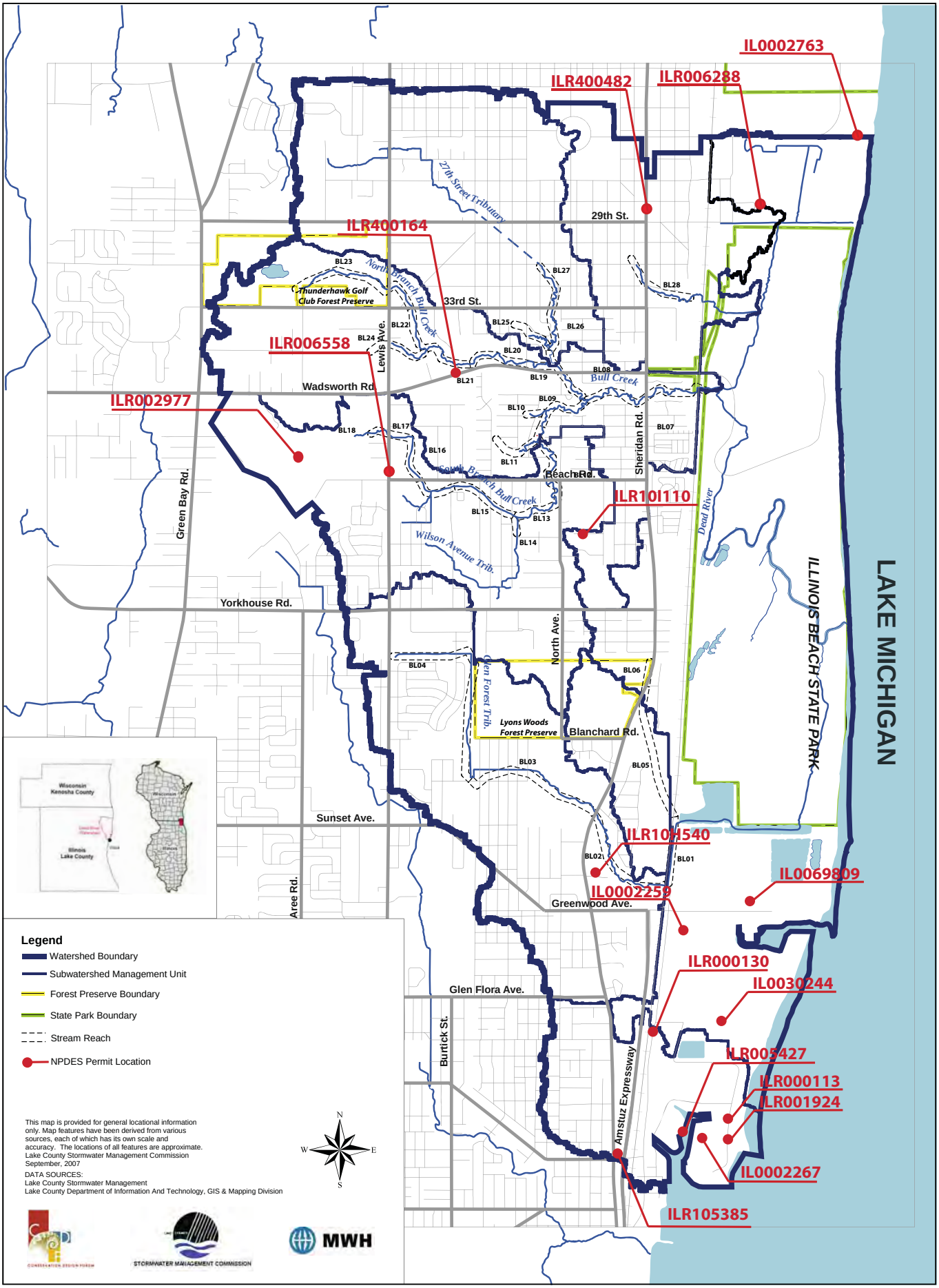

FIGURE 3.39 NPDES PERMITS

Within the harbor, the former Slip 3 and the Upper Harbor are the areas of greatest concern. Waukegan harbor was dredged and material disposed of in PCB containment cells, which are covered by a liner and soil or asphalt cap. These containment cells are now listed as the fourth cleanup parcel below. Maintenance of the PCB cells is ongoing. Slip #3 was reconstructed to maintain sealed separation from surroundings.

2. OMC Plant 2, the outboard engine manufacturing plant. Approximately 700,000 pounds of PCBs (and other fluids) were believed to be present in the OMC Plant 2 soils. VOCs, including trichloroethene (TCE) and vinly chloride, were found in soils and groundwater beneath Plant 2. The parking lot area north of Plant 2 was also contaminated with PCBs. According to the most recent five-year report, a large uncontrolled TCE solvent groundwater contaminant plume exists beneath

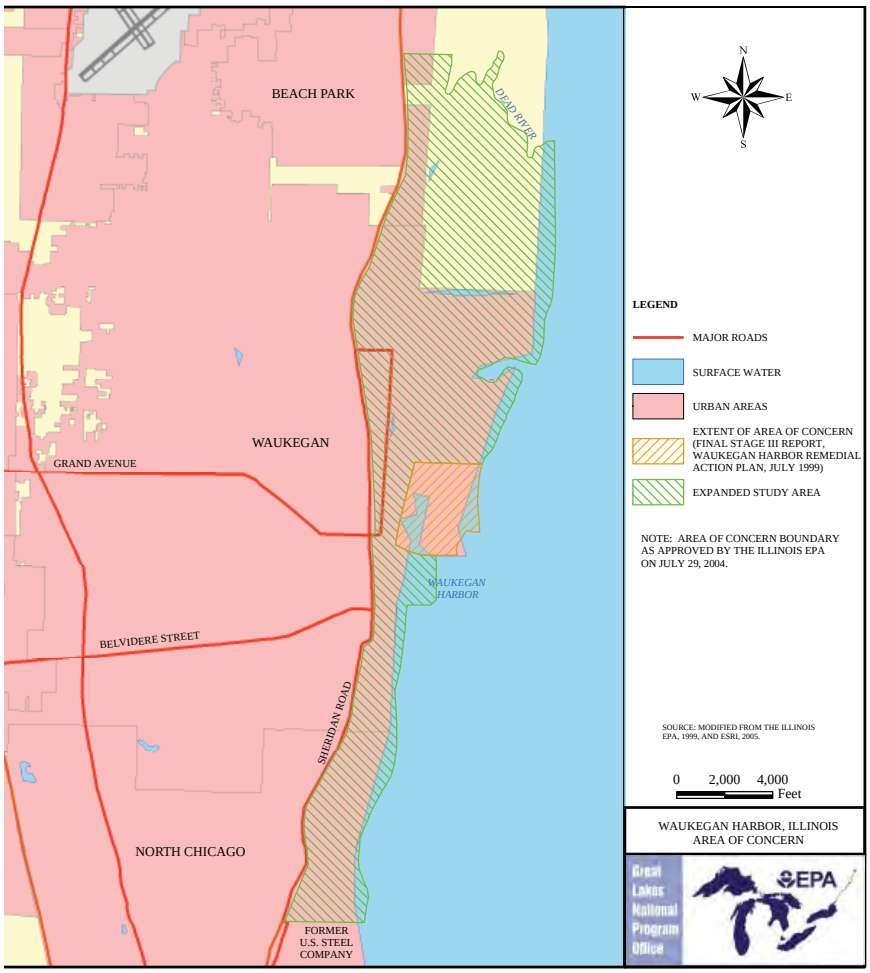

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FIGURE 3.40 WAUKEGAN HARBOR AREA OF CONCERN (AOC) AND EXPANDED STUDY AREA (ESA)

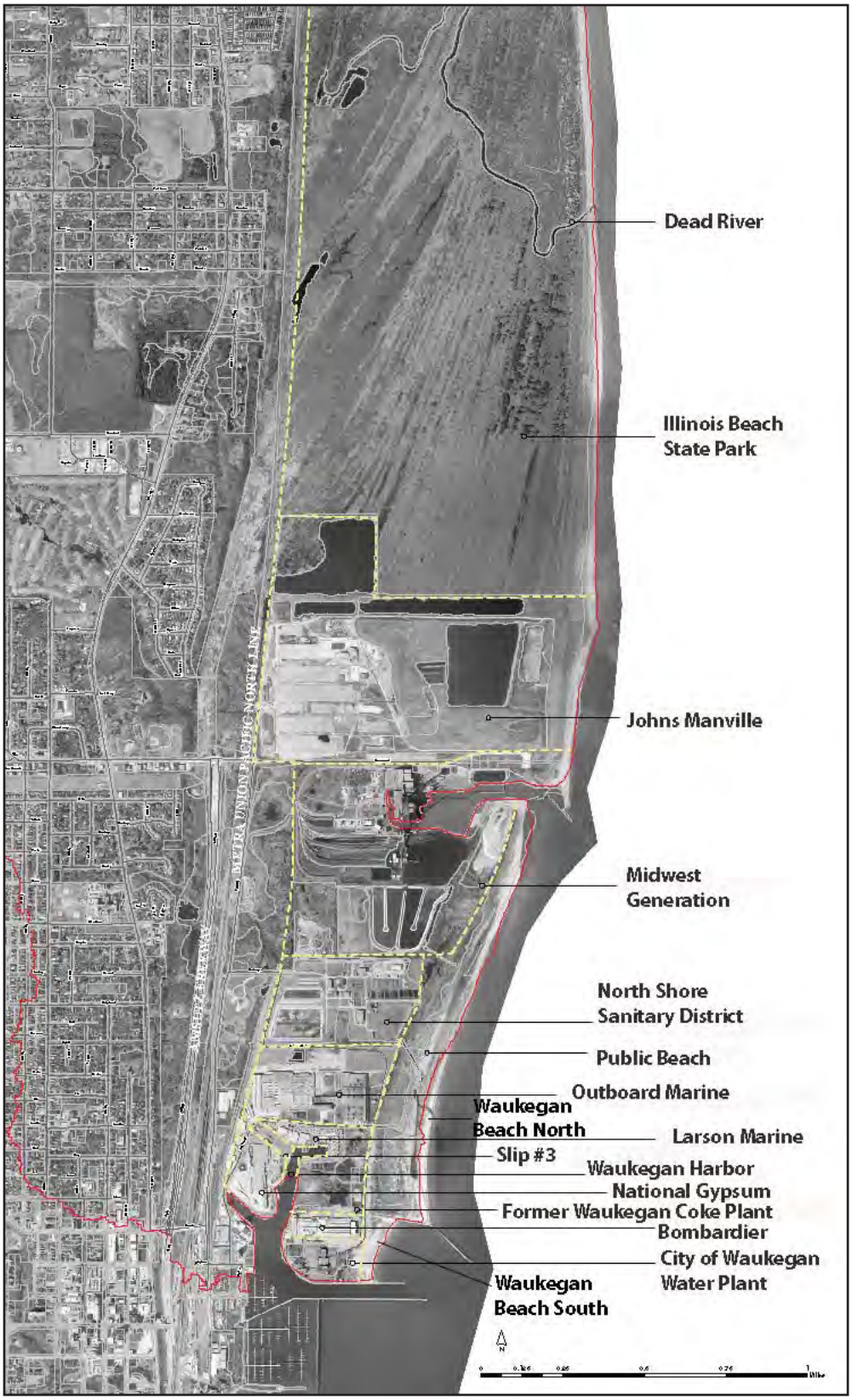

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FIGURE 3.41 WAUKEGAN HARBOR AREA OF CONCERN AND SURROUNDING AREA

Plant 2, and a PCB plume is expected to be present as well. Tributaries and ponds on the site, which drain and retain surface runoff from both the OMC and North Shore Sanitary District properties, all demonstrated PCB contamination. In 2002 and 2003, large amounts of acids, bases, paints, solvents, hydraulic oil, machining oil, compressed gases, metals, sludge and PCB containing transformer fluid were removed from the site and disposed. Additional remedial activities planned for OMC Plant 2 were scheduled to begin in 2007.

3. Waukegan Manufactured Gas and Coke Plant. The Waukegan Coke Plant (30 acres) property also contained high levels of polynuclear aromatic hydrocarbons (PAHs). Soils are contaminated with PCBs, PAHs, VOCs, coal tar, arsenic, and creosote. Groundwater is contaminated with ammonia, arsenic, phenol, benzene, and chlorinated VOCs. Sediment is contaminated with PCBs. Contaminated soil was removed in 2005 and groundwater treatment will continue for several years.

4. PCB containment cells from the 1992 Waukegan Harbor cleanup.

A nearby Lake Michigan beach and marine recreational uses (fishing and boating) in the harbor area pose potential risk human health impacts due to these contaminants. PCB contamination may be affecting the benthic and fish communities in Waukegan Harbor and human exposure through fish consumption poses a potential risk. The most recent fish sampling (as of the date of the report, 2002) show PCB levels at about 4-5 ppm, above the FDA recommended level of 2.0 ppm, indicating that there may still be an active source of PCBs to Waukegan Harbor, likely OMC Plant 2.

Potential carcinogenic risks are associated with arsenic, benzene, chlorinated VOCs and PAHs in groundwater, and groundwater ammonia presents a potential health hazard as well. Soil and groundwater contact are prevented at all four sites through fencing and restrictions on groundwater withdrawal.

The City of Waukegan intends to redevelop the property for marine recreational, commercial/ industrial, and possibly residential use as part of its larger lakefront revitalization plan, and has taken action to purchase some or all of these properties. Plans announced recently by the City of Waukegan would strictly limit the use of Waukegan Harbor for industrial use to help move forward on the lakefront revitalization plan. The next five-year review for the Outboard Marine Corporation site was scheduled for 2007.

3.14.4 NON-POINT SOURCES OF POLLUTION

When rain flows across the landscape, pollutants such as oil and grease, road salt, eroding soil and sediment, metals, bacteria from pet wastes, and excess nutrients (nitrogen and phosphorus) from fertilizers are washed from streets, buildings, parking lots, construction sites, lawns and golf courses into the streams and Lake Michigan. This kind of pollution is called nonpoint source pollution, because it comes from the entire watershed rather than a single point, plant, or facility. These pollutants accumulate as the water flows downstream and eventually begin to degrade the quality of our streams and Lake Michigan for aquatic life, as well as for human uses such as fishing, swimming, and bird watching. In this way, every small bit of pollution adds up to a very large problem.

In addition to chemicals and other substances picked up from the landscape, non point source pollution includes other measures such as temperature, acidity, and the amount of oxygen in the water. Aquatic organism, including fish and insects that are critical links in the food chain, need oxygen that is dissolved in the water to breathe. Low flows and non-point source pollution can cause the dissolved oxygen levels in the water to fall below healthy levels. When this happens, some plants and animals will die, in some cases causing large fishkills, and others will leave that location to try to find more habitable waters.

Water temperature can also cause problems. Many fish and other aquatic animals require cool or cold flowing water to survive. As rainwater flows across urban surfaces and through the sewer system, these surfaces warm the water causing the overall temperature of the receiving stream to be too warm for many aquatic plants and animals. This water can also be either more acidic or more alkaline than is healthy for these organisms to survive.

Two potential sources of pollution, in addition to the list of potential sources mentioned above, are the sanitary sewer system and Waukegan Regional Airport.

Table 3.21 Common Transportation-related pollutants

Constituent	Primary Sources (USEPA, 1993)
Particulates	Pavement wear, vehicles, atmosphere
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Tire wear, automobile exhaust
Zinc	Tire wear, motor oil, grease
Iron	Auto body rust, steel highway structures, moving engine parts
Copper	Metal plating, brake lining wear, moving engine parts, bearing and bushing wear, fungicides and insecticides
Cadmium	Tire wear, roadside insecticide application
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear, asphalt paving
Manganese	Moving engine parts
Cyanide	Anticake compound used to keep deicing salt granular
Sodium, Calcium, Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks, or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate

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Grease and oil slicks in the stream can be toxic to aquatic life.

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Waukegan Regional Airport

Sanitary Sewer System

The North Shore Sanitary District (NSSD) wastewater treatment facility discharges treated wastewater to a receiving body of water: this discharge is a point source of pollution covered by the National Pollutant Discharge Elimination System permitting process. However, non-point source pollution also can be traceable to issues (cross connections with the stormsewer system, leakage into or out of the sanitary sewer system, overflows of the sanitary sewer system due to stormwater infiltration or combined sewers) with the sanitary or sewer system. In this regard, the (NSSD), which is responsible for the sanitary sewers in the Dead River watershed, reports the following:

- No known cross connections exist between the NSSD sanitary system and the storm sewer system within the Dead River watershed that could result in sanitary discharge into the storm sewers.
- There are no combined sewers within these watersheds nor any NSSD overflow structures discharging into the waters of the watershed.
- There have been no overflows of the NSSD interceptor systems during periods of wet weather, indicating that the system had capacity to convey wet weather flows.
- Five Bull Creek Streambank Protection Projects, designed to reduce the exposure or risk of exposure of sanitary sewers to damage, were completed by spring of 2004.

The City of Waukegan Engineering Department reports that during heavy rain events there have been Sanitary Sewer Overflows out of the manholes at the bottom of the bluff on the east side of Sheridan Road and into the wetlands near the Amsutz Freeway.

Waukegan Regional Airport

As required by the National Pollutant Discharge Elimination System (NPDES) General Permit, the Waukegan Regional Airport developed a Storm Water Pollution Prevention Plan (SWPPP) for its stormwater discharges. The on-site stormwater system consists of inlets, underground sewers, drainage ditches, and detention basins, all of which discharge to one of two locations, one of which is Bull Creek and the other is the Des Plaines River. Approximately half of the airport drains to each receiving water.

The SWPPP lists the following potential sources of pollutants from the airport:

- Fluid drips from storage containers, aircraft, and non-aircraft vehicles and equipment.
- Trash deposited onto the ramp and apron areas.
- Accidental release of fuel during filling of Above-Ground Storage Tanks and drums.
- Accidental release of fuel during operations at the Under-Ground Storage Tank farms or while fueling aircraft or non-aircraft vehicles and equipment fueling.
- Accidental releases of motor oil, transmission fluid, or other chemical products.
- Storage or motor oil, transmission fluid, or other chemical products such that they may be exposed to stormwater.
- Paint solids from painting activities at Waukegan Airport Maintenance Garage.
- Nitrogen and phosphates from urea applied to paved areas as a de-icing solutions.
- Glycol from paved area de-icing activities.
- Soaps and other solvents and debris from aircraft washing.

The SWPPP identifies 8 actions that the airport takes for preventing or controlling stormwater pollution, all of which are currently being implemented by airport authorities and staff:

- Identification, by name and job title, of the individuals responsible for developing, implementing, and maintaining the SWPPP.
- Preventative maintenance measures to inspect and maintain stormwater conveyance structures to prevent their failure and subsequent discharge of pollutants into stormwater. Measures include oil/ water separators and the Spill Prevention, Control and Countermeasure Plan described below.
- Good housekeeping practices to maintain a clean facility, especially material handling areas, to reduce the potential for pollutants to come into contact with stormwater. Practices include grounds inspection, garbage and waste disposal, cleaning of chemical usage areas, use of pollutant recovery practices such as drip pans and absorbant, and storage of potential sources of pollutants under cover.
- Identification of areas where significant amounts of material are stored or used, procedures to prevent spillage and procedures for the appropriate cleanup of spills including protection of stormwater drainage structures. A Spill Prevention, Control and Countermeasure Plan is in place (see below).

- Stormwater management practices to control stormwater and reduce its potential for contact with pollutants. Practices include containment for containers and piping, debris and sediment control, waste chemical storage and disposal, and covered storage areas.
- Limitations of sediment and erosion (not currently applicable, but will apply if expansion or contstruction activities occur.)
- Training of employees on the responsibility of the components and the goals of the SWPPP including: good housekeeping practices, spill prevention and response procedures, material management practices, and inspection and reporting procedures.
- Regularly scheduled inspection procedures.

As required by the U.S. Environmental Protection Agency, Waukegan Regional Airport also developed a Spill Prevention, Control and Countermeasure (SCPP) Plan to prevent oil discharges from reaching navigable water of the U.S. or adjoining shorelines. The SCPP contains a list of the types and capacities of all oil storage containers and oil-containing equipment at the airport. The general response to an oil spill includes:

- Stop the oil spill or discharge by shutting off pumps, valves, or other equipment;
- Remove the threat of potential ignition source by shutting off pumps, motors, vehicles, or electrical devices in the vicinity of the spill or discharge. No flushing of spilled materials with water is permitted.
- Contain the oil spill or discharge using:
  - absorbent mats, pads, or socks, environmental organic absorbents, absorbent clay (oil dry), and or mopping to clean up smaller spills.
  - using absorbent mats or pads or drip pads to contain drips from storage containers, aircraft, and non-aircraft vehicles and equipment.
  - plugging floor drains.
  - placing emergency spill rubber mats over storm sewer inlets.
  - placing absorbent socks around floor drains and/or storm sewer inlets.
  - using absorbent socks, environmental organic absorbents, oil dry, sand or sand bagging, or earth berms to create a dike around the spill or discharge.

The Waukegan Regional Airport is in discussions to expand its operation and property to the north and east, which would potentially result in greater runoff and non point source pollution from airport grounds and facilities.

Non-Point Source Pollutant Load Modeling Assessment

For each of the 77 subbasins in the Dead River/Bull Creek watershed, twelve non-point source pollutants were mapped according to the degree of loading within each subbasin. Loading was determined using unit area loading rates in lbs/acre/year for each different land use derived by the Northeastern Illinois Planning Commission (now Chicago Metropolitan Agency for Planning – CMAP) and used for all Lake County watershed plans to date. The land use specific unit area loading rates were multiplied by the area of each of the land uses in the particular subbasin and summed to obtain the total load for the subbasin (in units of lbs/year). The unit area loading rates for residential were modified slightly to reflect changes in the Lake County land use data base as documented in Appendix K.

The twelve pollutants assessed included:

- Total Phosphorous (TP)
- Total Suspended Solids (TSS)
- Chemical Oxygen Demand (COD)
- Biological Oxygen Demand (BOD)
- Total Dissolved Solids (TDS)
- Total Nitrogen (TN)
- Total Kjedahl Nitrogen (TKN)
- Dissolved Phosphorous
- Cadmium (Cad)
- Lead (Lead)
- Copper (Cop)
- Zinc (Zn)

Four pollutants in particular (TSS, TP, COD, and BOD) are considered as pollution indicators for this watershed. TSS and TP are typical indicators of high urban pollutant loadings. TSS can lead to excessive sedimentation in stream reaches and ultimately cover and impair instream habitat. TP can lead to excessive productivity levels of aquatic plants in slow moving reaches and in lakes and wetlands. This can then lead to low DO levels as the plant material decays. Low DO levels make the stream uninhabitable for some species of aquatic life. Low DO levels was identified by the Lake County Health Department monitoring, as well as by the Illinois Environmental Protection Agency, as a problem for Bull Creek. Since COD and BOD represent oxygen demanding substances they were included in the list of indicator pollutants for this watershed.

For each pollutant, subbasins were classified as High, Medium, or Low based on the subbasin average loading rate (lbs/acre/year) relative to the watershed average loading rate, as shown in Table 3.22.

• If a subbasin average loading rate was greater than 1.5 times the watershed average loading rate, that subbasin was classified as a High contributor of the particular pollutant and given a rating of 3.

• If a subbasin average loading rate was between 1.5 times and 0.5 times the watershed average, that subbasin was classified as a Medium contributor of the particular pollutant and given a rating of 2.

• If a subbasin average loading rate was less than 0.5 times the watershed average, that subbasin was classified as a Low contributor of the particular pollutant and given a rating of 1.

After each subbasin was rated according to its loading contribution for each pollutant, a composite rating for the subbasin was determined based on the average of the rating of the four indicator pollutants as shown in the table below. The distribution of subbasin ratings for the four pollution indicators (TSS, TP, BOD, and COD) is shown in Figure 3.42. The pollutant load rating is one of the criteria used to identify watershed critical areas as described in a subsequent section. Loading maps for individual pollutant constituents are found in Appendix K.

In general, those subbasins with high density single family residential, commercial and industrial land uses with little or no open space or wetlands resulted in a rating of high contributor. Subbasins with moderate to low density residential use or with significant proportions of open space and/or wetland resulted in a rating of medium contributor. Only those few subbasins that were virtually entirely open space and/or wetland resulted in a rating of low contributor.

In most cases, the subbasin ratings are consistent with expectations. However, a few subbasins with high pollutant contributing land uses such as commercial and industrial received medium contributor ratings because the subbasin also had sufficient open space or wetland to reduce the subbasin average loading rate to the medium level.

Subbasins that rank as a high contributor have been identified as Critical Areas needing attention in Section 3.17.

Table 3.22 Pollutant Loading Contribution by Subbasin

Contribution Relative to Watershed Average	Contribution Rank	Subbasin Color	# of DR Subbasins
0.0 – 0.5	Low	Green	18
0.5 – 1.5	Medium	Yellow	37
1.5 or greater	High	Orange	22

3.14.5 SUMMARY OF WATER QUALITY ASSESSMENT

The conclusions drawn and management strategies recommended in this report are the best possible, given the relatively short period of record for water quality data in this watershed. However, in addition to using monitoring data to assess water quality, typical urban watershed problems as well as site specific issues also have been identified. Lake County Health Department, North Shore Sanitary District, and Illinois Environmental Protection Agency monitoring was also a valuable source of information for this assessment. The primary issues with respect to water quality, including those that relate to instream and riparian habitat, are discussed below.

Low Dissolved Oxygen

Algae and aquatic plants in the creek elevate dissolved oxygen (DO) concentrations during the day (due to photosynthesis) and lower DO concentrations at night (due to respiration). Low DO conditions typically exist in mid to late summer when air and water temperatures are high and water levels are low. DO concentrations below the Illinois Environmental Protection Agency standard of 5.0 mg/L can stress many fish species, and concentrations below 1.0 mg/L (hypoxic conditions) can be detrimental to aquatic life.

The Illinois Environmental Protection Agency has listed Bull Creek in the draft 2008 303(d) list of impaired waters for low dissolved oxygen levels based on continuous monitoring by the Lake County Health Department. The causes are listed as a lack of habitat conditions, such as pools and riffles to help aerate the water, and low flow conditions.

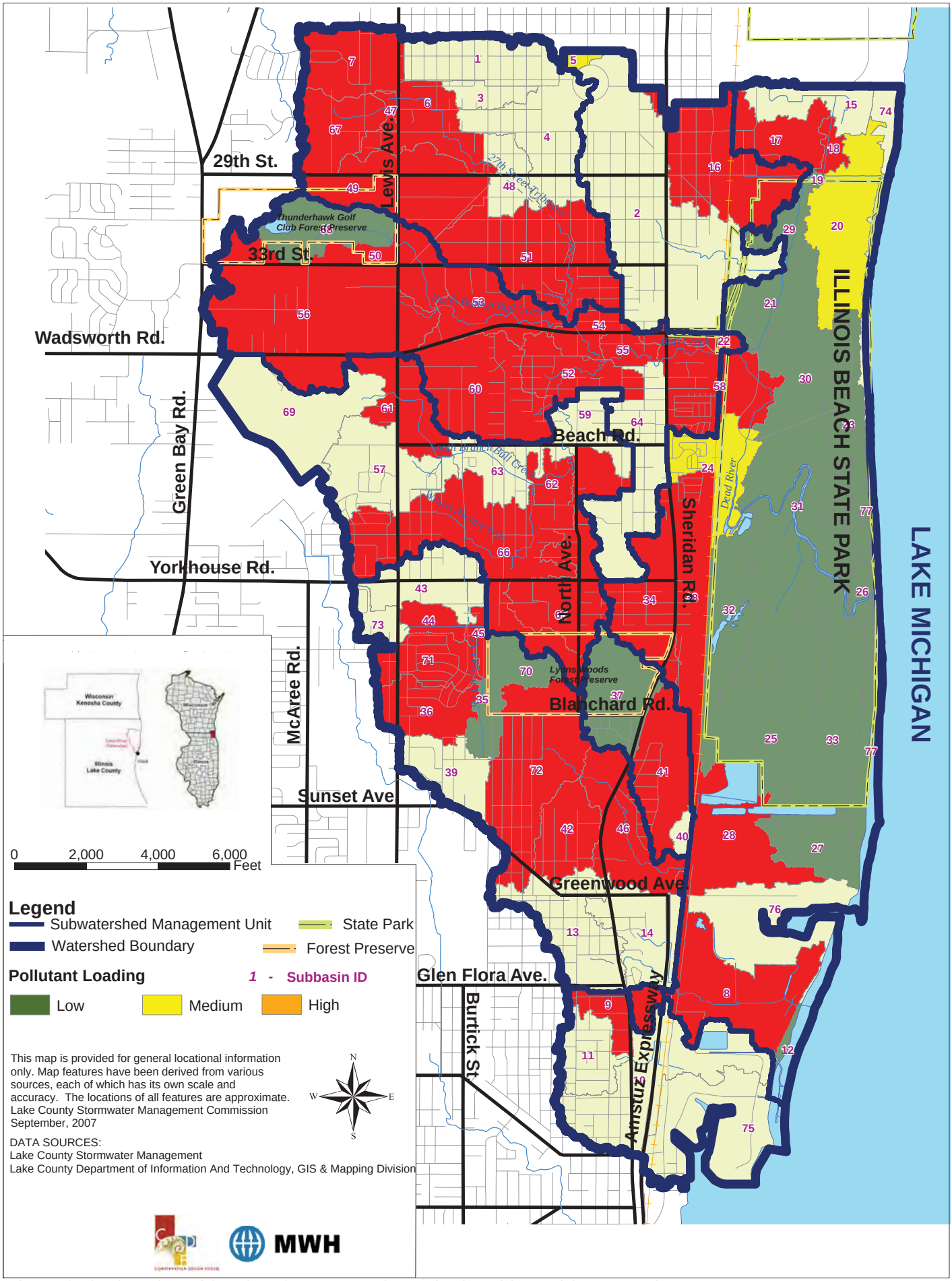

FIGURE 3.42 NON-POINT SOURCE POLLUTANT LOADING FOR TSS, TP, COD, AND BOD

Low dissolved oxygen conditions can lead to fish kills although no such reports were discovered during this inventory. Low dissolved oxygen levels also create conditions that only some fish and aquatic organisms can tolerate, causing the diversity of species to be reduced, which is an indicator of an impaired system.

Total Suspended Solids
Total Suspended Solids (TSS) and sedimentation are a source of impairment, generally within the low gradient lake plain reaches of the creek (I.e., Illinois Beach State Park) and within the western headwater areas that are also low gradient and subject to sedimentation. The primary impact of high suspended solids concentrations in streams occurs when these solids settle in depositional areas of the stream system and cover the more desirable gravel substrates. Excessive levels of particulate material also create difficult conditions for gill breathing fish and some of their food sources, including macroinvertebrate organisms.

Due to the higher velocity flow within the steeper reaches of the stream system within the ravines and middle portions of the watershed, TSS and sedimentation are not significant cause of impairment in these areas of the watershed.

The sources of TSS appear to be streambank erosion (due to hydrologic instability) with contributions from urban runoff over impervious surfaces. Suspended solids can be transported to the streams and lakes, even from remote areas of the watershed, via tile drainage, storm sewers, and roadside ditches. Another significant source of TSS in some reaches is runoff through overgrown woodlands along the stream corridor that have little or no ground cover vegetation to prevent surface erosion.

Increases in impervious cover combined with introduction of stormwater drainage systems and loss of wetlands has lead to significant changes in watershed hydrology (flow alterations). This has in turn lead to increased streambank and streambed erosion and degradation of instream habitat in many reaches.

Nutrients
High nutrient levels (nitrogen and phosphorous) do not appear to be a significant problem within the majority of the stream reaches, with algae blooms being noted only occasionally during the 2001 stream survey, primarily in areas of ponded or stagnant water. However, algae blooms, presumably caused by high phosphorous levels in the water column, seem to be more prevalent in the low velocity reaches of Illinois Beach State Park, indicating a nutrient load from upstream and a drainage problem within the park.

Algae blooms due to phosphorous impair the habitat quality of water resources and block light from reaching desirable aquatic plants. When the algae dies, the decomposition process can deplete dissolved oxygen levels in the water, impairing the habitat quality for aquatic wildlife. Urban runoff is the likely contributor of high nutrient loads, particularly phosphorous, to the stream systems. Stream or streambank dumping of yard waste, grass clippings, and leaves collected in the fall can also contribute significant nutrient loading to the stream.

Total Dissolved Solids
Dissolved solids (TDS) 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. Sodium chloride is not removed by BMPs and is conservative (does not decompose or readily change form), and can cause spikes in the water column, typically detected as increased conductivity. Salinity and chlorides were measured within the stream by collecting data on the conductivity levels in the stream, which indicated elevated conductivity readings and a water quality problem. Levels of dissolved solids are most likely low in the stream in the spring, summer, and fall, but may present problems in the winter months for both the stream and Illinois Beach State Park.

Toxic Substances
Potential sources of petroleum based hydrocarbons (oil and grease), metals, and synthetic organic compounds (SOCs) to the stream include stormwater runoff from urban land uses such as transportation, commercial, industrial, and residential and pesticide and herbicide contributions from agricultural and lawn management practices. These substances impair the quality of aquatic habitat and can bioaccumulate through the food chain. Oil and grease and other organic compounds also use oxygen as they decompose and therefore can deplete dissolved oxygen. Because these pollutants exist in stormwater runoff, “dumping” or “spills” are not necessary for these to be present. Normal wear and tear on vehicles, machinery, and other equipment can contribute metals and

other toxic materials to the water column. Oil and grease are common in urban runoff, were found during the 2001 stream inventory, and are considered a water quality issue for Bull Creek.

Industrial and Commercial Activities

Industrial and commercial activities are found distributed throughout the watershed. Though industrial point discharges are not considered to be significant contributors to impaired water quality in the stream, industrial and commercial land uses contribute significant non-point source pollution to the stream. There is evidence that the industrial legacy of Waukegan Harbor and industries to the north of the harbor continue to impact water quality and other environmental conditions due to contaminants such as PCBs and asbestos containing materials (ACM). Although these substances are problematic from the perspective of Lake Michigan and its beaches, they are not considered an impairment of Bull Creek itself, and thus are not included in Table 3.33 Watershed Impairments. Nonetheless, the industrial legacy of the Waukegan Harbor Area of Concern is identified as an issue needing attention in the Action Plan covered in Chapter 5.

Lake Michigan Beaches

Lake Michigan beaches exhibit problems with fecal contamination / pathogens (E.coli is the indicator for potential contamination), which causes beach closures due to the potential threat to human health that pathogens present. Though the Illinois Environmental Protection Agency reports urban runoff / stormsewers as the cause, the Lake County Health Department studies suggest gulls as the primary cause (+/-50%), with unidentified sources and human/ sewage the second and third major causes, and rodents, dogs, deer, and raccoons as minor causes.

A number of solutions to beach contamination have been suggested. In Lake County, beaches are working with the Illinois Department of Natural Resources to harass gulls and to destroy some gull nests, to reduce populations, but with limited success. Trash collection and containers to reduce garbage at beaches is being used in Chicago, and other communities have used dogs to harass gulls.

Beach contamination with PCBs was also noted by IEPA, and asbestos containing materials continue to be found and removed from the southern portions of Illinois Beach State Park (primarily found in the Dead River watershed).

Habitat

Despite the pervasive erosion problems throughout the watershed, the stream retains some high quality habitat features such as instream habitat and some intact and relatively natural floodplains and valleys in a number of reaches of the system. It is difficult, however, to draw many conclusions regarding the biological quality of the system due to the lack of sampling data that would yield MBI or other biological scores. Biological sampling should be conducted in a variety of locations to establish a baseline from which improvement or degradation can be assessed. Low quality fish communities may be due to intermittent hydrologic connections with Lake Michigan, the flashy hydrology of the streams due to urban development of the watershed, and periods of very low flow, and low dissolved oxygen conditions in the summer months, as reported by the LCHD. Warmer water holds less dissolved oxygen, and low oxygen levels can inhibit fish reproduction and reduce food organism populations. It appears that the stream channels may be of high enough habitat quality to support biological communities should the hydrology be stabilized and low dissolved oxygen concentrations be remedied.

Along much of the stream corridor, the riparian corridor is intact. However, in a few areas, there has been significant encroachment by urban uses into the stream corridor and loss of riparian habitat. These encroachments can be locations of yard waste dumping as well as sheet drainage of fertilizers and pesticides into the stream. These encroachments can also disrupt wildlife corridors.

Sources: Lake Michigan Beaches in Lake County - Swim Bans Due to E. coli, Lake County Health Department.

E. coli Source Identification on Lake Michigan Beaches in Lake County, Illinois, Lake County Health Department, 2003.

Illinois Environmental Protection Agency (IEPA) 2002 305(b) report, 2004 305(b) report, 2006 303(d) list, and 2008 DRAFT 303(d) Report.

Joe Marencik, Illinois Environmental Protection Agency, personal communication.

Bob Rung and Steve Pescitelli, Illinois Department of Natural Resources, personal communication.

Jim Stanczak, Waukegan Regional Airport Manager, personal communication.

U.S. EPA National Priorities List (i.e. Superfund sites) fact sheet from Johns Manville Corp. superfund site (www.epa.gov/R5Super/npl/illinois), the Superfund Site Progress Profile, (http://cfpub.epa.gove/supercpad/cursites), and the Second Five-Year Review Report for Johns-Manville Site, 2003.

U.S. EPA National Priorities List (i.e. Superfund sites) fact sheet from Outboard Marine Corporation superfund site (www.epa.gov/R5Super/npl/illinois), the Superfund Site Progress Profile, (http://cfpub.epa.gove/supercpad/cursites), and the Second Five-Year Review Report for Outboard marine Corporation Superfund Site, 2002.

U.S. EPA National Priorities List (i.e. Superfund sites) fact sheet for Yeoman Creek Landfill superfund site (www.epa.gov/R5Super/npl/illinois) and the Superfund Site Progress Profile.

Preliminary Stream Restoration Design Solution Report for Bull Creek Sheridan Road to Union Pacific Railroad, Natural Resources Ecosystem Management (NREM), 2000.

Preliminary Stream Corridor Assessment for Bull Creek Upstream of Sheridan Road-Phase II, Natural Resources Ecosystem Management (NREM), 2000.

Interceptor Inventory and Assessment Project Report for the North Shore Sanitary District and personal communications with Joe Robinson (NSSD) and John Moore (City of Waukegan).

Waukegan Regional Airport Storm Water Pollution Prevention Plan (SWPPP), 2006 Draft.

Waukegan Regional Airport Spill Prevention, Control and Countermeasure (SPCC) Plan, 2006 Draft.

Assessment of the Lake Michigan Monitoring Inventory: A Report on the Lake Michigan Tributary Monitoring Project, USEPA and Great Lakes Commission, 2000 (http://www.glc.org/monitoring).

Envirofacts website (http://www.epa.gov/enviro/) for NPDES permit information.

North Shore Sanitary District water quality sampling letters to Lake County Stormwater Management Commission, September 13, 2007 and December 13, 2007.

3.15 FLOODING

This section is divided into two parts: Flood Risk and Flood Damage. The section on Flood Risk describes the recent floodplain study and areas that have an increased flood risk due to the new floodplain boundary. The Flood Damage section describes location and extent of past flood damage and measures taken, if any, to remediate the problem.

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Flood Problem Area Inventory site

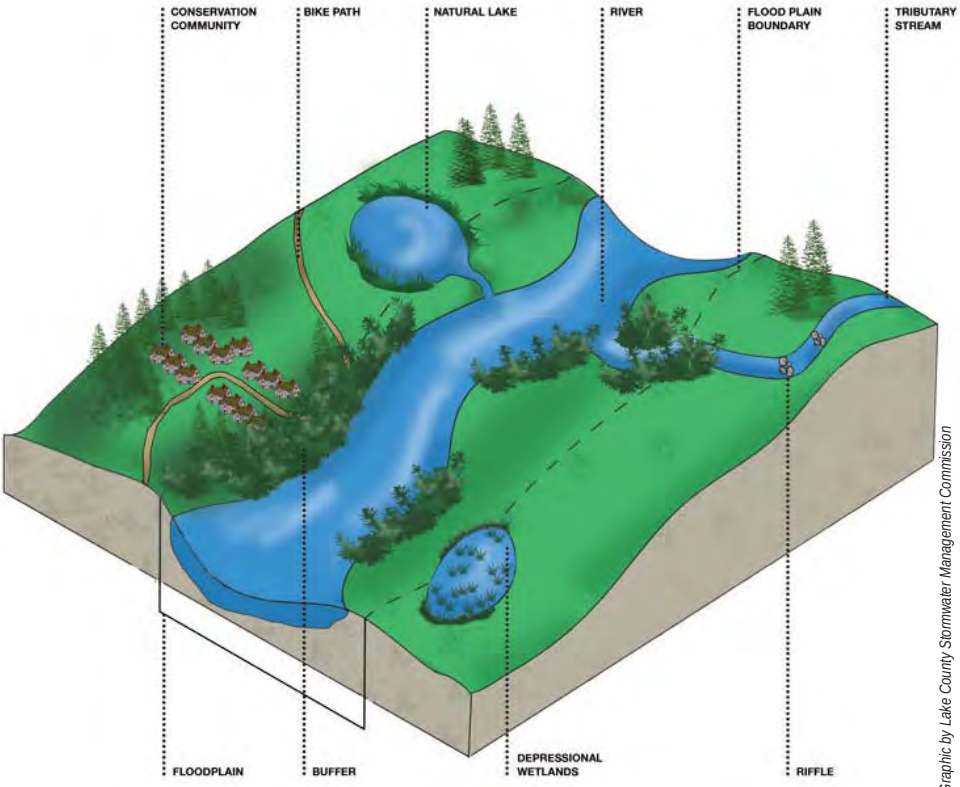
The Lake County All Hazards Mitigation Plan identifies a few different types of flooding that occur throughout the county. Several of these occur in this watershed.

- Overbank flooding from a waterway
- Flash flooding in ravines
- Local drainage problems (shallow flooding on roads, yards and sometimes buildings) often due to development in a drainage way, inadequately maintained drainage ditches, undersized storm sewers, and failing tile drains or storm sewers .
- Depressional flooding in areas where water ponds in a natural depression in the landscape and there is no natural outlet for runoff. May be caused by failed or broken field tiles or adjacent or surrounding development causing increased runoff into the depressional area.
- Sanitary sewer backups may occur, flooding basements, when stormwater infiltrates into the sanitary sewer pipes, leaky manholes, or inappropriate connections to the sanitary lines.

3.15.1 FLOOD RISK ASSESSMENT

As part of the watershed planning effort, the Illinois State Water Survey Center for Watershed Science conducted hydrologic and hydraulic modeling and floodplain mapping for Bull

Hydrology refers to the way that water behaves from its beginning as precipitation, through its movement on or beneath the surface of the earth, to its entry into sewers, streams, lakes, oceans and its eventual return to the atmosphere. A hydrologic assessment attempts to model how much precipitation falls in the watershed, what volume ends up in the creek, and the rate that it is discharged at critical locations. *Hydraulics* addresses how water flows over the land surface, within sewers and stream channels, over and under bridges and dams and through culverts, wetlands, lakes and impoundments (detention basins and reservoirs). A hydraulic assessment studies flow paths, velocities and stages of water as it is conveyed, as a concentrated flow, through the watershed.



© Graphic by Lake County Stormwater Management Commission

FIGURE 3.43 FLOODPLAIN FEATURES

© Graphic by Lake County, MWH, and Conservatioin Design Forum

FIGURE 3.43 LAKE COUNTY GARDENS

This graphic illustrates the Lake County Gardens subdivision (outlined in red) and associated updated floodplain (blue).

Creek and the Glen Flora Tributary in 2007. The underlying goals of this effort were to develop comprehensive hydrologic and hydraulic computer models of these watersheds and generate up-to-date floodplain and floodway mapping of the existing stormwater conveyance systems. Updated floodplains are necessary to help landowners, floodplain managers, and the Lake County Stormwater Management Commission understand flood issues and flood protection needs. The study did not include the coastal lake plain and Illinois Beach State Park.

The change in the boundary of the floodplain resulting from the study are shown in Figure 3.45. These maps display locations where the floodplain has been expanded since the previous study (red), retracted (green), and remains unchanged (yellow). As the figure shows, there has been significant change in some areas of the watershed and minor or no change in other areas. Overall, the proposed floodplain boundary contains 0.2% less land area than the existing FEMA floodplain.

Based on the results of this floodplain study, structures with a footprint greater than 100 square feet (flood structures) have been identified within the floodplain that appeared to have first floor elevations below the inundation water levels for the 10- and 100-year storm events. A schematic of the locations of the structures within the floodplain appears on Figure 3.46. Yellow shading denotes areas with groups of structures within the 100-year floodplain, and orange shading denotes areas with groups of structures within the 10-year floodplain. The 100-year floodplain is the area of land that is expected to be flooded, or has a 1% chance of being flooded, at least once in a 100-year period. Likewise, 10-year floods have a 10% chance of occurring in any given year. The structures themselves are shown with black outline. A summary of the structure counts for the existing and proposed 100-year floodplains are provided in Table 3.23.

Table 3.23 Structures in 100-year Floodplain

Structures	Number of Structures
Structures within existing 100-year floodplain	388
Additional structures in proposed floodplain	131
Structures proposed to be removed from existing floodplain	227
Structures in proposed floodplain	292
*Lake County Gardens area not included in the floodplain	

3.15.2 FLOOD DAMAGE

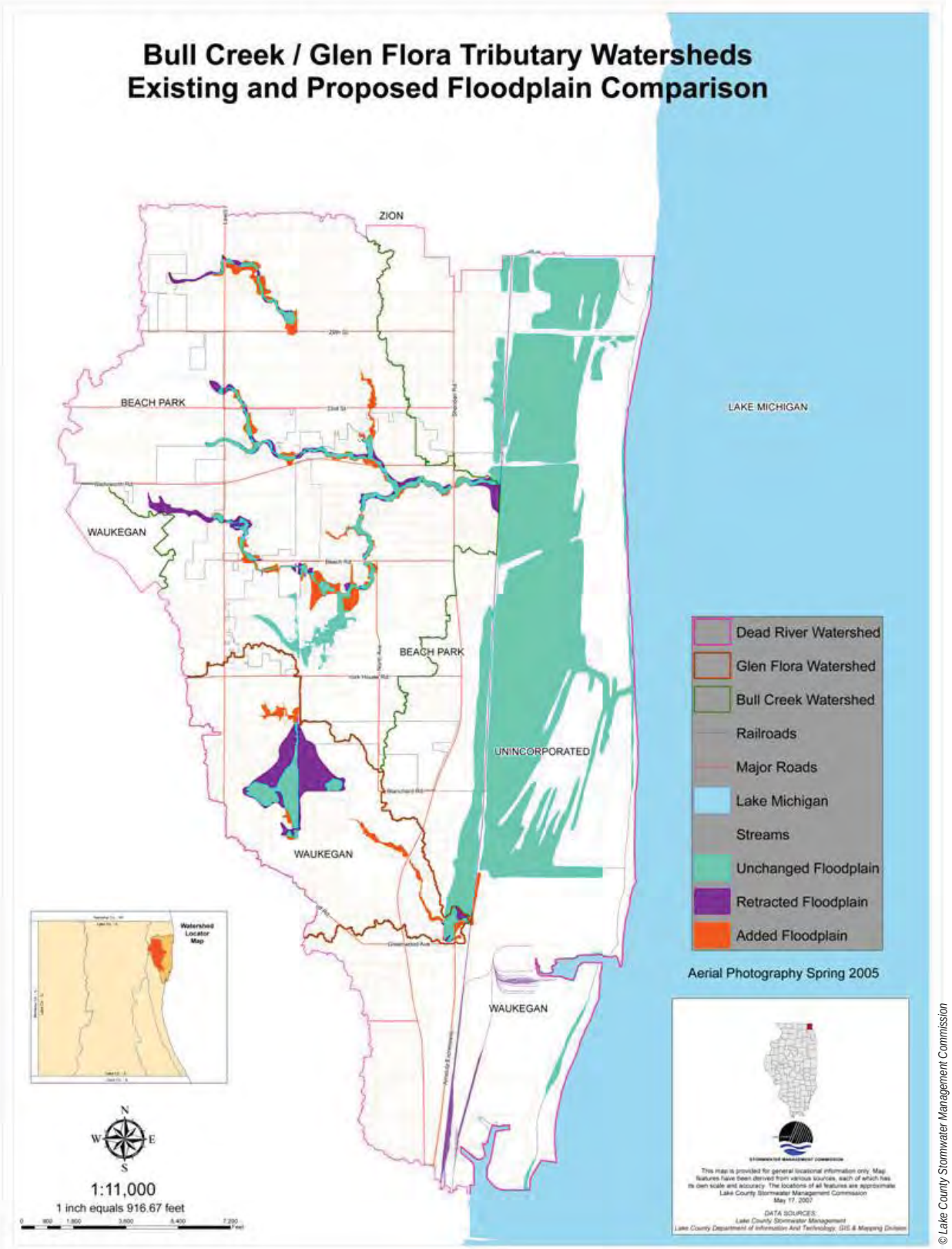
This section summarizes historical flood damage areas based on data collected from a variety of sources, one of which was the Flood Problem Area Inventory conducted by the Lake County Stormwater Management Commission. This study was a means of collecting updated information on new or existing flood problem areas in Lake County.

A "flood problem area" is composed of one or more structures in a geographical area that are damaged by the same primary source or cause of flooding. Common sources and causes of flood damage include overbank flooding; a local drainage system that has insufficient capacity; location in a depressional area in the landscape; or sanitary sewer backup. There also may be secondary sources/causes that affect all or part of an area as well. Known health and safety hazards such as septic failure, secondary sanitary sewer backup, erosion, and water pollution from hazardous materials are described for a flood problem area where they have been identified. Locations where road flooding results in damage to infrastructure, loss of critical access, or is a threat to safety are also considered flood problem areas.

Areas that only have "nuisance" flooding are not included in the Flood Problem Area Inventory. "Nuisance" flooding includes yard or open space flooding that does not result in damage to a structure, loss of access, or loss of septic or utility services.

Flood Problem Areas are described in this plan by a two-digit identification number and have been mapped in Figure 3.47. Roadway flooding locations identified by the Illinois Department of Transportation are also described in Table 3.24 and mapped in Figure 3.47. Where available, suggested solutions have been included in the descriptions below.

Uncorrected Flood Problem Area Inventory Sites



© Lake County Stormwater Management Commission

FIGURE3.45 EXISTING & PROPOSED FLOODPLAIN COMPARISON

These sites remain on the list of problem areas and have not been corrected.

20-02 — Village of Beach Park, area west of Sheridan Road between Center Street and Wyer Street. Inadequate outlets and poor drainage cause flooding that may affect six homes, one of which suffered approximately $17,695 of damage in 1986. Coolidge Avenue to the north has a new storm sewer that was installed to help alleviate flooding. The Howard Avenue project to the west (now a wet area) drains to this site. If flooding persists, additionial solutions may include improvement of drainage overland flow paths and installation of additional storm sewer capacity to alleviate the problem.

20-04 — Village of Beach Park, area bounded by North Avenue (north), New York Road (east), and Lewis Avenue (west). An inadequate drainage system causes sewer backup in 3-6 homes. A large pipe and ditch was installed as part of the Monarch Point development to the north, yet it is unclear if this fixed the problem. Sewer backups can be addressed with one-way flow valves in homes, or by improving the drainage capacity of the surrounding sewer and detention system.

20-05 — Village of Beach Park, Church at MacArthur, Lake Crest, and Chestnut Streets. The open ditch and culvert capacity, particularly the culvert under Yorkhouse Road, are inadequate and causing roads, three homes, and backyards to flood. No remedial action has been taken. Increasing the drainage capacity of the culvert and open ditch may provide the most feasible option to help alleviate flooding, though there also seems to be enough open space in the area to construct additional detention capacity as well.

20-06 — City of Waukegan, Lake County Gardens, Section 4, area bounded by Lewis Avenue (west), Blanchard (south), the McClory Bike Path (east), and the utility easement (north). This subdivision is reportedly developed on a depressional area (wet ground) and experiences street and backyard flooding and sewer backups. A site-specific mitigation plan was completed in 2004. Though no remedial action has been taken to resolve the flooding problem yet, a new floodplain study has resulted in correcting the floodplain map in this area. See detail description in “Lake County Gardens Subdivision” below. There may be opportunities to increase the detention and/or drainage capacity of the drainage system in this area, particularly within the community park to the north. However, improvement of the wetlands to increase their storage capacity may also be an option.

20-13 — City of Zion, Lydia Park Manor, north of 25th Street on Matthew Place. Matthew Place and 20 to 22 homes flood due to runoff from the west. A study of the area was completed and submitted to SMC and, according to the FPAI report, the city is working with SMC to resolve the problem. There may be opportunities within David Park and school property west of the problem area to help retain and reduce runoff and flooding, such as installation of a detention basin or infiltration practices.

Corrected Flood Problem Area Inventory Sites

These sites have been removed from the list of problem areas due to mitigation and/or correctional measures.

20-01— Village of Beach Park, area bounded by Waldo Avenue (north), Wadsworth Road (south), Evergreen Road, and McAree Road. Poor drainage causes a business at NE corner of McAree and Wadsworth, three homes on Waldo, and one home on McAree to flood. The county replaced a culvert under Wadsworth Rd., and re-graded a ditch to allow stormwater to reach the culvert, which corrected the problem.

20-03 — Village of Beach Park, area bounded by Beach Road (north), Highwood Road (south), Wilson Road (east), and North Shore Road (west). There have been reports of roads closed, damage or potential for damage to 12 homes, and sewer back-up due to poor drainage / inadequate conveyance capacity and possible infiltration into the sanitary sewer system causing surcharge. Work by the drainage district and the village included installation of a 48 inch storm sewer and improvement to an existing storm sewer in 1990, which corrected the problem. However, the stream channel needs to be cleaned of excess debris.

20-07 — City of Zion at 30th Street and Lewis Avenue. Poor drainage caused flooding of two lots and buildings, and some roadway flooding. A swale was constructed in 1999 to create positive drainage, which corrected the problem.

20-08 — City of Zion, area bounded by 25th Street (north), 21st Street (south), Galilee Road (east), and Lewis Avenue (west). Sewer back-up problem threatens 30-50 homes. A sanitary sewer relief main was installed in 1995, which corrected the problem.

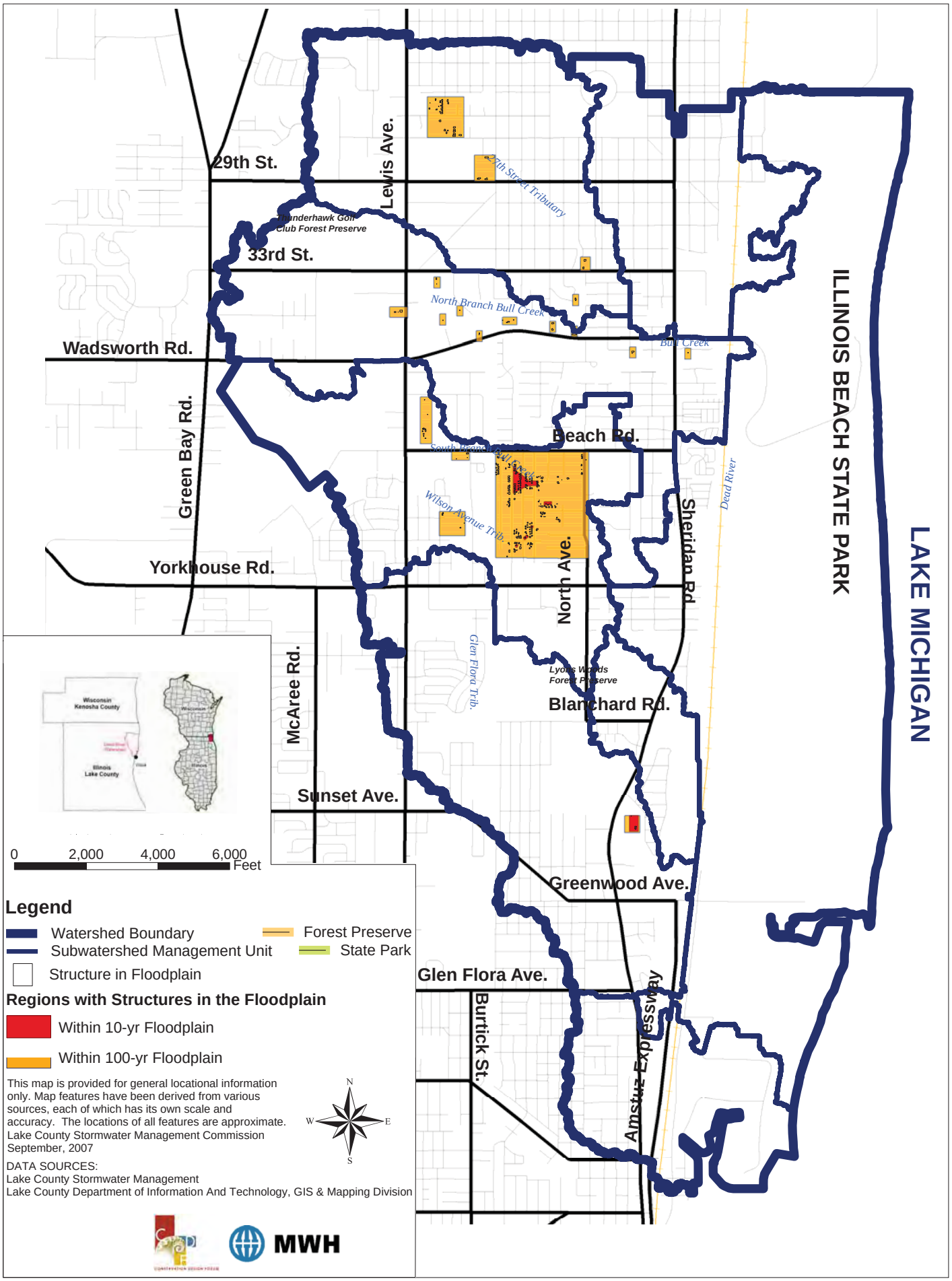


FIGURE 3.46 FLOOD STRUCTURES

20-10 — City of Zion, Galilee Avenue to Ezra Avenue and north and south alleys of Carmel Avenue between 34th Street and south Carmel Avenue alley; also alley between Gideon Avenue and Gabriel Avenue from Lebanon to south Carmel Avenue alley. Sewer back-ups in 20-30 homes were found to be caused by a sanitary sewer clogged with tree roots, which were removed in 1998 correcting the problem.

20-11 — Village of Beach Park, North Avenue from Hendee Street to Bull Creek. An undersized system caused flooding of 12 residences, which also exhibited septic problems. Drainage upgrades were installed in 1995, which corrected the problem. Some standing water still occurs in the ditches.

Lake County Gardens Subdivision

In 2004, the Lake County Stormwater Management Commission provided funding to the City of Waukegan studied flooding problems in the Lake County Gardens Unit 4 Subdivision, bounded by Lewis Avenue on the west, Blanchard to the south, the McClory Bike Path to the east, and the utility easement to the north, in Waukegan and unincorporated Lake County.

The topography of this area is relatively flat, lacking well defined overland flow paths to the North Shore Ditch and containing depressions where surface flooding has historically occurred during significant storm events. Flooding problems included sanitary sewer backups into basements, ponding in streets and yards, and overbank flooding from the North Shore Ditch (reach ID BL04). In some areas sanitary sewer backups occur 1-2 times per year, ponding of backyards and street intersections happen about once a year, and overbank flooding happens about once in ten years.

An evaluation of the problem and the existing conditions of the area landscape and the sanitary and stormwater management systems revealed a few interesting points, as noted below. Solutions to the overall flooding problem, and not specifically identified with each of the points below, follow.

- In several locations the existing network of storm sewers and detention facilities does not have adequate conveyance or storage capacity to effectively release or detain flows during significant rain events, causing water to pond in low lying streets and backyards and to overflow the North Shore Ditch channel. This condition

Table 3.24 Illinois Department of Transportation Flood Locations

Location	Dates of flooding
7-8-93	Sheridan at Gangster Road to Blanchard Road
8-3-95	Sheridan at Gangster Road to Blanchard Road
5-10-96	Sheridan at Wadsworth Road
6-17-96	Sheridan at Gangster Road to Blanchard Road
6-27-98	Sheridan at Wadsworth Road
10-17-98	Sheridan at Michigan Boulevard
11-10-98	Sheridan at Wadsworth Road
11-10-98	Sheridan at Gangster Road to Blanchard Road
6-5-00	Sheridan at Beach Road
5-27-00	Sheridan at Gangster Road to Blanchard Road
5-22-00	Sheridan at Gangster Road to Blanchard Road
10-24-01	Sheridan at Gangster Road to Blanchard Road
7-22-01	Sheridan at Gangster Road to Blanchard Road
10-13-01	Sheridan at Gangster Road to Blanchard Road
10-13-01	Sheridan at Wadsworth Road
10-24-01	Sheridan at Wadsworth Road
5-11-03	Sheridan at Gangster Road to Blanchard Road
5-11-03	Sheridan at Wadsworth Road
10-23-04	Sheridan at Gangster Road to Blanchard Road
10-23-04	Sheridan at Wadsworth Road
1-2-06	Sheridan at Yorkhouse Road

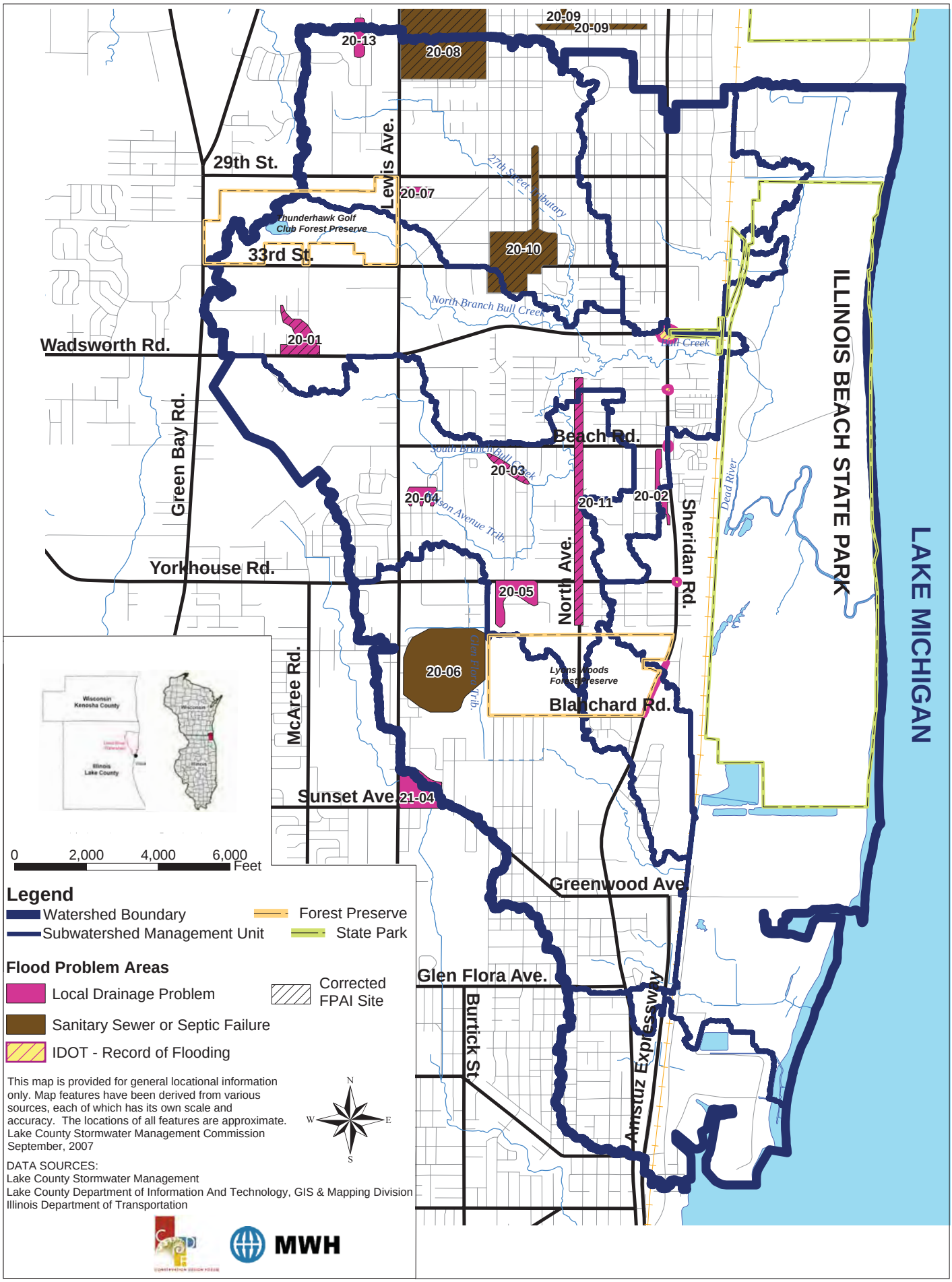


FIGURE 3.47 FLOOD PROBLEM AREA INVENTORY

is compounded by the lack of an overland flow path for floodwaters to leave this area and flow downstream.

- The existing Federal Emergency Management Administration flood insurance mapping prepared in the early 1980's was based on incorrect topographic information that resulted in a larger-than-actual floodplain and included 112 homes in the floodplain. The updated floodplain model resulted in 60 homes being included in the floodplain.
- Sanitary sewer backups into homes are likely due to inflow and infiltration of stormwater into the sanitary sewer system, causing that system to surcharge.
- Surrounding wetlands were found to contain approximately 1.9 acres (83,000 sq ft) of fill, which reduces their stormwater retention capacity and degrades their quality.

Possible suggested solutions to the flood problems include:

- Provide release structures from the North Shore Ditch to allow water to flow into the natural areas east of the McClory bike path.
- Increase natural storage capacity by removing fill from wetlands or excavating within the utility corridor.
- Increase conveyance capacity of the stormwater system by replacing inlets and culverts.
- Lower the floodplain elevation by installing relief sewers and/or excavating within the floodplain to provide additional storage capacity.
- Flood-proofing by sealing basement windows or doorways in homes, separating sanitary and storm sewer systems, and installing one-way valves in floor drains.
- Remap the floodplain based on better topographic and hydrologic data, which will remove approximately 52 homes.

IDOT Roadway Flooding Reports

The Illinois Department of Transportation records pavement flooding problem data for Illinois roadways. In the Dead River watershed, Illinois Route 137 (Sheridan Road) has experienced flooding according to Table 3.24.

3.15.3 DESIGNED DRAINAGE SYSTEM

The designed drainage system for the Dead River watershed began with field tiles used to drain farm fields. Today, this system includes a combination of constructed storm sewer infrastructure, detention basins, and surface drainage (mostly roadside ditches and swales). Most of the watershed is served by storm sewers, as shown in Figure 3.48, with the exception of Beach Park, which has very few stormsewers, and a few unsewered areas around 33rd St., Wadsworth Road, and Beach Road. Many of these areas were constructed before the adoption of the Lake County Watershed Development Ordinance, which requires stormwater management practices for new development, and some of them lack detention basins. Surface drainage is also found in older developments where there are no storm sewers. Surface drainage tends to filter, infiltrate, and cleanse stormwater more than stormsewers, slowing down and cleaning runoff before being discharged to the stream.

3.15.4 DETENTION BASIN INVENTORY

The detention basin inventory for the Dead River watershed, completed in 2007, captured the status of many of the watershed detention areas, including a few natural ponds and depressions that are not detention areas. A number of detention basins or ponds (with identification #s in the 200s) were not captured during the initial inventory and were located through an assessment of recent aerial photographs. The results of the detention basin inventory are displayed on Figure 3.49 and included in Appendix E. For Figure 3.49, a Problem Basin is defined as having one or more of the following characteristics:

- dry bottom detention basins (do not provide multiple benefits or improve water quality)
- turf grass, rip rap, or bare dirt side slopes (tend to erode and do not provide water quality improvement or habitat benefits)
- turf grass or very narrow buffer zone around the basin (provides little natural habitat)
- broken or clogged inlet or outlet pipe (impair function of the basin)
- steep and/or eroding shoreline (tend to erode if not stabilized)
- presence of algae (indicates high nutrient content in water and possibly impaired function)
- high sedimentation as determined by water cloudiness (indicates an erosion or sedimentation problem)
- concrete in the basin bottom (reduces ability of basin to act as habitat)

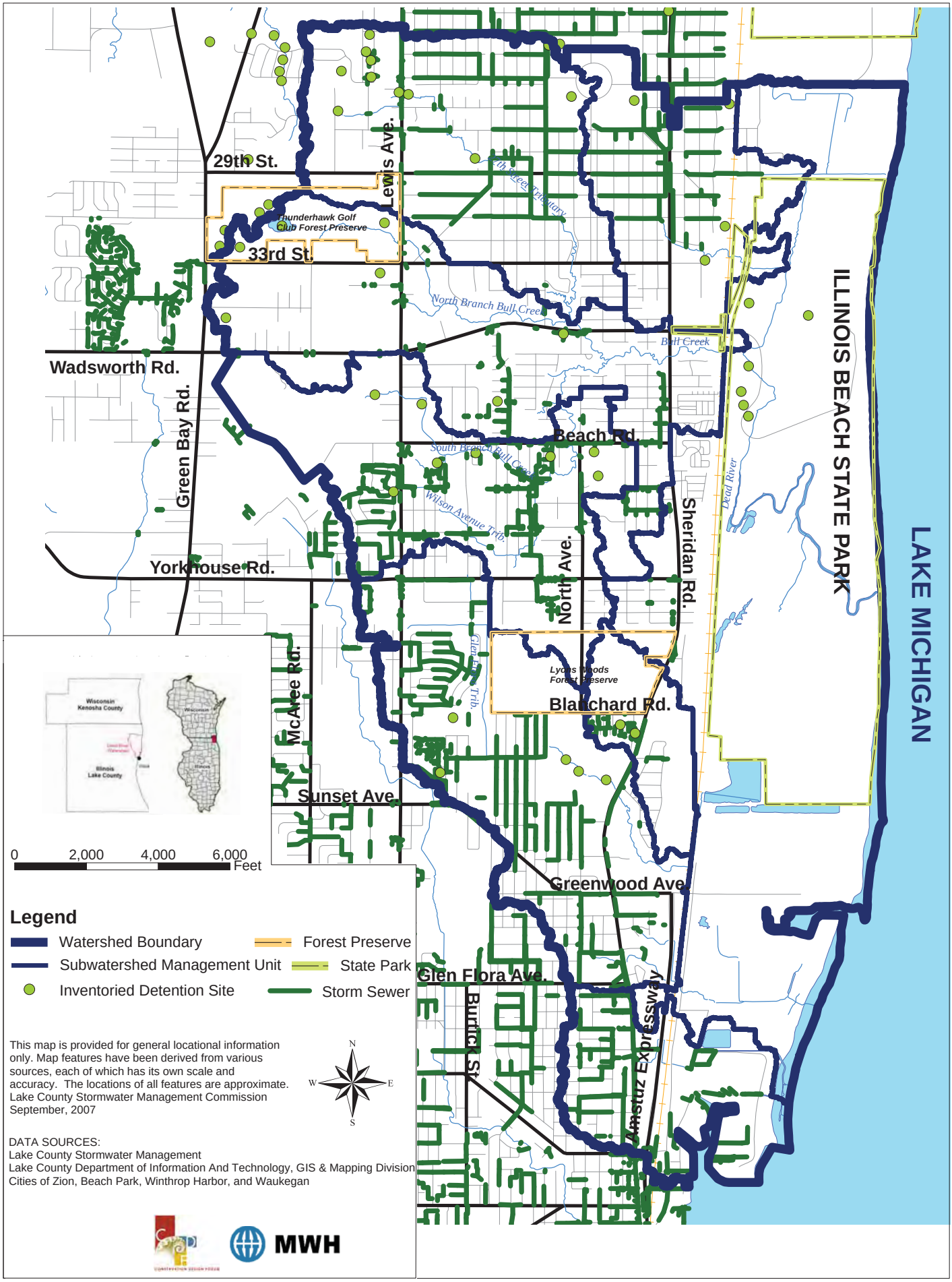


FIGURE 3.48 DRAINAGE NETWORK

- excessive debris, garbage, or woody vegetation (can impair basin function and appearance)

Of 71 total detention basins identified in the watershed, 11 were not detention basins, 17 were not assessed for a variety of reasons including lack of access, and 41 were inventoried. Of those inventoried, 33 were built before the WDO and 8 after. Of those not assessed, 11 were built before the WDO and 6 after. Of 41 detention basins inventoried dentified, 37 received recommendations for improvement.

Many of these recommended improvements are intended to retrofit single-function basins to be multi-functional features, in other words, to provide habitat, water quality, and aesthetic benefits rather than solely for stormwater detention. Recommendations to improve the water quality benefits and appearance of these basins included:

- retrofitting dry basins into wet basins that hold a permanent pool of water, which provides habitat for birds and aquatic creatures and improves water quality by allowing pollutants to settle out and be absorbed by plants and microorganisms.
- planting native vegetation on basin banks and buffer zones to help filter and absorb stormwater, stabilize basin banks with natural practices, and to provide habitat.
- addressing clogged, broken, or otherwise impaired inlet / outlet problems to enhance the flow of water and basin function.
- improving water quality by addressing turbidity and algae and removing excessive debris such as leaves and litter.

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This dry-bottom stormwater detention basin has been overtaken by reed canary grass, a common wetland invader.

3.15.5 REGIONALLY SIGNIFICANT STORAGE LOCATIONS

Regionally Significant Storage locations are defined as depressional areas or potential depressional areas (i.e. flat open spaces which could be excavated to form depressional

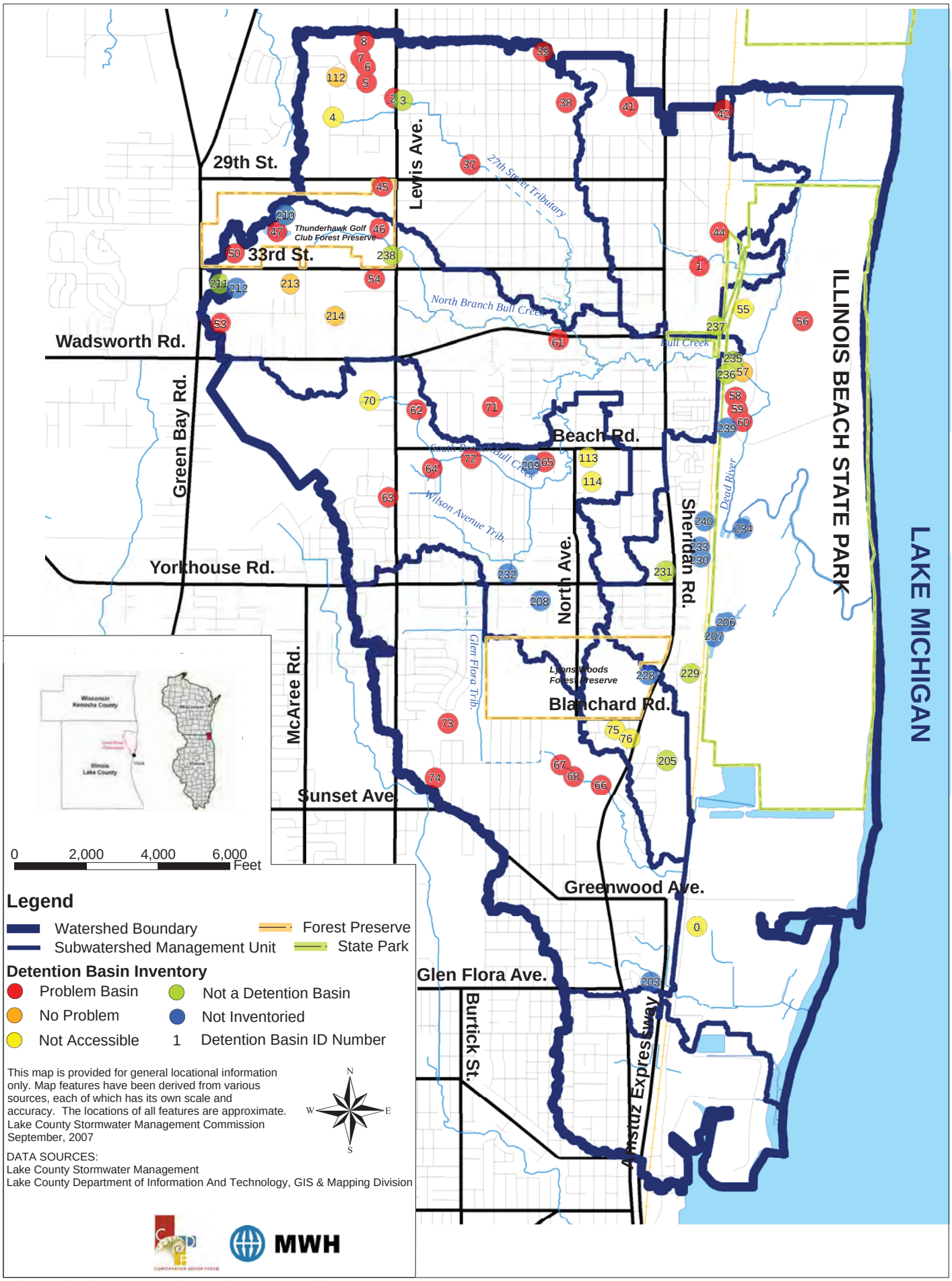

FIGURE 3.49 DETENTION BASIN INVENTORY

areas) with a total surface area of 5 acres or greater. These areas were identified within the watershed using the most recent 2-ft contour mapping of the study area. Depressional Storage areas between 2 and 5 acres are also identified as storage locations, but are not considered 'regionally significant'. A map of the locations of the Regionally Significant and Depressional Storate areas, as well as Potential Storage areas, appears on Figure 3.50. A summary of the number and approximate area and volume of storage areas is provided in Table 3.25.

Storage areas are of interest to the watershed plan due to their function as spots where water normally collects during high water runoff events, including a number of wetlands and hydric soil areas. Since these areas do or may collect and store excess water, they are at risk for flooding. And because modification such as filling and development reduces the ability of these areas to store water, alteration can cause water to flow elsewhere, where it can cause property or other damage. These areas also are potential locations for installing best management practices designed to improve water quality.

Source: Lake County Flood Problem Area Inventory.

Bull Creek Flood Study, Lake County SMC, 2007.

Lake County All Hazards Mitigation Plan.

Lake County Stormwater Management Commission Stream Inventory, 2001.
Lake County Gardens Subdivision – Site Specific Flood Mitigation Planning, Lake County Stormwater Management Commission, Illinois;

Illinois Department of Transportation Flooding Reports, various years, September 22, 2006 letter transmittal to SMC from Richard Wojcik, Hydraulics Section Chief, IDOT.

Table 3.25 Regionally Significant Storage Areas

Storage	Approx Storage Area (acres)	Approx Storage Volume (acre-ft)	Number of Areas
Depressional Areas (2-5 acres)	390	1,066	13
Regional Storage Areas	47	80	28
Potential Regional Storage Areas	67	-	6

3.16 WATERSHED VULNERABILITY ANALYSIS

The planning team conducted a Watershed Vulnerability Analysis (VA) to help understand how stream quality relates to the subwatershed area that drains to a particular stream

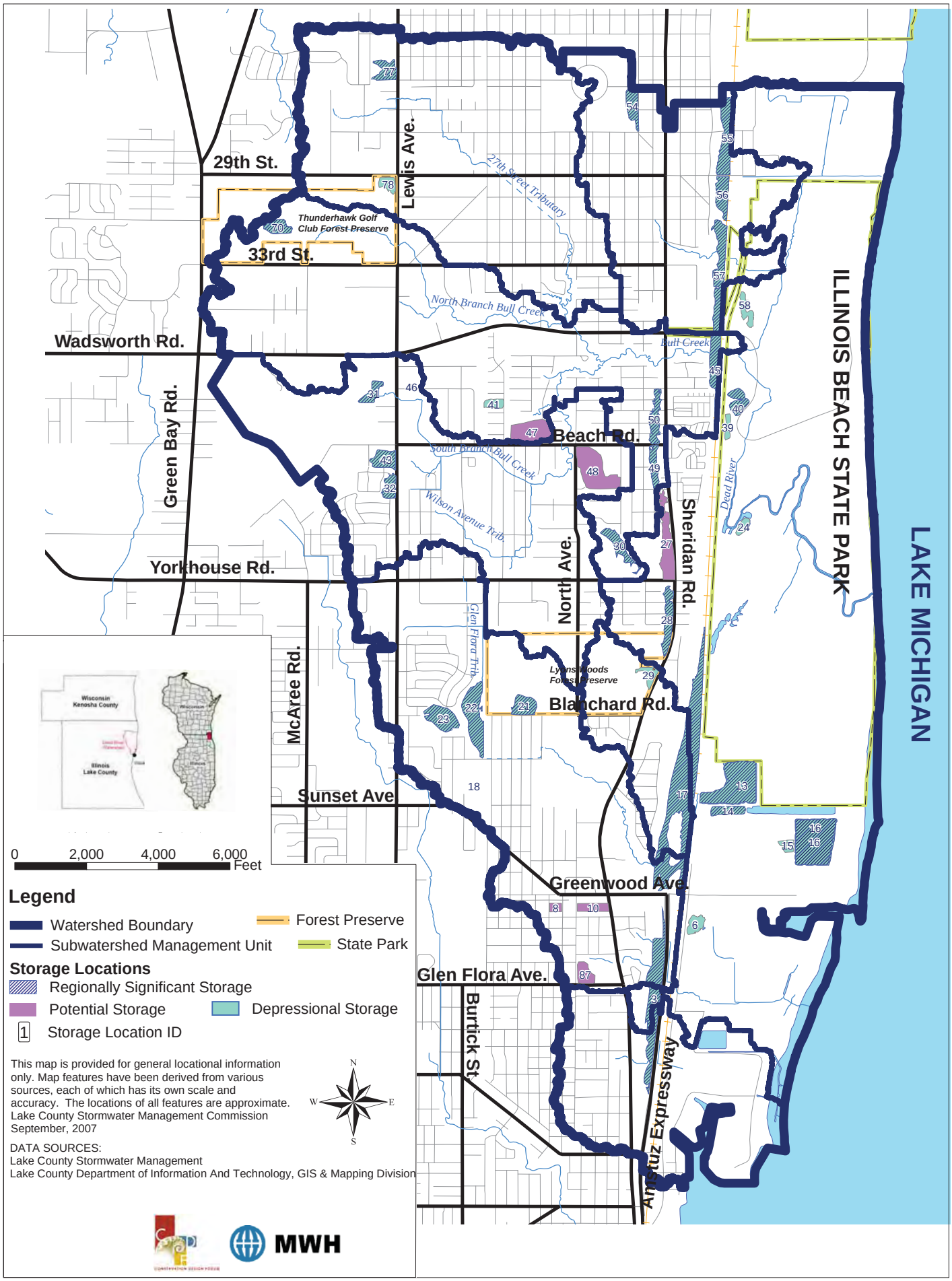

FIGURE 3.50 REGIONAL AND DEPRESSIONAL STORAGE

reach. This analysis uses the subbasins described in Section 3.13.2 above and illustrated in Figure 3.25. The objective of the Vulnerability Analysis is to identify watersheds and stream corridors that are particularly vulnerable to future degradation resulting from changing land use. Knowing which streams and subwatersheds are vulnerable provides information for prioritizing actions in these locations.

The Vulnerability Analysis used by the planning team is based on the well-established belief that as the percentage of watershed imperviousness increases with increasing urbanization, the quality of physical, chemical, and biological conditions of streams within the watershed decreases. It also assumes that many of the characteristics and qualities of a stream corridor are the cumulative result of what happens in the subbasin that flows to that reach as well as what happens upstream of that reach.

The following analysis methodology is based on that developed by the Center for Watershed Protection, which has been modified to use different ranking criteria that are more appropriate for this watershed. The watershed vulnerability analysis assesses two watershed elements: stream vulnerability and subbasin vulnerability.

3.16.1 STREAM VULNERABILITY ANALYSIS

Each of the stream reaches was assessed to determine whether the subwatershed draining to that reach currently supports healthy stream conditions or whether the characteristics of the subwatershed are expected to degrade conditions in the stream and riparian corridor. For the purposes of this analysis, the subwatershed being assessed is not simply the subbasin through which the stream flows, but the entire upstream subwatershed that drains to a particular reach, which may be comprised of one or many subbasins. In very simple terms, a subwatershed in its natural, predevelopment condition will support a healthy stream, and a subwatershed that is highly urbanized will cause significant degradation of the stream. The basis of this analysis is the percentage of imperviousness within each subbasin, which is based on Lake County land use data. The analysis steps were as follows.

Step 1. Determine whether a subwatershed supports or does not support healthy stream conditioins by calculating the percentage of impervious cover within all subbasins

Table 3.26 Current and Future Subwatershed Support Level

Subwatershed Support Level	% Imperviousness	Current # of Subbasins	Future # of Subbasins
Supporting	0 to 10%	15 (19%)	8 (10%)
Impacting	11 to 25%	29 (38%)	10 (13%)
Non-Supporting	25% or more	33 (43%)	59 (77%)

Table 3.27 Instream Habitat Criteria

Criteria	Characteristic needed to meet criteria
Channelization	No channelization
Pool & riffle development	Medium or high degree of pools and riffles
Armoring	None or low degree of armoring
Sediment accumulation	None or low sediment accumulation
Substrate composition	Gravel, sand, and cobble make up greater than 50% of substrate composition
Instream cover	Presence of 3 or more cover elements (undercut banks, deep pools, overhanging vegetation, logs, rootwads, boulders)
Streambank erosion	Low or no streambank erosion

Table 3.28 Stream Reach Quality and Subbasin Support Level

Category	Stream reach color
High Quality Stream Supporting Watershed (HQSW)	Dark green
High Quality Stream Impacting Watershed (HQIW)	Medium green
High Quality Stream Non-Supporting Watershed (HQNW)	Light green
Low Quality Stream Supporting Watershed (LQSW)	Light red / pink
Low Quality Stream Impacting Watershed (LQIW)	Medium red
Low Quality Stream Non-Supporting Watershed (LQNW)	Dark red

Table 3.29 Stream Vulnerability

Stream Category	Count	Reaches	Suggested Response
High Quality Stream + Supportive Subwatershed	0 (0%)	-	Preventive actions designed to maintain low subbasin imperviousness and preserve stream conditions
High Quality Stream + Impacted Subwatershed	12 (43%)	BL06 BL07 BL08 BL15 BL17 BL18 BL19 BL20 BL21 BL22 BL23 BL24	Preventive and remedial actions designed to maintain or reduce the impact of subbasin imperviousness and to preserve stream conditions
High Quality Stream + Non-Supportive Subwatershed	5 (18%)	BL02 BL03 BL25 BL27 BL28	Remedial actions to reduce the impact of watershed imperviousness and preventive actions to preserve stream conditions
Low Quality Stream + Supportive Subwatershed	0 (0%)	-	Remedial actions to restore stream conditions and preventive actions to maintain low subbasin imperviousness
Low Quality Stream + Impacted Subwatershed	9 (32%)	BL01 BL05 BL09 BL10 BL11 BL12 BL13 BL14 BL16	Remedial actions to restore stream conditions and preventive and remedial actions to maintain or reduce the impact of subbasin imperviousness
Low Quality Stream + Non-Supportive Subwatershed	2 (7%)	BL04 BL26	Remedial actions to restore stream conditions and minimize impact of subbasin imperviousness

Table 3.30 Subbasin Vulnerability

Watershed Vulnerability	Change in Support Level	Color	Count
Not Vulnerable	No decrease in support level	Green	45 (58%)
Moderately Vulnerable	one step decrease in support level (i.e., supporting to impacting or impacting to non-supporting)	Yellow	31 (40%)
Highly Vulnerable	two step decrease in support level (i.e., change from supporting to non-supporting)	Orange	1 (1%)

that drain to a particular stream reach. Each subbasin is then assigned a subwatershed support level based on its percentage of impervious cover according to Table 3.26.

Step 2. Determine the habitat quality of each stream reach according to the number of instream habitat quality criteria met, as described in Section 3.13.3 above. High quality stream reaches meet 5 to 7 of the instream habitat quality criteria, and low quality reaches meet less than 5 of the habitat criteria. The 7 criteria assessed, and the characteristic needed to be considered "meeting" the criteria, are included in Table 3.27.

Step 3. Classify and map each subwatershed and stream reach based on the current subwatershed support level and stream reach habitat quality as listed in Table 3.28 and mapped in Figure 3.51.

Figure 3.51 displays the results of the stream prioritization analysis, showing high quality and low quality stream reaches and whether the respective subwatersheds are supportive, impacted, or non-supportive based on subwatershed imperviousness.

As shown in Table 3.29, there are no Supportive Subwatersheds containing stream reaches that were assessed as part of this study. Of the 28 stream reaches, 17 (61%) are considered High Quality and 11 (39%) are Low Quality. For High Quality stream reaches, it is important to take action to preserve habitat conditions and to prevent stream degradation to Low Quality due to subwatershed influences. Impacted and Non-Supporting Subwatersheds will degrade streams if action is not taken to reduce the conversion of pervious to impervious surfaces, and to reduce the impact of impervious surfaces that already exist.

For the 11 Low Quality stream reaches, stream habitat restoration actions are necessary to improve the quality of these reaches. And, as above, Impacted and Non-Supporting Subwatersheds will degrade streams further if action is not taken to reduce the conversion of pervious to impervious surfaces, and to reduce the impact of impervious surfaces that already exist.

3.16.2 SUBWATERSHED VULNERABILITY ANALYSIS

Subbasins were assessed to identify those areas planned to undergo significant land use change and change in impervious surface percentage between the present and 2020. This analysis helps determine locations where runoff volumes and pollutant loads are expected to increase significantly due to changing land use, which would also result in a decrease in stream habitat quality. The analysis steps were as follows.

Step 1. Determine the current subbasin support level by calculating the percentage of impervious cover within all subbasins that drain to a particular stream reach, as done in Step 1 above. Each subbasin is then assigned a watershed support level based on its percentage of impervious cover, according to Table 3.27.

Step 2. Determine the future subbasin support level using planned future land uses and their associated imperviousness figures. Each subbasin is then assigned a future support level based on future impervious cover according to Table 3.27.

Step 3. Assign each subbasin a level of vulnerability that is based on whether the subbasin is expected to change its support level due to future land use change, as shown in Table 3.30 and mapped in Figure 3.52.

Figure 3.52 overlays the results of the stream prioritization analysis on the results of the subwatershed vulnerability analysis. As Table 3.30 indicates, if the watershed develops as planned, six subwatersheds (8%) will move from Supporting to Impacting support level, and 19 subwatersheds (25%) will move from Impacting to Non-Supporting support level. Only one subwatershed (#35, which is very small and difficult to see on the maps) would shift from Supporting to Non-Supporting. This change would result in an overall shift of 32 (41%) of subwatersheds to a lower level of support for stream health, which are indicated on Figure 3.52 as yellow (Moderately Vunlerable) and orange (Highly Vulnerable).

For these Moderately and Highly Vulnerable subwatersheds, it is important that development use conservation design and low impact development practices to reduce the amount and impact of impervious surfaces and to help filter and infiltrate stormwater runoff onsite. These practices are further explained in Chapter 4 Watershed Management Toolbox and Appendix F.

In order to generate specific recommendations for addressing the results of this analysis, the planning team identified Highly Vulnerable subwatersheds and Low Quality reaches with Supporting or Impacting subwatersheds as Critical Subbasins and Reaches that require the most immediate

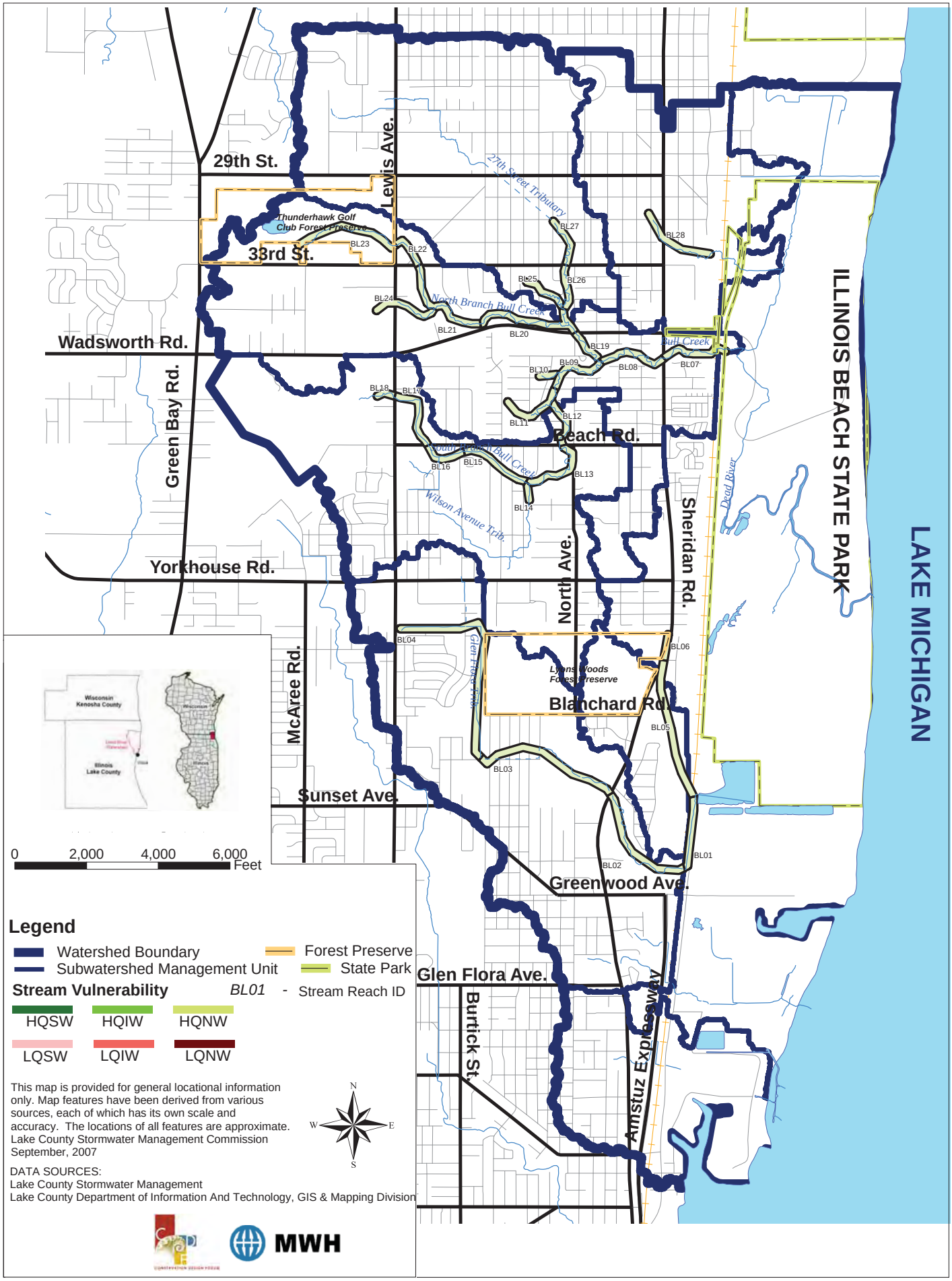

FIGURE 3.51 STREAM VULNERABILITY

attention. These Critical Areas are discussed in the next section, and recommendations for improving conditions within these areas are detailed in Chapter 5.

3.17 CRITICAL AREAS

The intent of identifying Critical Areas is to focus watershed improvement efforts on areas where impairments are concentrated or relatively worse than in other areas of the watershed. Restoration, prevention, and remediation efforts in these Critical Areas are expected to achieve a greater impact than in less critical parts of the watersheds. The Critical Area analysis identified three different types of Critical Areas: Critical Subbasins, Critical Reaches, and Critical Regions, as described below. These results, and recommendations for watershed improvement, have been incorporated into the watershed Action Plan.

3.17.1 CRITICAL SUBBASINS

Critical Subbasins are those that have particularly strong impact on watershed resources and water quality due to the type and extent of current and planned development. These subbasins will require action to reduce the impact of existing impervious surfaces, as well as actions to prevent impacts of planned impervious surfaces. Critical Subbasins, listed in Table 3.31 and shown on Figure 3.53, include the following:

1. 'Hotspot' subbasins identified from the nonpoint source pollutant loading model results. Due to the relatively high contribution of pollutants to the stream from these subbasins, and the importance of addressing these sources as priorities within the action plan, these subbasins are considered critical.

2. Highly Vulnerable subbasins identified during the Vulnerability Analysis. These subbasins are critical due to the potential conversion of land to greater imperviousness and the consequent impact on water resources.

3.17.2 CRITICAL REACHES

Critical Reaches are those that have been impacted due to the influences of the subbasins that feed them, to significant streambank erosion problems, and to low habitat quality. These reaches will require restoration of the channel and riaparian areas, which will help improve water quality. Critical Reaches, listed in Table 3.32 and shown on Figure 3.53, include the following:

1. Low Quality stream reaches being fed by Supporting or Impacted watershed drainage areas as identified in the Vulnerability Analysis. These reaches exhibit poor in-stream habitat conditions but are fed by subwatersheds that have the potential to support high quality streams based on subwatershed imperviousness, thus indicating the potential for stream restoration activities to be effective and successful. Reaches with Non-supporting watersheds are not included as Critical Reaches due to the difficulty of restoration when subwatershed conditions may not support it. High quality reaches are not included as Critical Reaches due to their relative healthy state and the complexity of identifying and detailing restorative measures for specific areas.

2. Stream reaches exhibiting High or Severe streambank erosion and reaches within ravines. These reaches have the greatest potential to contribute significant impairment of water resources, whether by erosion and sedimentation or by property and infrastructure damage, and are thus high priority areas for watershed restoration.

3. The 20% of stream reaches most impacted by problem points, in other words, the highest number of 'problem points' per 1000 linear feet of stream, as identified during the SMC stream inventory and assessment of stream photographs taken during the stream inventory. These 'problem points' are defined as follows:

   i. Point discharges exhibiting erosion, failed infrastructure or armoring, debris or sediment buildup, or other identified problem.

   ii. Hydraulic structures exhibiting erosion, failed infrastructure or armoring, debris or sediment buildup, or other identified problem.

   iii. Instream problem areas (as identified through photographic assessment) exhibiting erosion, failed infrastructure or armoring, debris or sediment buildup, or other identified problem.

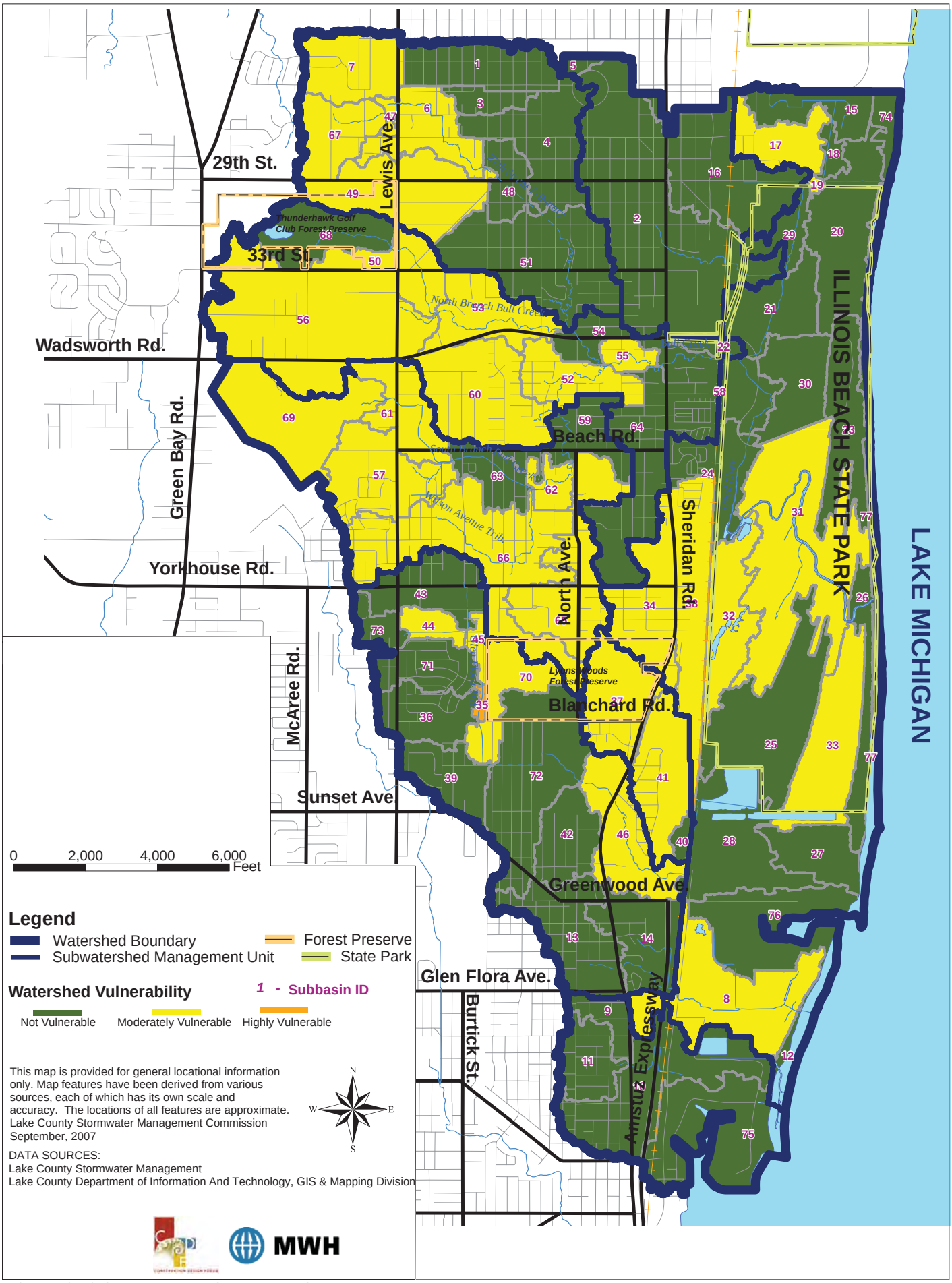

FIGURE 3.52 STREAM AND SUBWATERSHED VULNERABILITY

3.17.3 CRITICAL REGIONS

Critical Regions are those that are not geographically defined as a subbasin or a stream reach, but exhibit particular management challenges for watershed stakeholders. Critical Regions will require attention as they undergo planned land use change, as this change can significantly impact watershed resources if not done in an appropriate way. Critical Regions, listed in Table 3.31 and shown on Figure 3.53, include the following

1. The area within SMU #1 within and surrounding the Waukegan Harbor Area of Concern where former or current industrial uses have the potential for contributing toxic substances to water resources.

2. The area within and around the Zion Nuclear Power Plant site (SMU #1), which is located at a critical juncture between the North and South units of Illinois Beach State Park and is planned to be redeveloped as residential land use. Appropriate redevelopment of the site, and / or the integration into Illinois Beach State Park, can strengthen the watershed natural resource base.

These Critical Subbasins, Critical Reaches, and Critical Regions are identified within the Action Plan recommendations table and should be considered as priority areas for the watershed.

3.18 SUMMARY AND CONCLUSIONS

The Dead River watershed inventory and assessment provides important insight into the issues and problems in the watershed and the opportunities available for preserving

Table 3.31 Critical Subbasins and Regions

SMU	Hotspot Subbasins	Highly Vulnerable Subbasins	Critical Regions
1	15, 74, 76	-	Zion Nuclear Power Plant site; Waukegan Harbor Area of Concern
2	-	-	
3a	1, 3, 4, 48	-	
3b	69, 57, 63, 59	-	
3c	64	-	
4	40	-	
5	73, 43, 13, 14	35	
6	11, 10, 75	-	

Table 3.32 Critical Reaches

SMU	LQSW / LQIW Reaches	Severe Erosion + Ravine Reaches	Problem Reaches (worst 25%)
1	BL01	-	-
2	-	BL28	-
3a	-	BL27 BL26 BL25	BL27
3b	BL12 BL13 BL14 BL16	BL12 BL13 BL14 BL15 BL16	BL12 BL13 BL15
3c	BL09 BL10 BL11	BL07 BL08 BL09 BL10 BL11 BL19 BL20 BL21	BL07 BL08 BL09
4	BL05	BL05	-
5	-	-	-
6	-	-	-

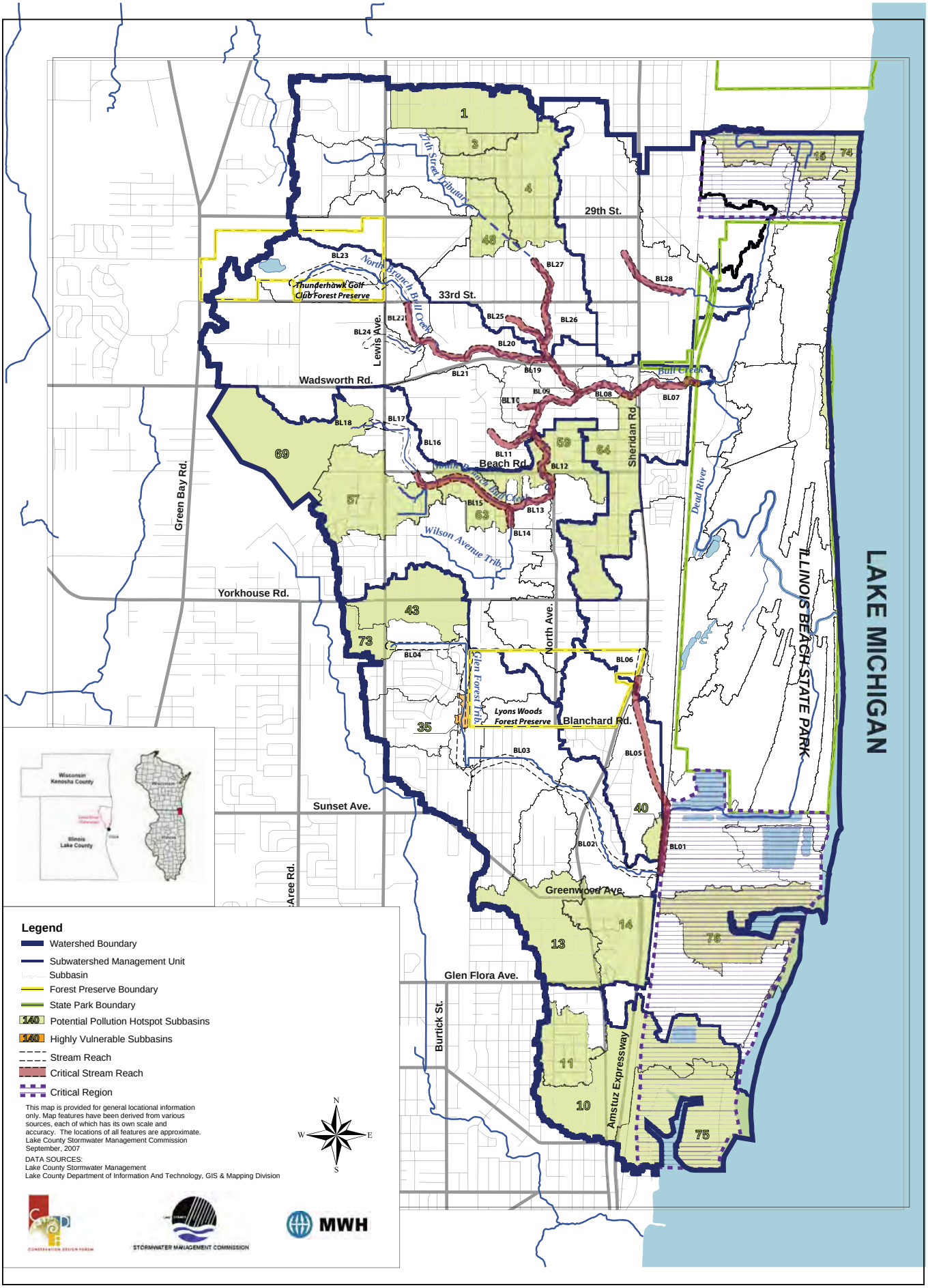

FIGURE 3.53 CRITICAL AREAS

and improving watershed resources. The vast majority of the impacts and impairments to watershed resources identified above are the result of years of modification of the stream and from a landscape changing from natural to agricultural to urban. The impacts of this changing landscape on watershed resources are summarized here and actions for addressing these impacts are included in the Action Plan in Chapter 5.

It is important to identify potential causes and sources of impairment in the watershed so that preventive and remedial measures can be planned and implemented. The issues, causes and sources identified below and in Table 3.33 are based on the best professional judgment of the planning team based on the watershed inventory assessment and input from the watershed planning committee. Thus, they should be considered as potential rather than confirmed until additional sampling and surveying can be done.

The causes and sources of impairment displayed in Table 3.33 are selected primarily from a more complete list included in the Illinois Environmental Protection Agency 305(b) and 303(d) water quality reports and supplemented to a limited extent by professional opinion. Table 3.33 includes those impairments, causes, and sources that are most relevant to the Watershed-Based Plan nine element requirements of the United States Environmental Protection Agency. Nonetheless, although the table does not include all of the issues and problems identified below, they all have been addressed within the Action Plan included in Chapter 5.

Water Quality

The most important water quality issues that need to be addressed include the following.

- low dissolved oxygen concentrations due to low flow and the lack of adequate stream habitat features to help oxygenate the water;
- sedimentation of stream channels within low gradient reaches, especially Illinois Beach State Park, that is the result of streambank erosion and runoff from the urban landscape including roads and highways;
- elevated chloride levels resulting from application of salt for snow and ice control on roads, as well as other toxic substances in the water column from urban runoff form impervious surfaces including roads and highways;
- bacterial contamination of Lake Michigan beaches, primarily from gull populations but also from other sources;
- moderate nutrient levels leading to algae blooms within areas of ponded or slow moving water, particularly within Illinois Beach State Park, resulting from urban runoff and inappropriate disposal of yard waste along the stream channel.

Stream Channels

The most important issues related to stream channels that need to be addressed include the following.

- streambank erosion resulting from flashy hydrology, unstable streambanks, and stormwater discharges;
- stormwater discharges from residential and municipal stormwater management systems that cause erosion of the streambanks and stream channel;
- streambank and stream channel armoring that is intended to control erosion but is not designed, installed, or maintained adequately, resulting in erosion problems;
- debris buildup and obstruction within the stream channel that is the result of streambank erosion and dislodged trees and vegetation;
- sedimentation buildup in low gradient stream channels, particularly Illinois Beach State Park;
- channelized and incised stream channels;
- loss / lack of habitat characteristics such as pools and riffles and healthy channel substrates.

Riparian Corridors

The most important riparian corridor issues that need to be addressed include the following.

- inappropriate management of riparian land uses, such as turf grass to the water or stream bank edge, which destabilizes streambanks and provides no water quality or riparian habitat benefits;
- dumping of yard waste along the stream banks, which smothers ground level vegetation and adds organic matter and nutrients to the water;
- narrow riparian buffers
- a dense tree and shrub canopy along the streambanks and riparian corridor that shades ground cover, exposing soils to erosion.

Ravines

The most important issues related to the watershed ravines that need to be addressed include the following.

- inappropriate land and water management by landowners, including dumping of yard waste and a dense tree canopy that shades out stabilizing ground

Table 3.33 Watershed Impairments, Causes, and Sources

Impairment	Causes	Sources
Water Quality	Total suspended solids / sedimentation and siltation	Urban runoff / storm sewers
		Streambank modification and destabilization
		Inappropriate land management
		Highway / road / bridge runoff
Water Quality	Low dissolved oxygen	Habitat modifications / lack of habitat features
		Hydrologic disturbance / flow alteration (low flow)
Water Quality	Nutrients (phosphorous)	Urban runoff / storm sewers
		Agricultural activity / golf courses
		Inappropriate waste disposal (e.g., yard waste)
Water Quality	Aquatic life toxicity (salinity / chlorides / total dissolved solids)	Urban runoff / storm sewers
		Road salt and storage / highway maintenance and runoff
		Highway / road / bridge runoff
		Contaminated sediments
		RCRA hazardous waste sites
		Marina operations
Water Quality	Fecal coliform (Lake Michigan beaches)	Water fowl (gulls) / other sources
Habitat degradation and alteration	Lack of habitat characteristics (pools, riffles, substrate, meandering, cover, streambanks)	Channelization (primarily lower reaches)
		Bank modification and destabilization
		Habitat modifications
Habitat degradation and alteration	Hydrologic disturbance / flow alterations (increase or decrease of streamflow) / creek obstructions	Urban runoff / storm sewers
		Development / Land use conversion
		Loss / drainage of depressional storage
		Hydrostructure flow regulation / modification
Habitat degradation and alteration	Draining, filling, and degradation of wetlands	Urban runoff / stormsewers
		Habitat modifications
		Draining, filling, loss of wetlands
Habitat degradation and alteration	Exotic and invasive species (wetlands and natural areas)	Spread from existing infestations
		Habitat modifications
Habitat degradation and alteration	Loss / reduction / degradation of natural buffer	Development / Land use conversion
		Inappropriate land management
		Streambank modification / destabilization
		Habitat modifications
		Loss of riparian habitat and vegetation
Habitat degradation and alteration	Streamside alterations	Habitat modifications
		Streambank modification and destabilization
		Agricultural activity / golf courses
		Site clearing / Development / Land use conversion
		Channelization
		Inappropriate land management
Increased flood flows	Increased rate and volume of runoff	Urban development / runoff / loss of infiltration capacity
Increased flood flows	Loss / drainage of depressional storage	Draining / filling of wetlands
		Development / Land use conversion
Flood damages	Past encroachments on floodplain	Past floodplain development

vegetation;
- discharge of residential stormwater from roof and footing drains onto the edge or the slopes of the ravines causing erosion;
- flashy watershed hydrology that is causing erosion of stream and ravine banks;
- lack of landowner awareness, management, and restoration of the natural quality of the ravines, including natural seeps and appropriate vegetation.

Watershed Hydrology
The most important issues related to watershed hydrology that need to be addressed include the following.
- flashy hydrology (higher high flows and lower low flows), which impact a number of other watershed resources;
- lack of consistent hydrologic connection of the stream system to Lake Michigan;
- modified drainage patterns within the low gradient stream reaches of Illinois Beach State Park, which impair natural streamflow patterns and degrade the natural ecosystems.

Green Infrastructure
The most important issues related to green infrastructure that need to be addressed include the following:
- lack of connections between existing green infrastructure hubs;
- lack of available land for making these connections;
- lack of local government recognition or mechanisms for preserving green infrastructure elements.

Natural Areas
The most important issues related to watershed natural areas, primarily the nature preserves, forest preserves, and Illinois Beach State Park, include the following:
- lack of management and restoration plans and action to preserve and restore native habitat for threatened and endangered species;
- invasive species infestations that degrade natural habitat;
- modified hydrologic / streamflow patterns that degrade natural habitat;
- impacts from upstream influences, such as erosion and sedimentation;
- erosion of the Lake Michigan shoreline, loss of the rare Lake Michigan panne ecosystem, and loss of important habitat and breeding grounds for migratory and resident birds.

Wetlands
The most important issues related to watershed wetlands include the following:
- lost wetland acreage and services: water quality improvement, water retention and storage, and habitat;
- impairment of natural hydrologic patterns that support healthy wetlands resulting from stormwater discharge;
- invasive species infestation, which degrades wetland quality;
- lack of restoration and management plans and action for existing and former wetlands.

Flooding
The most important flooding issues that need to be addressed include the following:
- risk of flood damage to structures within the floodplain;
- hydrologic modification causing high flows;
- lack of adequate drainage in a few locations;
- conversion of water storage and retention areas including wetlands and depressional storage.

Land Use
The most important land use issues that need to be addressed include the following:
- conversion of vacant, agricultural, or open land to urban uses, which increases impervious surface area and impacts water quality and runoff volume;
- redevelopment of existing developed land to other land uses with greater impervious surface area and/or higher pollutant loading rates;
- cleanup and redevelopment / restoration of the Waukegan Harbor Area of Concern and the Zion Nuclear Power Plant site.

As noted above, these issues are addressed in the Action Plan in Chapter 5. With dedication and determination, these issues can be addressed and the watershed can be restored to health and well-being.

4

watershed best management practices toolbox

4 stormwater best management practices toolbox

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 were integrated into the Dead River Watershed management action items and recommendations presented in Chapter 6. Policies and standards BMPs provide the legal framework for conservation development, while planning process BMPs are on-site strategies that preserve 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 & effectiveness, and design considerations. A more detailed toolbox is included in Appendix F.

4.1 POLICIES AND STANDARDS

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

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

Conservation and Floodplain Standards: Standards established to preserve stream corridors and floodplains from urban development and other encroachments.

Watershed Development Ordinance: Ordinance to regulate development for the purpose of minimizing 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 mechansisms for wetland creation and enhancement.

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Bioswales along streets (Portland, OR)

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Filter Strips/ Level Spreaders (Chesterton,IN)

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Green Roof (Portland, OR)

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Naturalized Detention (Bolingbrook, IL)

4.2 PLANNING PROCESS BMPS

Planning 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 preserved are identified using environmental planning processes. Many of these areas can then be preserved by open space requirements and other standards. Open Space/Natural Greenway delineation, Riparian Buffers, and Floodplain Standards are tools used to preserve 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.

Conservation Development: Site planning and design approaches that preserve existing natural areas and utilize 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.

Open Space/Natural Greenway: Designation of open spaces and/ or natural areas as greenways, in order to preserve and 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.

4.3 ON-SITE STORMWATER BMPS

On-site stormwater BMPs are site-specific practices that can minimize onsite and offsite hydrologic and water quality impacts derived from stormwater runoff via methods of incorporating and re-establishing natural hydrologic process 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.

Bioswales: 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 Strips/Level Spreaders: Filter strips are an area of dense, preferably native, vegetative cover used to filter and absorb runoff. Level spreaders are often used in conjunction with filter strips and are laid on the contour to distribute runoff over filter strip areas. Filter strips/level spreaders can be used within stream and wetland buffers to diffuse 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 Barrels/Cisterns: A vessel used to capture and temporarily store rainwater for various uses, including landscape irrigation, reuse for graywater purposes, etc.

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

Vegetated Swales: Vegetated stormwater features that convey, retain, infiltrate and cleanse stormwater. Native vegetation enhances filtration and retention of stormwater.

© Conservation Design Forum
Porous Pavement (Elmhurst, IL)

© Conservation Design Forum
Rain Barrel (Chicago, IL)

© Conservation Design Forum
Rain garden (Maplewood, MN)

© Conservation Design Forum
Vegetated Swales (Madison, WI)

© Conservation Design Forum

Native Landscaping (Geneva, IL)

4.4 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 can not 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.

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

4.5 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.

Tables 4.1 and 4.2 summarize the stormwater management tool applicability and effectiveness for each of the best management practices described in this toolbox. Following these tables is a vignette for each of the BMPs that begins with its definition and continues with its range of applicability, associated benefits, and finally some potential design considerations, as described below.

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.

Table 4.1 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
Policies / Standards												
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												
Conservation Development	X	X	X			X		X	X	X	X	X
Conservation and Floodplain Standards	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 Strips/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 Barrels/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 4.2 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
Policies / Standards							
Conservation Easement	-	-	H	-	-	-	-
Wetlands / 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
Conservation and Floodplain Standards	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

Conservation Easement

©

conservation easements provide mechanism for long term preservation 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		
	☒ Preventive	☐ Remedial	☐ Ongoing/ Maintenance	
	☐ 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.
- Preserves created/restored natural areas from development and other disturbances.
- Provides opportunity to preserve morphologically and ecologically-based corridors that may be more difficult to preserve 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 preserved through the development process.
- Conservation easements may also be used to preserve high quality uplands and other areas not readily preserved through zoning and/or stormwater ordinances.

© Conservation Design Forum

one's backyard may be wildlife's treasure habitat

Wetland / Stream Management & Restoration Management

© Conservation Design Forum

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		
	☐ Preventive	☒ Remedial	☒ Ongoing/ Maintenance	
	☐ 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.

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

Watershed Development Ordinance

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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

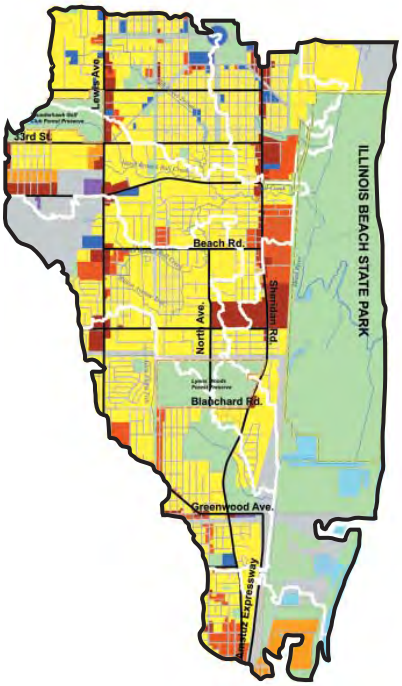
Scale	☒ Watershed/County	☒ Town/Village	☐ Neighborhood	☐ Lot
Applications	☒ Retrofit	☒ New		
	☒ Preventive	☐ Remedial	☐ Ongoing/ Maintenance	
	☒ Roofs	☒ Streets	☒ Driveways	
	☒ Parking Lots	☒ Lawn	☒ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☒ Physical Habitat Preservation/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

Benefits

- Provides consistent standard 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 preservation, 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.



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comprehensive land use plan

the watershed development ordinance is a critical element of the Dead River Watershed Management Plan (Conservation Design Forum)

Conservation Development

© Conservation Design Forum

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 ☒ Preventive ☐ Remedial ☐ Ongoing/ Maintenance ☐ 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 preserved from construction site runoff during establishment.

© Conservation Design Forum

conservation moderate density residential site plan
(Conservation Design Forum)

Planning

Floodplain Zoning

floodplain zoning prevents development from occurring in floodprone areas

Definition

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

Applicability

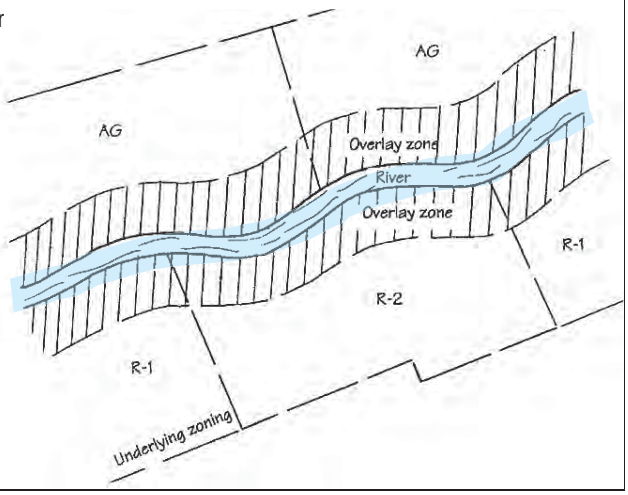
Scale	☒ Watershed/County	☒ Town/Village	☐ Neighborhood	☐ Lot
Applications	☒ Retrofit	☒ New		
	☒ Preventive	☐ Remedial	☐ Ongoing/ Maintenance	
	☐ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☐ Lawn	☒ Sensitive Areas	
Effectiveness	☒ Runoff Rate Control	☐ Runoff Volume Control	☒ Physical Habitat Preservation/ 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.
- Preserves natural floodplain functions.

Design Considerations

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



floodplain zoning overlays underlying zoning (source: SEMCOG)

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 ☒ Preventive ☐ Remedial ☐ Ongoing/ Maintenance ☒ 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.

© Conservation Design Forum

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

Planning

Open Space / Natural Greenway

© Conservation Design Forum

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

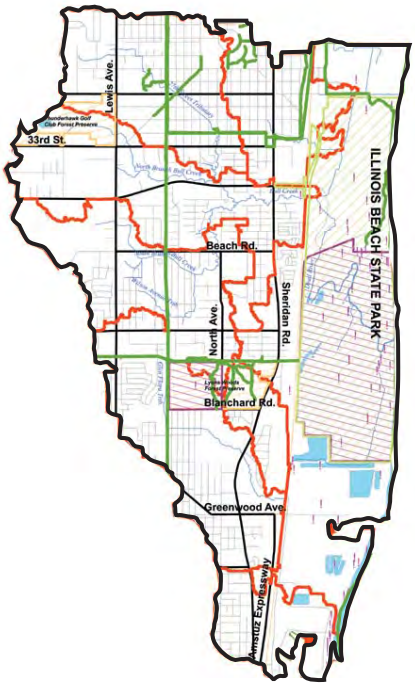
Scale	☒ Watershed/County	☒ Town/Village	☒ Neighborhood	☐ Lot
Applications	☒ Retrofit	☒ New		
	☒ Preventive	☐ Remedial	☐ Ongoing/ Maintenance	
	☐ Roofs	☐ Streets	☐ Driveways	
	☐ Parking Lots	☐ Lawn	☒ Sensitive Areas	
Effectiveness	☐ Runoff Rate Control	☐ Runoff Volume Control	☒ Physical Habitat Preservation/ 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.



© Conservation Design Forum

an open space/natural greenway system is designated to preserve key natural resources in the Dead River Watershed Area (Conservation Design Forum)

Riparian Buffer

© Conservation Design Forum

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		
	☒ Preventive	☐ Remedial	☐ Ongoing/ Maintenance	
	☐ 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

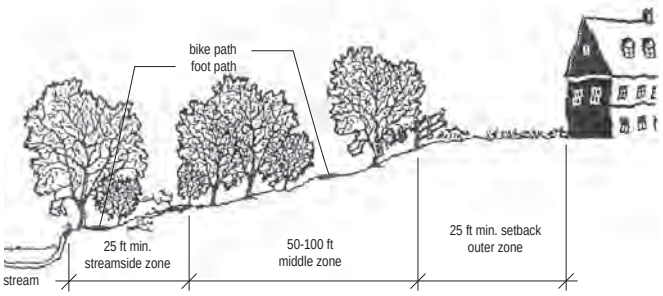
- Preserves natural functions of lakes, streams, and wetlands. Naturally attenuates flow rates.
- Provides filtering of lateral surface and groundwater inflows.
- Helps stabilize streambanks and shorelines against erosion.

© Conservation Design Forum

riparian buffers preserve 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/ preserved through a watershed development ordinance.



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

Bioswale

© Conservation Design Forum

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

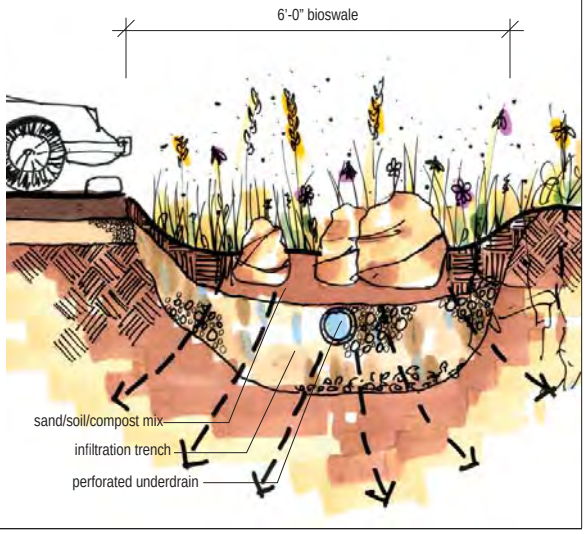
- Scale: ☐ Watershed/County ☐ Town/Village ☒ Neighborhood ☒ Lot
- Applications: ☒ Retrofit ☒ New ☒ Preventive ☒ Remedial ☐ Ongoing/ Maintenance ☐ Roofs ☒ Streets ☐ Driveways ☒ Parking Lots ☐ Lawn ☐ Sensitive Areas
- Effectiveness: ☒ Runoff Rate Control ☒ Runoff Volume Control ☐ Physical Habitat Preservation/ 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 preserve 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.



© Conservation Design Forum

cross section of bioswale (Conservation Design Forum)

Filter Strip/ Level Spreader

© Conservation Design Forum

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	☒
➢ Applications	☒ Retrofit	☒ New		
	☒ Preventive	☒ Remedial	☐ Ongoing/ Maintenance	
	☐ Roofs	☐ Streets	☒ Driveways	
	☒ Parking Lots	☒ Lawn	☒ Sensitive Areas	
➢ Effectiveness	☒ Runoff Rate Control	☒ Runoff Volume Control	☐ Physical Habitat Preservation/ Creation	☒
	☒ Nutrient Control	☒ BOD Control	☒ Other Pollutant Control	

Benefits

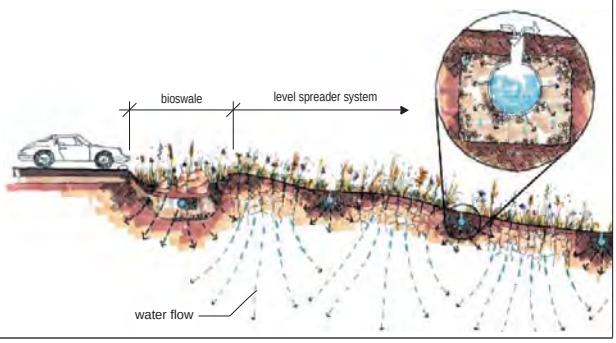
- Reduces runoff volumes and rates by allowing runoff to infiltrate over a large area.
- Recharges groundwater and sustains base flows.
- Reduces sediment and nutrient runoff.
- Deconcentrates storm sewer and detention basin discharges to dissipate energy, reduce scour, and better mimic historic runoff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

© Conservation Design Forum

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.



© Conservation Design Forum

cross section of level spreader (Conservation Design Forum)

Green Roof

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.

© Conservation Design Forum

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

Applicability

- Scale: ☐ Watershed/County ☐ Town/Village ☐ Neighborhood ☒ Lot
- Applications: ☒ Retrofit ☒ New ☒ Preventive ☐ Remedial ☐ Ongoing/ Maintenance ☒ 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

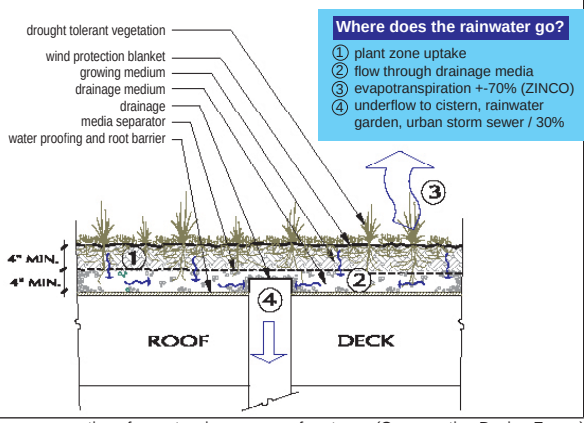
- Significantly reduces runoff volumes and rates as well as thermal impacts (50 - 90% reduction in annual runoff).
- Can reduce detention needs.
- Contributes to reduction in urban heat island effect.
- Can reduce energy requirements associated with heating and cooling.
- Creates opportunities for outdoor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

© Conservation Design Forum

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

© Conservation Design Forum

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 ☐ Preventive ☒ Remedial ☐ Ongoing/ Maintenance ☒ 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.

© Conservation Design Forum

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

Porous Pavement

© Conservation Design Forum

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		
	☒ Preventive	☒ Remedial	☐ Ongoing/ Maintenance	
	☐ 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.

© Conservation Design Forum

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.

© Conservation Design Forum

porous pavement in parking lot

Rain Barrel/ Cistern

© Conservation Design Forum

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		
	☒ Preventive	☐ Remedial	☐ Ongoing/ Maintenance	
	☒ 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.

© Conservation Design Forum

a cistern system collects rainwater from Kresge Foundation Headquarters (Troy, MI) (Photo: Conservation Design Forum)

Rainwater Garden

© Conservation Design Forum

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		
	☒ Preventive	☒ Remedial	☐ Ongoing/ Maintenance	
	☐ 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

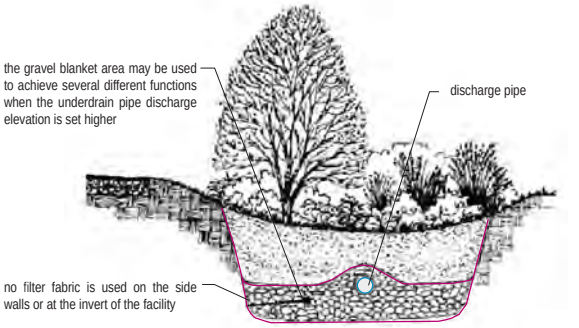
- Reduces runoff volumes and rates from lawns, roofs, and driveways.
- Recharges groundwater and sustains base flows.
- Reduces sediment and nutrient runoff.
- Can reduce detention needs.
- Can increase aesthetic value for the properties.
- Can provide wildlife habitat.

© Conservation Design Forum

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

© Conservation Design Forum

vegetated swales planted with native grasses and forbs along the street

Definition

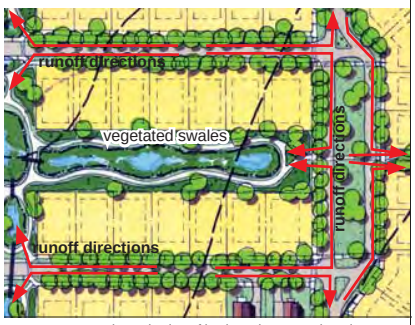
- Vegetated swales are planted stormwater features that convey, retain, infiltrate, and cleanse stormwater.

Applicability

Scale	☐ Watershed/County	☐ Town/Village	☐ Neighborhood	☒ Lot
Applications	☒ Retrofit	☒ New		
	☒ Preventive	☐ Remedial	☐ Ongoing/ Maintenance	
	☒ 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.



© Conservation Design Forum

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.

© Conservation Design Forum

urban bioswale

Native Landscaping

© Conservation Design Forum

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 ☒ Preventive ☒ Remedial ☐ Ongoing/ Maintenance ☒ 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.

© Conservation Research Institute

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

Design Considations

- 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.

© Conservation Design Forum

Tellabs Bolingbrook (Bolingbrook, IL)

5 prioritized action plan

While Chapter 4 identifies types of best management practices that can be used in the Dead River watershed, this chapter presents specific recommended action items developed jointly by the watershed stakeholders, Lake County Stormwater Management Commission, and the consultant planning team. This chapter begins by describing the implementation partners (Section 5.1), followed by recommended action items that presented in three sections. The Programmatic Action Plan (5.2) provides general recommendations that should be applied watershed-wide and may also apply to large sites such as the Waukegan Regional Airport and the Zion Nuclear Plant. The Site Specific Action Plan (5.3) presents detailed recommendations for specific problem areas within the watershed as identified during the inventory and assessment. The Information and Education Plan (5.4) specifically identifies the recommended actions that will likely need more outreach and education in order to be implemented.

As a reminder, the eleven most important recommendations are summarized as follows:

1. Stabilize streambanks and ravine slopes to reduce erosion, protect property and infrastructure, improve water quality, and improve habitat.
2. Restore and manage stream corridors by restoring native riparian buffers, reducing the density of trees, removing excessive debris, and stabilizing the stream bed with practices that also enhance habitat.
3. Manage, retrofit, and stabilize the stormwater management system including detention basins and culverts, with focused attention on stormwater discharge points (pipes and ditches), to reduce runoff rate and volume and to improve water quality in the streams and Lake Michigan.
4. Preserve and restore priority green infrastructure areas to provide natural surface water storage areas, provide space for installing best management practices, and preserve an ecologically functioning network of open space, wetlands, streams, and natural areas as part of an interconnected system.
5. Manage and restore watershed natural areas including wetlands, former wetlands / hydric soil areas, and especially Lyons Woods Forest Preserve and Illinois Beach State Park.
6. Develop positive and creative new uses for the Zion Nuclear Power Plant and Waukegan Harbor areas, ensuring that these uses are compatible with protecting and improving watershed resources and Lake Michigan.
7. Remediate existing flood problems and prevent future flooding by reducing stormwater runoff and preserving areas for surface water storage and absorption such as floodplains, depressional storage areas, and wetlands, which also provide water quality improvement benefits.
8. Use better stormwater management, conservation design, and low impact development practices for new and existing development that slows, filters, infiltrates, cools, and cleanses stormwater runoff, especially in Critical Subbasins. This includes source controls and lot level best management practices such as vegetated swales, naturalized detention basins, rain gardens, stream buffers, filter strips, and reduced use of lawn chemicals and fertilizers.
9. Modify and use planning and development standards, policies, and capital improvement plans and budgets to protect and enhance water quality.
10. Provide public education and outreach to enhance understanding and apprciation of watershed resources and problems, to provide solutions, and to provide opportunities for people to get involved in watershed improvement activities.
11. Monitor and evaluate watershed plan implementation and physical watershed conditions to guage progress towards watershed goals.

5.1 IMPLEMENTATION PARTNERS

Throughout the prioritized action plan tables and narrative, responsible parties are suggested for taking the lead or providing a supporting role in plan implementation. This section presents the responsible parties as well as a brief description of their role. Where the roles are identified within tables, parties indicated with bold lettering are the lead party, and non-bold parties providing support. Table 5.1provides a concise reference or key for reviewing the programmatic and site specific action plan tables that follow.

Beach Park Drainage District (BPDD)

The Beach Park Drainage District maintains drainage ways and addresses local drainage problems within a boundary that covers portions of Beach Park and small portions of other communities as well. The drainage district first tries to address drainage and flooding problems that may cause damage to property and/or structures and then removes debris from stream channels as a secondary goal. Thus, issues related to channel and stormwater management infrastructure should include the BPDD as an implementation partner.

Chicago Metropolitan Agency for Planning (CMAP)

Formerly the Northeastern Illinois Planning Commission (NIPC) and the Chicago Area Transportation Study (CATS), CMAP provides technical and planning assistance to watershed protection groups. CMAP has developed model ordinances tailored to the region for stormwater management, sediment control, streams and wetlands, and floodplains. CMAP also offers technical assistance and training opportunities to local governments and watershed groups and helps local governments apply for state and federal funding programs.

Corporate and Business Landowners (CBL)

The active participation of CBLs in the planning process can lead to significant positive impacts on the quality of the Dead River watershed. Businesses can become involved by retrofitting existing facilities, managing their grounds, roof runoff, and parking lots to reduce runoff volume and pollutant loadings, and sponsoring watershed events. With an up front commitment from the CBL community, new development can also be designed to minimize runoff and pollutant loadings.

Developers & Homebuilders (DH)

The practices of developers can significantly impact a watershed. Developers should be encouraged or required to employ sustainable development techniques such as conservation subdivision development and other practices described in the Best Management Practice Toolbox. Homebuilders should use BMPs during the construction process, especially those related to soil erosion and sedimentation control. Failure to use BMPs, or improper use, can lead to soil erosion and other pollutant discharges.

Federal Emergency Management Agency (FEMA)

FEMA is the principal federal agency involved in flood mitigation and flood disaster response. Among its duties, FEMA is responsible for the National Flood Insurance program, helps municipalities develop and enforce floodplain ordinances, develops floodplain maps, and administers funding for flood mitigation plans and projects.

Golf Courses (GC)

Golf courses are important potential sites for the use of BMPs, primarily due to their location along the stream and their potential impact as sources of pollutants and their contribution as a green infrastructure element. Golf courses can help reduce pollutant loadings, especially nutrients, as well as runoff volume by incorporating BMPs into their golf course management programs.

Illinois Department of Natural Resources (IDNR)

Several offices within IDNR provide services that will be key to the implementation of the Dead River watershed plan for issues related to water resource management, habitat protection and management, wildlife management, invasive species control, wetland management, and hunting and fishing permitting.

- The IDNR manages Illinois Beach State Park and is responsible for issues relating to water, hydrology and hydrologic connections to Lake Michigan, natural resources, wildlife, wetlands, and beach management in the park as well as North Point Marina.
- The Office of Water Resources (OWR) is the state's lead organization for the regulation of floodplain development as well as for the implementation and funding of structural flood control and mitigation.
- The Office of Realty and Environmental Planning (OREP) is responsible for natural resource and outdoor recreation planning. It also administers the Conservation 2000 Ecosystems Program, which provides technical and financial assistance through a grant program to natural resource protection partnerships (e.g., Lake Michigan Watershed Ecosystem Partnership).
- The Office of Resource Conservation (ORC) reviews Clean Water Act Section 404 wetland permits for

Table 5.1 Implementation Partners

Acronym	Responsible Party	General Responsibility
BPDD	Beach Park Drainage District	Drainage system management and maintenance.
CMAP	Chicago Metropolitan Agency for Planning	Technical and planning assistance, training, and funding assistance.
CBL	Corporate and Business Landowners	Grounds management and maintenance.
DH	Developers & Homebuilders	Land development, stormwater management system design and construction.
FEMA	Federal Emergency Management Agency	National Flood Insurance Program, floodplain mapping and enforcement, and mitigation funding.
GC	Golf Courses	Grounds management and maintenance.
IDNR	Illinois Department of Natural Resources	Natural area preservation and management, research, technical and financial assistance.
CMP	IDNR Coastal Management Program	Preserve and manage Lake Michigan coastal resources (if established).
IDOT	Illinois Department of Transportation	Road and highway planning, construction, and maintenance.
IEMA	Illinois Emergency Management Agency	Flood and disaster planning, emergency response, and hazard mitigation.
IEPA	Illinois Environmental Protection Agency	Water resource monitoring, pollution regulation and control, project funding.
LC	Lake County	Land use planning for unincorporated areas, natural resources, drainage system management.
LCFPD	Lake County Forest Preserve District	Manage and maintain green infrastructure, natural areas, and open space.
LCHD	Lake County Health Department	Monitor, manage, and provide technical support for water resources.
LCSMC	Lake County Stormwater Management Commission	Technical and financial assistance for flooding, watershed planning, and water quality.
LMEP	Lake Michigan Ecosystem Partnership	Watershed advocacy and education, technical and financial assistance.
LMGLO	Lake Michigan / Great Lakes Organizations	Great Lakes and Lake Michigan water resource management, education, and outreach.
M	Municipalities (all departments)	Land use and development, technical and financial support, and drainage system management.
NGRREC	National Great Rivers Research & Education Center	Stream, lake, wetland, and coastal data collection, watershed education and outreach.
NRCS / SWCD	Natural Resources Conservation Service / Soil and Water Conservation Districts	Provide natural resource management technical and financial assistance.
PD	Parks and Recreation Districts	Management and maintenance of parks and open space.
PRL / RL	Private Residential / Riparian Landowners	Land management and maintenance including stream channels and riparian corridors.
NSSD	North Shore Sanitary District	Maintain sanitary sewer system infrastructure, stream monitoring.
T	Townships	Road maintenance and support for watershed improvement projects.
USACE	U.S. Army Corps of Engineers	Wetland protection and regulation, wetland restoration funding.
USDA	U.S. Department of Agriculture	Farmland and natural resoruce technical and financial assistance.
USEPA	U.S. Environmental Protection Agency	Lake Michigan and Great Lakes management and restoration.
USFWS	U.S. Fish and Wildlife Service	Threatened and endangered species, technical and funding assistance for habitat restoration.
CAG	Waukegan Harbor Citizens Advisory Group	Organize and coordinate activities related to Waukegan Harbor contamination and cleanup.
WPC	Watershed Planning Committee	Coordinate watershed plan implementation, education and outreach.

impacts on fish and wildlife resources; it manages threatened and endangered species issues; it also protects fisheries and other aquatic resources through regulation, ecological management and public education.

- The Office of Capital Development (OCD) administers state and federal grants for open space programs.
- The Office of Scientific Research and Analysis (OSRA) conducts research and data collection provides this information to planners and formulates natural resource protection policy.

IDNR Coastal Management Program (CMP)

The IDNR is the lead state agency responsible for establishing the Illinois Coastal Management Program (CMP), which is funded through the National Ocean and Atmospheric Administration (NOAA). If established, the program will support and coordinate partnerships among local, state and federal agencies, and local organizations, share information on coastal care efforts, and preserve, restore, and where possible, enhance coastal resources in Illinois. Upon CMP approval, Illinois will be eligible to receive approximately $2 million/year, which will fund a grant program to implement local projects. Local and state agencies and non-profit organizations would be eligible to apply for and receive funds. Potential projects that may receive funding under the CMP program include beach access and recreation, waterfront development, shore and bluff stabilization, wetland and natural resource protection and restoration, coastal waters protection (i.e., water pollution control), erosion control, and education and interpretation.

Illinois Department of Transportation (IDOT)

IDOT is responsible for the planning, construction, and maintenance of portions of the transportation network that covers the Dead River watershed. Incorporation of best management practices and sustainable management measures into IDOT projects can help lead to improvements in the environmental quality of the watershed.

Illinois Emergency Management Agency (IEMA)

In Illinois, IEMA is the state agency responsible for flood and disaster planning, emergency response, and hazard mitigation. IEMA works with local governments on flood mitigation plans and provides operational support during floods. IEMA also administers FEMA-funded programs in the state, including flood mitigation grant programs.

Illinois Environmental Protection Agency (IEPA) Bureau of Water

Under the federal Clean Water Act and state legislation, IEPA is responsible for the protection of the state's water resources and ensuring that Illinois' rivers, streams and lakes will support all uses for which they are designated including protection of aquatic life, recreation and drinking water supplies. Several IEPA activities are important to this plan:

- Monitoring: IEPA oversees data collection at various sites (rivers, streams, lakes, etc.) across the state, including the Dead River watershed. The Illinois Water Quality Report (305(b)) summarizes these monitoring efforts.
- Funding: IEPA administers several state and federal grant programs. A primary example is Section 319 funding under the Clean Water Act, which helps local governments, nonprofit entities, and numerous other state, federal, and local partners to reduce nonpoint source pollution through technical and financial support.
- Regulation: IEPA regulates point and nonpoint source pollution discharges into the state's waters through regulatory and non-regulatory programs.

Lake County

The Dead River flows through Lake County, which plays a role in land use planning, development, natural resource protection, and drainage system management in the unincorporated areas of the watershed. Working with the County and its public works, health, and transportation departments, can help ensure that the Dead River enjoys responsible, sustainable land use planning, road and sewer maintenance, and public health policies.

Lake County Forest Preserve District (LCFPD)

The Forest Preserve District of Lake County owns and manages a number of acres of green infrastructure / open space within the Dead River watershed. Issues related to the protection and management of these and potential future

FPD holdings will rely in part on the FPD.

Lake County Health Department (LCHD)

The LCHD Lakes Management Unit provides technical expertise essential to the management and protection of Lake County surface waters. The goal of the LMU is to monitor the quality of the county's surface water in order to maintain or improve water quality and alleviate nuisance conditions, promote healthy and safe lake conditions, and protect and improve ecological diversity. To this end, the LDHC monitors the watershed lakes and has also begun monitoring water quality conditions to provide data on stream health and quality. The LCHD is also responsible for septic system management programs and well testing and monitoring.

Lake County Stormwater Management Commission (SMC)

SMC's mission is to coordinate the stormwater activities of over 90 jurisdictions throughout the county. SMC provides technical assistance, local knowledge and problem-solving skills to coordinate flood damage reduction, flood hazard mitigation, watershed planning, water quality enhancements and natural resource protection projects and programs. The 2002 Comprehensive Stormwater Management Plan Update guides agency programs and projects. Major components of the Plan include: a) implementation of countywide minimum standards for new development (Watershed Development Ordinance); b) projects to reduce existing flooding and water pollution problems; c) rehabilitation of the existing drainage system; d) flood hazard mitigation; e) interjurisdictional coordination and technical assistance; f) public information.

Lake Michigan Watershed Ecosystem Partnership (LMWEP)

LMWEP is a public–private cooperative of watershed stakeholders formed in 2005 to preserve, protect, and enhance local natural systems and integrate them into the life and future of the community through coordination and cooperation. The partnership can help with advocacy, management of watershed projects, grant applications and review, and general coordination of watershed activities. The LMWEP includes the involvement of the Great Lakes Alliance, which is described below.

Lake Michigan / Great Lakes Management Organizations and Programs (LMGLO)

The Great Lakes Alliance focuses its policy, management, and restoration programs on water quality, water conservation, habitat recovery, land use, and education and outreach. The Great Lakes Regional Collaboration, which includes the EPA-led federal agency task force, the Great Lakes states, local communities, tribes, non-governmental organizations, and other interests in the Great Lakes region, is focused on restoring and protecting the Great Lakes. The Great Lakes Initiative is a plan agreed upon by EPA and the Great Lake states to restore the health of the Great Lakes.

Municipalities (all departments) (M)

Municipalities (i.e., local elected officials and local agency staff) have the principal responsibility for land use and development planning, establishing legislative and administrative policies, adopting ordinances and resolutions, setting zoning standards, establishing the annual budget, appropriating funds, and setting tax rates. There are also opportunities to make others aware of the watershed management planning process through local government newsletters and presentations at board meetings, which are often televised on local cable television networks. Municipalities are therefore crucial to watershed protection efforts. By partnering with municipalities and encouraging the adoption of sustainable zoning and development practices, a watershed protection group can check the increase of water quality impairments. Municipalities are also a key part of any watershed protection strategy because they are responsible for the enforcement of local land use and development ordinances.

The National Great Rivers Research & Education Center (NGRREC)

The NGRREC's RiverWatch program, formerly under the Illinois DNR, relies on a volunteer base to monitor, collect and record stream, lake, wetland, and coastal data for the state database. It is also a valuable educational resource that can be used to educate others about watershed issues and concerns.

Natural Resources Conservation Service (NRCS) / Soil

and Water Conservation Districts (SWCD)

NRCS and SWCD provide technical expertise and education on conservation, development, management, and wise use of natural resources to landowners and land managers, county and local governments, and local organizations. Areas of expertise include streambank stabilization and soil erosion/ sediment control, wetland and habitat restoration, community planning, environmental education, agricultural conservation, water quality protection, nonpoint source pollution, stream health, conservation planning, and natural resource maps and reports. NRCS and SWCD also administer several cost-share programs targeted to water quality, wetland restoration, and other watershed priorities.

As part of its watershed protection effort, NRCS administers the USDA Watershed Program (under Public Law 83-566). The purpose of the program is to assist federal, state, and local agencies; local government sponsors; tribal governments; and other program participants in protecting watersheds from damage caused by erosion, floodwater, and sediment; restoring damaged watersheds; conserving and developing water and land resources; and solving natural resource and related economic problems on a watershed basis. The program provides technical and financial assistance to local people or project sponsors, builds partnerships, and requires local and state funding contributions.

Parks and Recreation Districts (PD)

Park and recreation districts often control a large amount of open space in a watershed and maintain recreational facilities and parks. Parks also contain many recreational opportunities and trails, several bordering the Dead River. Partnerships with local park districts can help ensure the preservation of open space while also facilitating recreational and other community opportunities that can help increase support for watershed protection efforts.

Private Residential Landowners and Homeowners Associations (PRL)

The activities of residential landowners, often unknowingly, can have a significant impact of the quality of a watershed. Practices such as excess lawn fertilization, connection of downspouts to the sewer system, or destruction of riparian buffers can be significant sources of nonpoint pollution. Watershed protection efforts should educate residents on the consequences of their actions and present alternatives. More positively, political pressure from local residents on municipal or county officials can lead to increased emphasis on watershed protection. And many local residents play important roles in watershed planning and protection efforts.

North Shore Sanitary District (NSSD)

The North Shore Sanitary District is a municipal government that provides wastewater treatment service for watershed communities. The NSSD maintains the sanitary sewer system in the watershed, which in some cases follows the alignment of the stream channel, and has also begun a stream monitoring protocol for Kellogg Creek and Dead River watersheds.

Townships (T)

While unincorporated townships generally play a secondary role in watershed protection, they often have responsibility for road upkeep and occasionally sponsor drainage system improvement projects. The use of BMPs by townships, especially for road maintenance, can help improve water quality within the watershed.

U.S. Army Corps of Engineers (USACE)

USACE plays a major role in wetland protection and regulation through Section 404 of the Clean Water Act, which requires USACE to administer permit applications for alterations to wetlands. The USACE Chicago district has also established a Wetlands Restoration Fund, which may be available to the Dead River watershed communities.

U.S. Department of Agriculture (USDA)

USDA's Farm Services Agency (FSA) has several programs that support watershed protection and restoration efforts. Under the Conservation Reserve Program (CRP), farmers receive annual rental payments, cost sharing, and technical assistance to plant vegetation for land they put into reserve for 10 to 15 years. The Conservation Reserve Enhancement Program (CREP) targets state and federal funds to achieve shared environmental goals of national and state significance. The program uses financial incentives to encourage farmers and ranchers to voluntarily protect soil, water, and wildlife

resources. The Grassland Reserve Program (GRP) uses 30-year easements and rental agreements to improve management of, restore, or conserve up to 2 million acres of private grasslands. The Conservation Security Program (CSP) is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands.

U.S. Environmental Protection Agency (USEPA)
The USEPA oversees the environmental protection efforts of the IEPA and is the ultimate source for Section 319 and other environmental improvement programs. Section 404 of the Clean Water Act, which regulates the dredging and filling of wetlands, is jointly administered by USEPA and the U.S. Army Corps of Engineers.

U.S. Fish and Wildlife Service (USFWS)
The USFWS provides technical assistance to local watershed protection groups. It also administers several grant and cost-share programs that fund wetland and aquatic habitat restoration. The USFWS also administers the federal Endangered Species Act and supports a program called Endangered Species Program Partners, which features formal or informal partnerships for protecting endangered and threatened species and helping them to recover. These partnerships include federal partners as well as states, tribes, local governments, nonprofit organizations, and individual landowners.

Solid Waste Management
Many local governments have solid waste programs that address the disposal of solid waste and yard waste. They might also handle the recycling, illegal dumping, and household hazardous waste programs.

Waukegan Harbor Citizens Advisory Group (CAG)
The Waukegan Harbor Citizens Advisory Group was organized in 1990 to help citizens and business leaders concerned about the harbor environment develop plans to identify and clean up contaminated harbor properties. The CAG is composed of business, fishing, recreation, environmental, government, and other interested groups and individuals. They formed a partnership with the Illinois Environmental Protection Agency to develop the Waukegan Harbor Remedial Action Plan, detailing use impairments and how these impairments could be restored through a cooperative effort. The Waukegan CAG has been instrumental in obtaining cooperation from local parties involving additional investigations. Groundwater monitoring from local parties is being conducted in an area south of the harbor. The CAG helped obtain access from private businesses and federal grant money to install the monitoring wells. A federally funded 319 grant has been released to the Waukegan CAG to develop a watershed plan to reduce nonpoint source pollution and improve water quality in the Waukegan River watershed.

Watershed Planning Committee (WPC)
The WPC, composed of watershed stakeholders, organizes, coordinates, and advises project partners on watershed planning methods and issues, demonstration project selection and provides technical assistance. The WPC also is responsible for helping coordinate the implementation of the watershed plan.

5.2 PROGRAMMATIC ACTION PLAN

To supplement the Watershed Best Management Practice Toolbox, 77 programmatic action recommendations were identified that apply generally throughout the watershed, including measures related to stream and riparian corridors, water quality and stormwater management, drainage, and retention, planning and development standards, green infrastructure, natural areas, land management, flood management, and coordination. This Programmatic Action Plan should be considered as general guidance for all watershed stakeholders and plan implementers. Parties that have lead and supporting responsibility for implementing the Programmatic Action Plan are identified for each action recommendation. This Programmatic Action Plan includes remedial, preventative, regulatory, and maintenance action items that are applicable throughout the watershed. An expanded programmatic action plan is included in Appendix G.

5.2.1 STREAMS AND RIPARIAN CORRIDORS

Stabilization, restoration, and management of the stream channel, streambank, and riparian corridor are needed throughout the watershed to improve and protect water quality, maintain floodplain functions, and reduce property loss caused by erosion. Of particular importance are remediating the impairments and problems that were identified during the watershed inventory and assessment and preserving the beneficial characteristics of the stream channel such as healthy stream substrates. Streambank and ravine erosion is threatening property, damaging infrastructure, and degrading water quality and habitat. This problem includes significant erosion around and near stormwater outfall and discharge points and hydraulic structures. The most severe streambank erosion problems in terms of threats to property damage are those where the ravine slope is also the streambank. Aquatic and riparian habitat are also in need of restoration, including restoring instream habitat such as pools and riffles, removing excessive debris from the stream channel, establishing naturalized streambanks with native plants, and managing stream corridors by restoring native riparian buffers and reducing the density of trees.

Presently, private landowners, including golf courses, are responsible for maintaining the stream as if crosses their property or flows along a property line. This includes all aspects of management and maintenance, such as debris removal, invasive species control, streambank stabilization, and management of private stormwater outfall pipes. Since problems within the stream and riparian corridor can be the result of land use and other activities upstream of a particular property, it is in everyone's best interest to help ensure that this plan is implemented watershed-wide.

Exceptions to private landowner responsibility exist where the stream passes through public land, including Illinois Department of Natural Resources holdings, or areas within the jurisdiction of the Beach Park Drainage District, which are the responsibility of these public entities. Municipalities have primary responsibility for land use and development decisions within their jurisdiction, including the allowable quantity and quality of stormwater discharge, which dramatically affects the quality of the stream corridor. Municipalities also are responsible, in part, for maintaining drainage system infrastructure, which includes most stormwater discharge points. Within the Beach Park Drainage District boundary, fees assessed to property owners are used to repair and maintain Bull Creek as a drainage system. The Drainage District is primarily concerned with conveyance and flooding issues, but are also responsible for the maintenance and upkeep of the channel within a 50-foot easement on each streambank. The Lake County Stormwater Management Commission addresses stormwater management issues on a watershed basis throughout the county and can help coordinate multi-jurisdictional stormwater management projects, including those within the stream channel, and provide technical assistance to parties implementing these recommendations. The Illinois and Lake County Departments of Transportation are responsible for maintaining some culverts and bridges along the stream corridor.

Programmatic actions for streams and riparian corridors are listed in Table 5.2.

Table 5.2 Stream and Riparian Corridor Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
1	Stabilize and retrofit stormwater outfall structures and the associated streambanks and channel. Install flow attenuation and outlet protection measures to reduce erosion and improve filtration of stormwater runoff entering the stream.	M BPDD RL	SMC	S
2	Stabilize eroding streambanks, toe, and side slopes using bioengineering practices with deep-rooted native plants to reduce erosion and sediment loads downstream and to reduce property loss. Bioengineering practices include A-Jacks, lunkers, fiber rolls, geotextile mats, live stakes, fascines, brush and branch layers, cribwalls, and vegetated geogrid lifts.	RL BPDD GC	SMC IEPA	M
3	Where feasible, replace failing or crude armoring and concrete lined channels with more sustainable, natural and habitat friendly stabilization measures.	RL BPDD	SMC	L
4	Preserve, enhance or establish native riparian buffers along all unbuffered or inadequately buffered stream reaches using emergent wetland and wet prairie vegetation to stabilize streambanks, filter out pollutants, and enhance aquatic habitat. Development within buffer areas should be strictly limited.	RL BPDD GC	M	S
5	Restore stream channels, streambeds, and aquatic habitat to a healthy condition. This includes instream habitat features, such as natural channel substrates and pools & riffles, to improve water quality and aquatic biodiversity.	RL BPDD	IDNR SMC M	S
6	Where feasible, daylight and remeander streams that have been contained in ditches or moved underground into culverts or pipes.	RL BPDD	IDNR SMC M	L
7	Modify bridges, culverts, and other hydraulic structures that are directing flow into the streambanks, eroding around the edges, blocking flows and fish passage or otherwise problematic.	RL M BPDD DOT GC	SMC	M
8	Restore hydrologic connections to Lake Michigan to promote recolonization of the aquatic community.	IDNR	CMP	L
9	Develop and implement a regular stream inspection and maintenance program among the Beach Park Drainage District, municipalities, homeowners, and SMC to remove accumulated woody debris and other debris and litter and to target restoration needs.	SMC	BPDD M RL	S
10	For moderately and severely eroded stream reaches, develop a stream restoration plan and cost estimate.	M BPDD RL	SMC	S

5.2.2 WATER QUALITY AND STORMWATER MANAGEMENT

As described in the introduction and the watershed inventory, stormwater runoff is one of the primary sources of water quality impairment. The causes and sources of water quality problems in the Dead River watershed are primarily urban in nature. These problems are the result of many years of modification of the watershed landscape as it changed from natural to agricultural to urban. These changes have included modification of the stream channel, floodplain, wetlands, riparian corridor, and other water resource-related landscape features. Other changes are the result of the increased watershed impervious cover (e.g., paving, concrete, rooftops) that has led to an increase in the volume and rate of runoff in the watershed. The increased quantity of runoff has caused problems such as excessive stream bank erosion and the deepening of the stream channel due to channel erosion. This erosion causes increased levels of Total Suspended Solids that settle out in the lower gradient reaches within Illinois Beach State Park and impair aquatic habitat. The efficient stormwater system also causes decreased baseflows during the drier summer and fall months, which can result in low dissolved oxygen levels that impair aquatic habitat. Conductivity levels, an indicator of chlorides within the water column (also referred to as Total Dissolved Solids or TDS), were also shown to be high, indicating that salt applied to roads for snow and ice control are impairing water quality. Lake Michigan beaches exhibit ongoing problems with fecal contamination due to high gull populations.

To improve this situation, the use of stormwater best management practices and the preservation and natural buffering of the natural drainage system (overland flow paths, streams, wetlands, lakes and floodplain) should be required in all new development and encouraged in areas that are already developed. Drainage and detention in existing developed areas also should be retrofitted to better control runoff rates and to improve water quality. Natural hydrologic regimes and drainage systems should be preserved and/or restored to the extent practicable to reduce the impact of development and hydrologic modification on flooding and water quality and to help achieve aquatic habitat objectives.

All landowners and stakeholders within the watershed can contribute to water quality improvement by managing land and property to prevent or remove pollutants from the landscape before they can be washed into the stream. Management and maintenance of the stormwater management system is primarily the responsibility of municipalities and the Beach Park Drainage District, including both the conveyance system (pipes and drainage swales) and detention ponds, unless management of these features has been assumed by a homeowners association or other party. The implementation of green infrastructure best management practices (BMPs) is the responsibility of all landowners (for existing development) and developers and homebuilders (for new development). However, municipalities must require or encourage these practices to be installed. Preservation of remaining natural drainage and storage (green infrastructure) features of the landscape is the responsibility of municipalities.

Programmatic actions for water quality and stormwater management are listed in Table 5.3.

Table 5.3 Water Quality and Stormwater Management Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
11	Use green infrastructure BMPs such as natural stormwater drainage, infiltration, and detention practices and lot level BMPs in new and existing development to reduce surface runoff volumes, to filter pollutants from stormwater runoff, and to improve infiltration of precipitation into the ground. Stormwater BMPs should use, to the extend possible, native plants that are appropriate for the location in which they are being planted. Reducing runoff rate and volume will also minimize sediment loadings from in-stream and surface erosion and riparian habitat degradation .	M PRL CBL DH	SMC IEPA PD LC	M
11a	Where feasible, convert existing swales and open drainage ways to infiltrate runoff with natural landscaping.	M BPDD DOT	SMC PRL CBL DH LC	S
11b	Retrofit curb and gutter areas along roadways, parking lots, and other impervious surfaces to allow stormwater to enter swales or other naturalized filtration and infiltration measures such as parking lot and roadside rain gardens.	M CBL DH DOT	LC	M
11c	Install bioswales into parking lots as construction and reconstruction occurs.	M CBL DH DOT	LC	M
11d	Install vegetated filter strips or rain gardens where sheet flow leaves impervious surface to capture pollutants and infiltrate runoff.	M CBL DH DOT	LC	S
11e	Install sand filters, filtration basins, treatment wetlands, other bioretention practices, or other filtration practices downstream of industrial, commercial facilities and other land uses potentially generating a heavy load of pollutants. Install sand filters, appropriate proprietary water treatment units, or settling basins at the storm sewer inlets in parking lots	M CBL DH DOT	LC	M
11f	Install green roofs where feasible to capture, filter, and evaporate stormwater.	PRL CBL DH	M	L
11g	Reduce the hydraulic connectivity of impervious surfaces by disconnecting roof downspouts from discharging to impervious areas and instead directing the flow into a lawn or naturally landscaped area, raingarden, filter strip, rain barrel, or dry well. Substitute swale and raingarden systems for curbs and gutters to increase infiltration.	PRL CBL DH	M LC	S
11h	When replacing existing pavement, or installing newly paved areas, use pervious or porous pavement or permeable paving blocks for parking lots, emergency access roads, driveways and streets where appropriate to increase infiltration and reduce runoff volumes and pollutant loads.	PRL CBL DH DOT M	PD LC	M
12	Utilize naturalized wet bottom or wetland detention basin designs and retrofit existing single function dry bottom detention basins to provide multiple benefits including reduced pollutant loads, and to provide habitat. Upgrade and maintain existing stormwater detention basins and online water storage ponds to provide water quality benefits and slower release rates where feasible.	M PRL CBL DH GC	DOT SMC BPDD	M
12a	Stabilize eroding shorelines and replace rip rap, concrete and turf pond and detention basin edges with deep-rooted native landscaping for shorelines and buffers.	M PRL CBL DH GC	DOT SMC BPDD	M
12b	Install settling basins upstream of wet and wetland detention where feasible and where the catchment area contains a large amount of impervious surface to capture sediment in runoff. Where settling basins can not be installed upstream, install a forebay in the basin and remove accumulated sediment to maintain detention capacity.	M PRL CBL DH GC	DOT SMC BPDD	M
12c	Monitor, maintain, and clean out stormwater detention facilities, storm drains, and catch basins to ensure effective operation and provide maximum detention, water quality benefits and habitat. Develop a monitoring and maintenance plan that identifies who is responsible, a maintenance schedule, budget and funding source.	M PRL CBL DH GC	DOT SMC BPDD	S
12d	Where possible, restrict discharge rates from detention basins to mimic natural instream flow rates.	M PRL CBL DH GC	DOT SMC BPDD	M
13	Preserve and protect natural drainage and storage (green infrastructure) features of the landscape to filter and infiltrate runoff and to reduce the threat of flood damage, including native vegetation, natural riparian buffers, floodplains, flood prone areas, natural depressional and regional storage areas, and wetlands. Prevent fill, excavation, development, and other modifications. Smaller depressional areas may potentially be incorporated into development as raingardens, bioswales, and other measures that retain runoff rather than releasing it offsite.	M DH PRL	SMC LC	L
14	Maintain the drainage system conveyance including cleaning out catch basins, channel maintenance, swale maintenance, culverts, and removing excess debris, trash, and other obstructions to improve aesthetics maintain flow capacity, and minimize erosion. Some natural elements such as rocks and woody debris should be left as in-stream habitat features.	M BPDD RL	DOT SMC	S

5.2.3 PLANNING AND DEVELOPMENT STANDARDS

The Dead River watershed is largely built out, meaning that a very limited amount of developable land remains. The existing developed landscape has and continues to impact watershed resources primarily due to the conversion (and loss) of the natural landscape to urban uses, alteration of the natural drainage and water retention features of that landscape, and the rate, volume, and quality of stormwater runoff.

The Lake County Watershed Development Ordinance provides good standards and practices for addressing some of these impacts, however, the jurisdictional scope of the County is limited, and watershed municipalities, as the primary land use and development decision-making entities, are responsible for adopting and enforcing many of the planning, zoning, subdivision, and development standards that will affect watershed resources. Current municipal planning and development standards do not adequately identify, prioritize, or preserve valuable landscape features nor require (and in some cases, they do not even allow) the use of conservation design, low impact development, or stormwater best management practices.

Watershed and green infrastructure recommendations should be integrated into local policies, plans, and budgets. Standards and policies that protect the natural drainage system from hydrologic modification activities such as clearing, compaction, draining, filling, dredging, and straightening, such as providing overlay zoning for high priority green infrastructure, are needed. These development standards may include changes to zoning regulations, subdivision, commercial, and industrial standards, to include conservation and low impact development techniques by right (rather than as an exception), natural buffers, and green infrastructure protection/management programs.

The parties that are responsible for implementing planning and development standards are primarily those responsible for land use decisions. Thus, the primary responsibility lies with the municipalities and Lake County.

Programmatic actions for planning and development standards are listed in Table 5.4.

Table 5.4 Planning and Development Standards Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
15	Lake County, municipalities, park districts, the Forest Preserve District and other local governments units should incorporate the goals and recommendations of the watershed plan into comprehensive land use plans, development policies (zoning and subdivision regulations) capital improvement plans and budgets, and land preservation/acquisition strategies.	M	BPDD LCFPD SMC T LC	S
16	Use the site development planning and approval process to encourage watershed-friendly development practices and designs that protect watershed resources and water quality by right rather than by exception.	M	LC	S
17	Establish incentive programs for developers to implement conservation and low impact development planning and design practices and techniques. These incentives could include expedited permitting and review procedures, density bonuses, tax credits, cost-share, or fee reductions for early projects that serve as demonstrations and free technical assistance.	M LC		M
18	Make it easy for developers and builders to incorporate best management practices recommended by this watershed plan into new developments or redeveloped areas. Modify zoning and development standards to facilitate implementation of the watershed plan recommendations. This could include the following: review and update development standards, add incentives such as density bonuses, park and open space donation credits, and other incentives, for preserving the green infrastructure system. Within new developments, easements or deed restrictions should be placed on lands identified as Category 1 parcels on the Green Infrastructure Plan.	M	LC	M
19	Establish and adopt bluff-and-ravine protection standards.	M LC		S
19a	Establish a 30' minimum buffer distance between bluff edges and development.	M LC		S
19b	Require appropriate deep-rooted native plants as ground cover to help stabilize erodable soils on ravine slopes, edges, and buffers. Erodable soils are found in reaches BL02, BL05, BL07, BL08. BL09, BL10, BL11, BL13, BL19, BL20, BL21, BL25, BL26, and BL27. Allow cutting of trees on ravine slopes where appropriate for ground cover vegetative restoration. Require proper removal and proper disposal of cut trees.	M		S
19c	Prohibit dumping of grass clippings, leaves, or other natural or man-made fill or debris that may damage underlying vegetation or prevent re-vegetation on ravine slopes.	M		S
19d	Encourage the use of on site infiltration techniques to reduce direct stormwater flow from impervious surfaces into the ravines. Where stormwater can not be infiltrated on site, prohibit downspout pipe and/or sump pump outlets on or within 10 feet of or on steep ravine slopes. Allow discharge at the bottom of the ravine.	M LC SMC		S
19e	Limit concentrated stormwater discharges to ravines to storm events larger than the 1-year frequency. Level spreaders may be required to distribute concentrated flows across a large area.	M SMC		M
20	Adopt and enforce flexible local zoning and subdivision standards that allow adaptable, nontraditional designs for development that minimize negative impacts from stormwater runoff and nonpoint source pollution. Standards should limit runoff volume increases, minimize impervious surface area, manage stormwater on site using BMPs, and minimize land disturbance during and following construction. This action is most relevant for Highly Vulnerable Critical Subbasin #35, which is at risk for land use conversion that may result in significantly higher imperviousness.	M	LC	M
20a	Reduce minimum street widths to those necessary to carry the expected average traffic volume rather than the maximum traffic volume.	M	LC	L
20b	Use alternative parking lot designs including: ensure that the number of spaces built reflects actual, everyday demand rather than infrequently needed maximums; reduce the dimensions of the normal parking spaces where feasible; convert parking lot islands and landscaping to depressed bioretention areas; allow shared parking between adjacent facilities with alternating times of parking needs (e.g., a church and an office building).	M	LC	M
20c	Allow permeable paving practices for plazas and pedestrian areas, parking, driveways and low volume traffic streets.	M	LC	M
20d	Allow reduced street setbacks, frontages, and lot sizes in areas where riparian or sensitive natural areas need protection and to reduce the impervious surface area for streets and driveways.	M	LC	M
20e	Allow cluster / conservation design development to reduce the disturbed area and preserve green infrastructure (open land) for infiltration and treatment of runoff.	M	LC	M

5.2.4 GREEN INFRASTRUCTURE

The green infrastructure network of the Dead River watershed, outside of Illinois Beach State Park, is neither extensive nor well connected. Some large open parcels have been protected as natural areas, such as Illinois Beach State Park (IBSP) and Lyons Woods Forest Preserve, and others are protected for more active use, such as Thunderhawk Golf Club Forest Preserve and Shiloh Park in Zion. While these public holdings form good, large green infrastructure hubs, the connections between those hubs, particularly along the stream corridors where they are most needed, are largely nonexistent. In many cases, the opportunity does not exist to preserve these areas--they are privately owned and already developed. However, a few open parcels do remain, as illustrated in Figure 5.1. The preservation of this green infrastructure system is not only important for preserving environmental resources, but makes good economic sense for the community as well. Green infrastructure helps protect the natural conveyance system, absorb flood waters reducing flood damage, can reduce the continued degradation of stream resources needing expensive remediation, and can preserve high value resources making the community a healthy and desirable place to live.

A connected green infrastructure network throughout the watershed should be protected and enhanced or restored to improve its functional value. The watershed green infrastructure network primarily consists of the natural drainage system including open parcels along the stream corridor and those prioritized as Category 1 (highest priority) sites. Municipalities, which are primarily responsible for preserving green infrastructure parcels, should identify these areas as important within community plans, policies, and budgets, avoid extending gray infrastructure (roads and utilities) in a way that would impact green infrastructure parcels, and take action to preserve them using planning and development standards described above. Other parties that can support land preservation efforts include the Lake County Forest Preserve District and, for parcels of higher biological quaility, the Illinois Department of Natural Resources.

Programmatic actions for green infrastructure are listed in Table 5.5. Prioritized green infrastructure areas, which are describedin greater detail in Tables 5.6 through 5.11, are shown in Figure 5.1.

Table 5.5 Green Infrastructure Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
21	Land planning jurisdictions such as municipalities, park districts etc. adopt the Green Infrastructure Plan to use as a tool in prioritizing and implementing green infrastructure preservation and restoration programs.	M PD LCFPD	LC	S
21a	Clearly identify and designate areas prioritized in the Green Infrastructure Plan as green infrastructure conservation areas in county, park district and municipal comprehensive plans and maps.	M PD LCFPD	LC	S
21b	Identify and conserve connecting greenways, especially along streams and other water features. Provide passage and remove or mitigate barriers to fish & wildlife movement (such as highways, dams, and weirs) throughout the corridors and between the green hubs.	M PD LCFPD	LC	L
21c	Avoid development and installation of gray infrastructure through Category 1 green infrastructure system parcels wherever possible.	M	LC T DOT	S
21d	For lands not readily protected through land use planning and zoning, develop a preservation strategy to prioritize and purchase or otherwise protect Category 1 Green Infrastructure parcels and the natural drainage system of stream corridors, and wetland complexes. The strategy may include purchase funds, developer fees and donation funds, conservation easements, purchase of development rights programs, or other measures.	M PD LCFPD	LC	S
22	Actively manage, restore, buffer and expand Category 1 and 2 Green Infrastructure Parcels by controlling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer. These areas may include Illinois Natural Areas Inventory sites, forest preserve holdings, private conservation lands, and other public agency lands such as park districts.	PRL CBL M	PD IDNR LCFPD	L

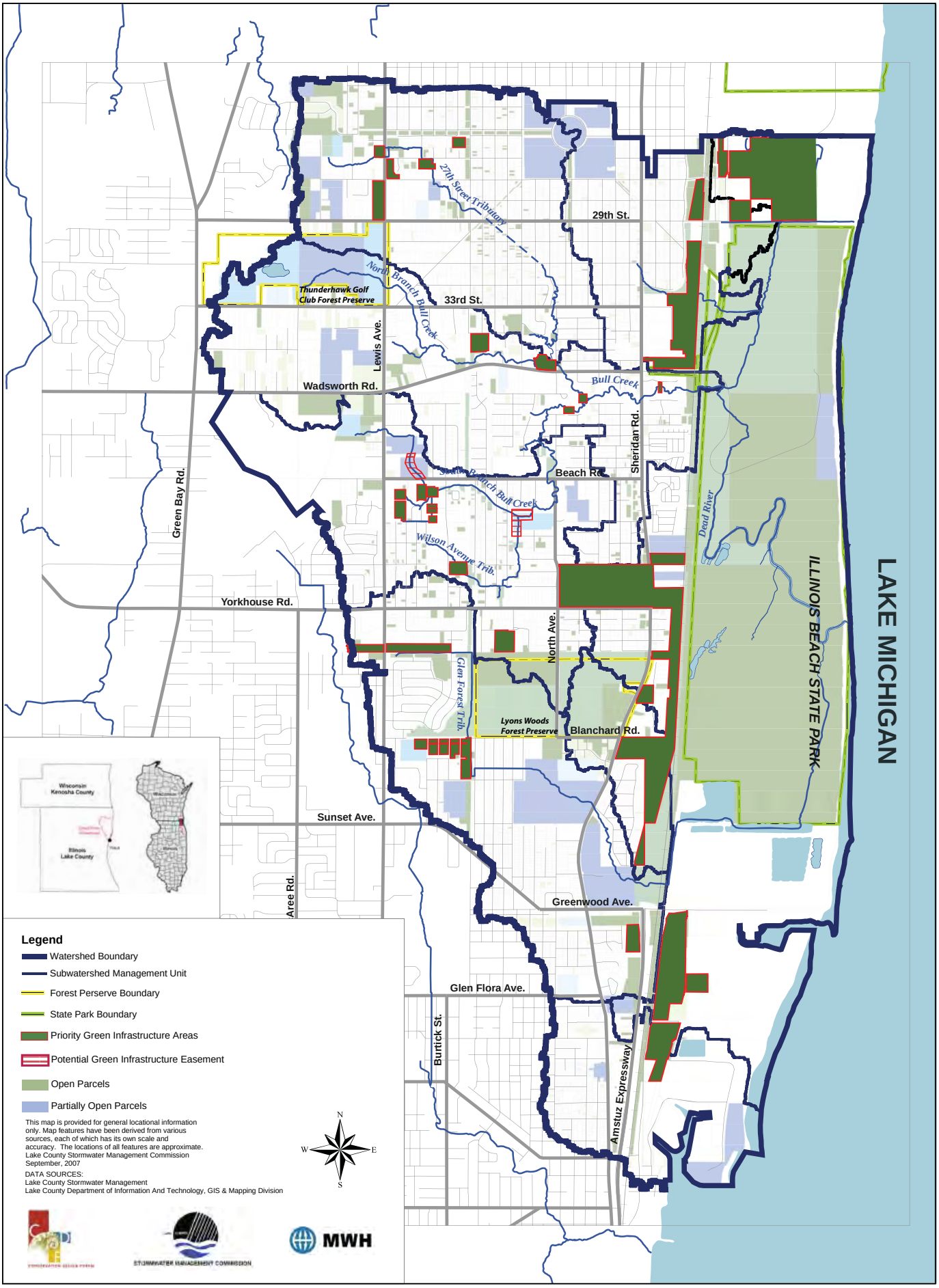


FIGURE 5.1 PRIORITIZED GREEN INFRASTRUCTURE AREAS

5.2.5 NATURAL AREAS

Natural areas such as stream and riparian corridors, wetlands, forest preserves, and some of the open and partially open green infrastructure parcels that remain in a natural state provide flood water retention and natural buffering for streams, but are also important to preserve the biological heritage of the watershed, conserve unique habitat found no where else on earth, and serve as passive and active recreational spaces for watershed residents and visitors.

Natural areas within the Dead River watershed include Illinois Beach State Park, Lyons Woods Forest Preserve, and parts of Thunderhawk Golf Club Forest Preserve. Lyons Woods and IBSP are some of the most biologically diverse ecosystems in the State of Illinois. The state park has one of the last remaining reaches of natural Lake Michigan shoreline in Illinois. These holdings significant and form a strong foundation for the green infrastructure network. Outside of these areas, natural areas are sparse and found primarily along the Union Pacific railroad corridor, with three remaining open parcels bounded by Yorkhouse Road, North Avenue, and Sheridan Road. Nonetheless, landowners along the stream corridor are responsible for restoring and managing the stream and riparian areas, which are very important to the natural health of the watershed.

Wetland protection, management, and restoration are needed to protect the natural conveyance system, improve water quality, provide stormwater storage, and other natural resource benefits. As recipients of drainage from the entire Dead River watershed upstream, IBSP and Lyons Woods are being degraded by that runoff and are in critical need of restoration and management to protect and enhance their high quality wetlands and natural areas. Upstream watershed management that restores a more natural hydrology and reduces erosion, pollution, and sediment loads to the park and forest preserve will help stabilize the hydrology and preserve rare and highly valued natural communities in the park and forest preserve downstream.

Erosion of the Lake Michigan shoreline is a problem related to the disruption of the natural transport and deposition of sand that under natural conditions replenishes the beach. While a number of actions have been taken to help reduce erosion and replenish the sand, they have resulted in very limited and temporary success.

Programmatic actions for natural areas are listed in Table 5.6.

Table 5.6 Natural Area Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
23	Actively manage, restore, buffer and expand natural areas (riparian zones, wetlands, and high quality habitat sites) by controlling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer. These areas may include Illinois Natural Areas Inventory sites, forest preserve holdings, private conservation lands, and other public agency lands such as park districts.	M IDNR PD LCFPD	CBL PRL	L
24	Protect, and restore degraded, drained, and/or farmed wetlands to improve water quality, provide surface water storage, and improve habitat. Vegetative management, prescriptive burning, invasive species management, and hydrologic restoration can all be used to help improve wetland quality. The strategic removal and/or blockage of wetland drainage tiles, flood control structures, or other drainage structures can help restore wetland hydrology. Approximately 754 acres are available as potential wetland restoration sites.	M LCFPD PRL	IDNR PD	L
25	Restore stream channels to natural state by preserving and/or installing pools and riffles, removing excessive debris, stabilizing steam banks and the stream bed.	RL	BPDD IDNR	L
26	Stabilize upstream hydrology to reduce erosion, pollution runoff, and sediment loading to downstream natural areas and preserve valuable and unique resources within Illinois Beach State Park and Lyons Woods Forest Preserve.	M PRL		L
27	Replenish and stabilize the Lake Michigan shoreline to protect this valuable and unique habitat.	IDNR CMP	USACE USFWS	L
28	On private lands, actively manage, restore, buffer and expand on-site natural areas by controling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer.	PRL RL CBL		L

5.2.6 LAND MANAGEMENT

In any watershed, the way that land is managed, developed, grown, and otherwise acted upon by the residents and others in the watershed affects the quality of watershed resources. Land uses such as transportation, industrial, and commercial, with large areas of impervious surfaces such as rooftops, roads, and parking lots, contribute significant amounts of pollutants to streams and other water resources. Management of the turf grass areas of residential and other land uses such as schools and parks contribute fertilizers and pesticides, and the disposal of yard waste in or near the stream or other water feature impacts these resources by contributing decomposing organic matter, which reduces dissolved oxygen levels in water. Animal populations, including pets, deer, and gulls along the Lake Michigan shoreline contribute bacterial contamination to the stream and beaches, making them unsuitable for human contact. Construction activities can result in significant site erosion, which sends sediment into the stream system. All of these pollutants eventually end up in Lake Michigan, the source of drinking water and recreation for millions of people.

Appropriate land management practices can help reduce pollutant loading at the source, before pollutants reach streams and other water resources. Road and parking lot maintenance, including street sweeping and the reduction of road salt application in winter, can help prevent toxic materials, sediment, and chlorides from flowing to the stream and impairing water quality. Soil erosion and sediment control practices installed during the development and construction process can significantly reduce the contribution of sediment from these sites. Appropriate landscape maintenance, such as reduced application of fertilizers and pesticides, installation of native landscapes, and appropriate disposal of yard waste, can reduce the concentration of landscaping pollutants in stormwater runoff and the stream. Installing best management practices such as riparian buffers and filter strips can remove pollutants from runoff before they can reach the stream. For example, stream riparian buffers have the potential to remove 75% of sediment and 50% of phosphorous from stormwater runoff. Naturalized swales can remove up to 80% of total suspended solids and 30% of phosphorous.

Three sites within the Dead River watershed present unique challenges and opportunities for land managment. The Waukegan Regional Airport, which is planning to expand within the next 10 years, is partially covered by impervious surfaces and requires the use of fluids and chemicals to support the airport activities, some of which are toxic or otherwise harmful to water quality and habitat. The airport implements a Storm Water Pollution Prevention Plan and Spill Prevention, Control and Countermeasure Plan that it should continue to update and apply. The airport should also consider implementing the road and parking lot maintenance recommendations, as well as those related to turf grass and grounds management for those areas not covered by impervious surfaces.

The Zion Nuclear Power Station is scheduled to be decommissioned over the next 10 years and the City of Zion plans the future land use of this area to be single family residential. If feasible, and if all contamination or other nuclear legacy issues can be adequately addressed, this land should be remediated, restored to a natural state, and re-integrated into Illinois Beach State Park and the unique resources found there.

Property owners within the Waukegan Harbor Area of Concern, which includes the harbor and the industrial land uses to the north and surrounding the harbor, should take special land management precautions. Property should be kept clean of debris, fluids, chemicals, and other materials that have the potential to leach or otherwise migrate into streams, Lake Michigan, or other areas. Material piles or storage areas also should be covered or contained.

Programmatic actions for land management are listed in

Table 5.7 Land Management Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
29	Improve road maintenance practices, such as street and parking lot sweeping and reduce application of de-icing salt, to reduce the flow of particulates, sediment, chlorides, and other pollutants into the stormwater system, stream, and ultimately Lake Michigan.	M DOT CBL	T	S
30	Investigate and address potential contamination issues in Illinois Beach State Park and the Dead River. Remediate, cap, cover, or install other controls for any potential sources of toxic or other pollutants including waste storage piles, landfills or facilities, hazardous materials, nuclear contamination sites, and salt piles to prevent stormwater contact or to capture runoff if stormwater contact does occur.	IDNR CMP USEPA IEPA	LCHD CAG LMGLO	L
31	Reduce fecal coliform contamination on Lake Michigan beaches by controlling gull populations, human sewage, and other contributing sources. Further study is needed to identify the non-gull sources of fecal coliform contamination.	LCHD IDNR	IEPA LMGLO	S
32	Use sustainable site and land management practices (including golf courses and agricultural operations).	PRL CBL GC	M PD LCFPD	S
32a	Avoid disposal or burning of yard waste in or near the stream or riparian buffer, which adds excess nutrients to the stream system and kills the plant buffer that stabilizes the streambanks and filters runoff to the stream. Properly dispose of yard and pet wastes, household chemicals, and trash. Do not dispose of these in stormsewers, roadside swales, or the stream.	PRL GC	CBL M PD LCFPD	S
32b	Utilize deep-rooted native vegetation wherever possible for landscaping rather than turf grass to increase stormwater infiltration and evapotranspiration, reduce the need for watering, pesticides and fertilizers, filter pollutants from surface runoff, and provide habitat for native species. Plant native trees appropriate to the local area to increase interception, evapotranspiration, and uptake of precipitation.	PRL CBL GC PD	M	S
33	Protect water resources from sedimentation due to construction site erosion by inspecting and enforcing soil erosion and sediment control standards as required by the Lake County Watershed Development Ordinance. Require an approved SESC plan to help protect water resources from sedimentation by filtering and trapping sediments out of stormwater before it leaves a development site. Assess erosion and sediment control practices after storm events and ensure SESC plan implementation.	M DH LC	NRCS/SWCD	S
33a	Minimize soil compaction, clearing and mass grading to only where absolutely necessary to build and provide access to structures and infrastructure (site fingerprinting). Avoid clearing and grading in or immediately adjacent to water resources and steep slopes. Clearing should be done immediately before construction, rather than leaving soils exposed for months or years.	M DH LC	NRCS/SWCD	S
33b	During construction protect and retain existing vegetation to decrease concentrated flows, maintain site hydrology, and control erosion.	M DH LC	NRCS/SWCD	S
33c	Limit soil exposure by phasing construction so that only a portion of the site is disturbed at any one time to complete the needed building in that phase. Other portions of the site are not cleared and graded until exposed soils from the earlier phase have been stabilized and the construction is nearly completed.	M DH LC	NRCS/SWCD	S
33d	Stabilize / revegetate exposed and disturbed soils including soil stockpiles within 14 days after disturbance with seeding, mulch cover, erosion control blankets, or other stabilization practices. Topsoil stockpiles can be reapplied as a soil amendment to reestablish vegetation following construction.	M DH LC	NRCS/SWCD	S
33e	Employ a soil erosion sediment control treatment train, and install perimeter controls and risers as a last line of defense to retain and filter sediments before runoff exits the site.	M DH LC	NRCS/SWCD	S
34	The Waukegan Regional Airport should continue to update and implement the Storm Water Pollution Prevention Plan and Spill Prevention, Control and Countermeasure Plan, sweep impervious surfaces regularly, and find more environmentally-friendly de-icing compounds for airplanes and runways.	Waukegan Regional Airport		S

Table 5.7.

5.2.7 FLOOD MANAGEMENT

Flooding and risk of flooding are fairly common in northeastern Illinois and Lake County, primarily due to the impact of urban development, which increases impervious surfaces, increases the rate and volume of stormwater runoff, and modifies and builds in natural storage and floodplain areas. These factors, coupled with a flat Illinois landscape where excess water tends to spread out over a wide area, has resulted in flooding problems. For this reason, it is important to preserve and not modify existing flood storage capacity of the landscape including depressional areas, wetlands, and floodplains.

While Flood Problem Area Inventory (FPAI) sites within the watershed are not extensive in terms of affected area, flooding within these areas can be extremely destructive and disruptive to those suffereing from flood damage. Flooding of roads and intersections, such as those reported by the Illinois Department of Transportation, disrupt travel and economic activity. In addition to these identified flooding problems, potential flood areas have also been identified that may affect up to 270 structures in the 100-year floodplain and 682 structures in the 500-year floodplain.

Addressing current and potential flood problems is important for those affected and for the overall impact of flood damage to society in general. Current flooding issues were due either to a local drainage problem, meaning that the size of the drainage system, whether underground sewer, ditch, or overland flow path, is insufficient to carry the volume of water required, or to sanitary sewer or septic failure, as in the Lake County Gardens Subdivision.

None of these locations fall within the 100-year floodplain, and flood insurance is not an option for these landowners. Increasing the local drainage capacity for these areas will probably require installation of new or larger sewer pipes, larger culverts, or improving or increasing the capacity of the ditch or overland flow path. Installing or increasing local flood storage, such as through installation of detention basins, is another potential solution. Floodproofing options, such as raising the structure above the level of flooding, protection using the surrounding land such as levees, sealing basement windows and doorways in homes, and application of floodproofing materials to buidling foundations also exist for these locations.

For sewer backup problems, one-way flow valves are available that allow flow to leave a structure via the sewer pipe but do not allow flow to enter a structure through the same pathway.

For landowners with structures within the 10- or 100-year floodplain boundary, options include flood insurance to help repair damages due to flooding, floodproofing such as raising a structure, and flood buyouts, where a property owner voluntarily sells the land and structure. Under flood butyouts, the structure is typically removed from the property and floodplain and the land is no longer available for development.

Programmatic actions for flood management are listed in Table 5.8.

Table 5.8 Flood Management Programmatic Actions

#	Flood Management Programmatic Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
35	Adopt and continue to enforce floodplain protection standards within zoning, subdivision, and building codes or a 'stand-alone' floodplain protection standard that prohibits new building and roadway development, fill, or other encroachment within the floodplain.	M LC SMC		M
36	Address Flood Problem Area Inventory and Illinois Department of Transportation flooding sites, and avoid potential flood damage within 10- and 100-year floodplains.	M PRL FEMA DOT	LC SMC	L
36a	Preserve riparian and depressional floodplain and wetlands as open and undeveloped to maximize flood storage and conveyance.	M LC		L
36b	Mitigate flood damages through floodproofing of at-risk structures such as raising the structure, sealing basement windows and doors, floodplain buyouts, and installing landscape features such as floodwalls or levees.	PRL CBL	M LC FEMA	L
36c	Mitigate sanitary sewer backup flood damages through remediation / correction of infiltration and cross connections with the sanitary sewer system and installation of one-way valves.	PRL NSSD		L
36d	Mitigate local drainage capacity flood damage by providing additional flood storage and or maintaining / improving local drainage system through installation of new or larger sewer pipes, larger culverts, or improving or increasing the conveyance capacity of ditches and overland flow path.	PRL M	LC SMC	L

5.2.8 STAKEHOLDER COORDINATION

Activities within one area of the watershed can impact watershed resources in areas of the watershed that seem distant or unconnected. For example, appropriate stormwater management practices applied in the western headwaters of the watershed can improve aquatic resources as far away as Illinois Beach State Park and Lake Michigan, and can reduce flooding and streambank erosion problems for downstream communities and landowners. And just as the actions of one stakeholder can impact distant resources, the participation, coordination, and action of all of the stakeholders is needed to create real and lasting improvement of watershed resources. No single party, stakeholder, jurisdiction, or discipline can effectively implement this watershed plan alone.

Coordination across property and jurisdictional lines is critical for implementing plan recommendations that require multiple funding sources and coordination of time and effort beyond a single stakeholder's resources. For example, municipalities must adopt the green infrastructure plan and coordinate implementation efforts and resources to achieve the most efficient and effective results. Neighbors must work together to address streambank erosion issues that threaten their properties. A strong coalition of dedicated watershed stakeholders, including representatives from all of the municipalities, the county, and residents and landowners must form a new Dead River watershed-based organization to help coordinate and lead watershed plan implementation efforts, provide education and assistance to watershed stakeholders, and make recommendations for project funding. Local, state, and federal agency programs, including voluntary education initiatives, technical and financial support for planning and best management practice projects, and regulatory programs that permit or restrict development activities, can be combined and leveraged for multiple benefits.

Programmatic actions for stakeholder coordination are listed in Table 5.9.

Table 5.9 Stakeholder Coordination Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
37	Form a watershed organization to coordinate and lead watershed plan implementation activities.	SMC M	WPC IEPA	S
38	Coordinate watershed restoration projects and develop cost-share funding for best management practices.	SMC	M WPC	S
39	Establish regular (e.g., quarterly) stakeholder coordination meetings to discuss projects, watershed plan implementation, and land use planning and development activities.	SMC	M WPC	S
40	Incorporate plan recommendations into regional, county, and municipal plans and budgets.	M LC CMAP		S

5.3 SITE SPECIFIC ACTION PLAN

In addition to the programmatic recommendations, which generally apply watershed wide, site specific action items and recommendations are tied to a particular location in the watershed: one of the Subwatershed Management Units, one of the stream reaches, or a specific point on the stream. As with the programmatic actions, these site specific recommendations were developed to address watershed problems, to improve watershed resources, and to achieve the watershed goals and objectives.

The process of identifying specific sites that are in need of, or suited to, watershed improvement projects has been ongoing during the planning process and will continue throughout plan implementation. Watershed improvement projects in the site specific plan range from small maintenance and repair tasks, to large wetland restoration and green infrastructure preservation projects.

During development of the watershed-baed plan, several methods were used to identify project sites.

1. Members of the Watershed Planning Committee provided site and project recommendations to the planning team during meetings.
2. Sites were identified based on results of previous watershed studies such as the Flood Problem Area Inventory and 2001 Stream Inventory.
3. New data was collected during the field assessment conducted by the planning team.
4. Extensive map analysis using existing data including land use, wetlands, soil, floodplain and green infrastructure overlays. These analyses included green infrastructure prioritization, identification of critical areas, and non-point source pollution loading.

This action plan (Tables 5.10 through 5.15) is organized by the jurisdiction in which the recommendation falls, and includes the information listed below. This structure should allow jurisdictional representatives to easily identify which recommendations are within their sphere of influence and control. The action recommendations have been located on the Subwatershed Management Unit Maps found in Figures 5.2 through 5.10 and are identified by the three-digit Recommendation ID#. Tables 5.10 through 5.15 are subsets of a more detailed action plan table that is included in Appendix H. Chapter 6 identifies a number of implementation details, such as area and cost, that are essential for understanding the difficulty and extent of putting these recommendations into effect.

Recommendation Identification # (ID#): each action is identified by a three-number identification label: (1) SMU, (2) stream reach, and (3) identification number for each action. For example, 2.27.4 would refer to Action #4 along Reach 27 within SMU 2. These ID numbers correspond to those on the SMU maps in Figures 5.2 through 5.10.

Jurisdiction: identifies the jurisdiction within which the recommendation falls. Individual jurisdictions are listed first, followed by multi-jurisdictional recommendations.

Recommendation Description: narrative explanation of the action recommendation. Those recommendations that address Critical Areas (identified in Chapter 3 Section 17) are shown in italics.

Goal-Obj: the Goal and Objective the action item is intended to address.

Priority: priority refers to the rank importance of the action. A "1" indicates high priority and "3" indicates lower priority.

Ease of Implementation: indicator of how difficult the recommended action is to implement, with "1" indicating a fairly simple action and "3" more complex or difficult action to implement.

Time frame: indicator of when the action recommendation is intended to be implemented: Short (1-5 years), Medium (5-10 years), or Long (10+ years).

Implementation Responsibility: indicates the lead party that will most likely be responsible for implementing the action recommendation as well as any supporting parties.

The site-specific recommendations in Tables 5.10 through 5.15 reflect the opportunity sites identified by stakeholders, past studies and inventories, and other components of the watershed assessment. However, they do not include all of the opportunities for best management practice projects in the watershed. Figures 5.2 through 5.10 illustrate the location of the site specific recommendations included in Tables 5.10 through 5.15.

Table 5.10 Site Specific Action Plan for the City of Zion

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.1	Zion	Preserve Category 1 and 2 green infrastructure open space areas to connect the North and South units of Illinois Beach State Park, enhance recreational opportunities, and expand and restore important rare habitat. Decommission and remove the power plant and associated structures. Acreage count includes private / utility owned land within the area. It is assumed that restoration would address the potential pollutant loading hotspots identified as Critical Subbasins #15 and #74.	C1, C2, C3, E1, E2	1	3	L	IDNR/Utility	Zion
2.0.3	Zion	*Manage / minimize runoff impacts of commercial land uses along Sheridan Road, particularly at Sheridan and 33rd St and Sheridan and 27th, 28th, and 29th along the stream. Cost estimate assumes 8400 lf of Sheridan Road frontage treated with improved, 10' swales (approximately 2 acres) as a proxy for on-site source control BMPs.*	E1, E2, E7, E9, G1	1	3	S	Zion	Owner Developer
2.0.6	Zion	*Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin; remove excess debris.*	E1, E2, E9	2	2	S-M	Owner	
2.0.7	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin; remove excess debris. This is depressional area #54.	E1, E2, E9	2	2	S-M	Zion Park District	
2.0.8	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2	S-M	Zion Park District	
2.0.9	Zion	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	Owner	Zion
2.28.1	Zion	Restore stream channel and improve instream habitat by installing pools and riffles.	A1, A10, C3	3	3	S	Zion Park District	
2.28.2	Zion	*Restore and manage the channel, native riparian buffers, and ravine woodland system, particularly the reach running through Ophir Park west of Sheridan Road, and Carmel Park east of Sheridan Road. Management practices include controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.*	A1, A3, A5, A6, A10, C3, E2, E4	1	2	S	Zion Park District	
2.28.3	Zion	*Stabilize and reduce downcutting of the incised channel through Ophir Park, and install a naturalized riparian buffer. Cost estimate assumes stabilization of streambanks with Moderate erosion problem.*	A6, A10, A11, B1, B4, C3, E1	1	2	S	Zion Park District	
2.28.4	Zion	Manage the culvert outflow at the upstream end of the reach for energy dissipation and pollutant removal, possibly with a settling basin or small constructed wetland.	A10, A11, B4	2	3	S	Zion Park District	

Table 5.10 Site Specific Action Plan for the City of Zion (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
2.28.5	Zion	*Stabilize Moderate streambank erosion along the entire reach using bioengineering stabilization measures, which will help reduce the instream silt / sedimentation load within this reach.*	A1, A3, A8, C3, E1	1	3	M	Zion Park District, Owner	
2.28.6	Zion	Remove debris, tires, and logs using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	SMC
2.28.7	Zion	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	SMC
2.28.8	Zion	Remove concrete debris and remove or repair failed headwall and outfall pipe.	A10, A11, B4	2	3	S-M	Zion Park District	Zion
2.28.9	Zion	*Stabilize major erosion, bank slumping / blowout, and headwall failure at upstream end of the reach near the culvert. Use bioengineering stabilization measures if possible, and more structural measures if necessary. Cost estimate reflects stabilization of severe erosion problem.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
2.28.10	Zion	*Stabilize 4 foot diameter plunge pool erosion below outfall. If feasible use bioengineering measures, though rip rap and structural measures may be necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
2.28.11	Zion	*Stabilize bank erosion caused by stormwater outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
2.28.12	Zion	Inspect and, if necessary, repair five culverts under trail, which may be crushed and/or failing.	A10, A11, B4	3	3	S	Zion Park District	Zion
3a.0.3	Zion	Preserve approximately 21 acres of wetland and stream corridor open and partially open Category 1 green infrastructure areas and greenways within the headwaters of the 27th St tributary. Target areas are located (1) southwest of 25th St and Galilee, (2) south of Jethro and 26th Street, (3) west of 26th and Lewis, (4) southeast of 26th and Lewis, (5) northwest of 29th and Lewis.	A6, B1, C2, C3, G2, G4	1	3	L	Zion Park District, Zion, Owner	
3a.0.7	Zion	Manage the golf course grounds and detention / water features in Shiloh Park, in the northeast corner of the SMU for water quality and habitat benefits, including installation of a 5 foot riparian buffer along shoreline / banks of water features.	B1, C3, E1, E2, E4, E9, G2, G4	2	1	S	Zion Park District	
3a.0.8	Zion	FPAI site 20-13 experiences local drainage problems due to runoff from the west. Retrofit David Park and the school property west of the problem area with detention or infiltration practices to reduce runoff rate and volume.	B4	2	3	S	Zion	SMC
3a.0.9	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a minimum 5 ft buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2	S-M	HOA	Zion
3a.0.10	Zion	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	

Table 5.10 Site Specific Action Plan for the City of Zion (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.0.11	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	HOA	
3a.0.12	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	E1, E2, E9	2	2	S-M	HOA	
3a.0.13	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; retrofit bottom concrete channel.	E1, E2, E9	2	2	S-M	HOA	
3a.0.14	Zion	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; remove excess debris.	E1, E2, E9	2	1	S-M	HOA	
3a.0.15	Zion	Stabilize / regrade shoreline using bioenginnering practices and native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2	S-M	Zion Park District	Zion
3a.0.16	Zion	Stabilize / regrade shoreline and plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation.	E1, E2, E9	2	2	S-M	Zion Park District	
3a.0.17	Zion	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	1	S-M	Zion Park District	
3a.27.1	Zion	Restore and manage the native riparian buffer plant communities along this reach within Sharon Park by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer may be appropriate in the lower parts of the reach.	A6, A10, B1, C3, E1	2	2	S	Zion Park District	
3a.27.2	Zion	Address High streambank erosion along entire reach using bioengineering stabilization measures, some of which may threaten buried sewer lines.	A1, A3, A8, C3, E1	1	3	M	Zion Park District	
3a.27.3	Zion	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Zion Park District	SMC
3a.27.4	Zion	*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream.*	A1, A3, A8, C3, E1	1	3	M	Zion Park District	
3a.27.5	Zion	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Zion Park District	SMC
3a.27.6	Zion	*Stabilize significant erosion and exposure of manhole and sewer infrastructure using bioengineering stabilization measures and other hardscape solutions to ensure protection of the infrastructure elements. Length difficult to determine from photo; assume 100 lf for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Zion	NSSD?, Zion Park District

Table 5.10 Site Specific Action Plan for the City of Zion (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.27.7	Zion	*Stabilize erosion creating open channel at discharge point using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion	Owner (Bd. Of Edu.)
3a.27.8	Zion	*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 150 lf for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Zion Park District	
3a.27.9	Zion	*Stabilize erosion at outfall that is creating an open channel using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
3a.27.10	Zion	*Stabilize major erosion, headwall, and outfall pipe failure using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
3a.27.11	Zion	*Stabilize minor channel erosion using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	
3c.22.1	Zion	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	
3c.22.2	Zion	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Zion	SMC

Table 5.11 Site Specific Action Plan for the Village of Beach Park

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.3	Beach Park	Preserve and restore open and partially open green infrastructure bounded by North Ave, York House Road, Sheridan Road, and residential areas to the north (spanning SMUs #1, #3b, and #3c) for natural resource restoration and management and recreation. Preserving two corridors (19 acres) east of Sheridan Road would connect this piece to the larger Illinois Beach State Park system. The area also contains storage area #30 and potential storage area #27, which may help reduce flooding in the area of FPAI 20-02 along Coolidge Ave.	B1, C1, C2, C3, G2, G4	1	3	L	Owner	Beach Park
1.0.8	Beach Park	Monitor IDOT-recorded flooding location at Sheridan and York House Road for further problems.	B4, F7	3	1	S	IDOT	SMC
1.0.9	Beach Park	Monitor IDOT-recorded flooding locations at Sheridan and Beach Road for further problems.	B4, F7	3	1	S	IDOT	SMC
1.0.14	Beach Park	Install filtration and infiltration BMPs for existing commercial properties along Sheridan Road. Cost estimate reflects 10' wide swale improvements (as a proxy for lot level / source control BMPs) along 1500 lf of Sheridan Road frontage.	E1, E2, E7, E9, G1	2	3	S	Beach Park	Owner Developer
1.0.15	Beach Park	Improve any swale and other surface stormwater drainage systems within the developed areas of the western part of this SMU, which is mostly unsewered, and install stormwater filtration and infiltration BMPs. Details reflect 54,000 lf (approximately 12.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of roads within this part of the SMU.	E1, E2, E7, E9, G1	1	3	S	Beach Park	
1.0.23	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.24	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.27	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
2.0.5	Beach Park	Monitor past IDOT-recorded flooding at Sheridan and Wadsworth for further problems and remediate if flooding continues.	B4, F7	3	1	S	IDOT	
3a.25.4	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3a.26.1	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	A6, A10, B1, C3, E1	2	2	S	Owner	
3a.26.2	Beach Park	Restore stream channel and improve instream habitat by installing & enhancing pools and riffles.	A1, A10, C3	3	3	S	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.26.3	Beach Park	*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt and sediment load.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3a.26.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3a.26.5	Beach Park	Remove chain link fence placed across stream channel.	A1, A10, B4	2	1	S	Owner	Beach Park, BPDD
3a.26.6	Beach Park	*Remediate significant erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3a.26.7	Beach Park	Investigate and remediate collapsed pedestrian bridge in the stream channel.	A10, A11	2	2	S	Owner	Beach Park, BPDD
3b.0.2	Beach Park	Consider daylighting and restoring as much of the Wilson Avenue Tributary (not inventoried) as possible through the residential areas. Daylighting and restoration should address concerns about the tank cars and transite pipes that are reported to transmit the flow below ground in this location.	A1, A6, C3, G2	3	3	L	Beach Park	Owner
3b.0.3	Beach Park	Buffer the Wilson Avenue Tributary from encroachment by preserving open Category 2 green infrastructure areas.	B1, C1, C2, C3, G2, G4	1	3	L	Owner	Beach Park
3b.0.5	Beach Park	Restore and manage the wetlands within the open and partially open Category 1 Green Infrastructure areas just north of Lyons Woods Forest Preserve; reconnect these wetlands to the Lyons Woods system.	B1, C1, C2, C3, E1, E2, G2	3	3	L	Owner	SMC
3b.0.8	Beach Park	FPAI site 20-04, in the Village of Beach Park, experiences sewer backup into homes due to an inadequate drainage system. Investigate whether the remedial measure, a large pipe and ditch installed as part of the Monarch Point development to the north, fixed the problem. If not, remedial action should be taken, which may include working with the open areas identified on the SMU map to relieve drainage issues.	B2, B3	2	3	S	Beach Park	SMC
3b.0.9	Beach Park	"FPAI site 20-05, in the Village of Beach Park, experiences road, home, and backyard flooding due to inadequate conveyance capacity of the open ditch and culvert, particularly the culvert under Yorkhouse Road. Remedial action may include retrofit / restoration of open green infrastructure areas to help absorb / store flood water.	B1, B2, B4	2	3	S	Beach Park	SMC

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.0.10	Beach Park	The area where BL13, BL14, and BL15 come together is in need of a stream restoration plan to remediate the buildup of debris, concrete lined channels, underground culverts and railroad tank cars, yard waste in the stream channel, and other impacts from nearby residential areas.	A1, A6, A10, A11, C3, E5, E9, G2	1	3	S	Beach Park SMC Owner	
3b.0.11	Beach Park	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2	S-M	Waukegan Park District	
3b.0.13	Beach Park	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	2	S-M	Owner HOA	
3b.0.14	Beach Park	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	HOA	
3b.0.17	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
3b.0.18	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
3b.0.19	Beach Park	Plant banks with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	E1, E2, E9	2	1	S-M	HOA	
3b.0.20	Beach Park	Convert to wet or wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	2	S-M	HOA	
3b.0.21	Beach Park	Plant banks and a surrounding buffer with native vegetation; remove excess debris.	E1, E2, E9	2	1	S-M	Owner	
3b.12.1	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.*	A1, A10, C3	1	3	S	Owner	Beach Park, BPDD
3b.12.2	Beach Park	*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3b.12.3	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	
3b.12.4	Beach Park	Investigate / inspect failed / broken concrete dam along west of Cheney / North Ave. for impact on stream, and remove impacting dam elements if found be have a negative impact.	A1, A2, A11, C3	3	1	S-L	Owner	Beach Park, BPDD
3b.12.5	Beach Park	*Stabilize typical 1-2 foot erosion on right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.12.6	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3b.12.7	Beach Park	*Stabilize significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3b.12.8	Beach Park	*Remove debris and sediment from culvert under Beach Road.*	A10, A11, C3, E1, E7, E8, F7	1	3	S	Owner	Beach Park, BPDD
3b.12.9	Beach Park	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3b.12.10	Beach Park	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3b.13.1	Beach Park	Manage and restore the wooded ravine along reach BL13. Assumes an area 2500 lf by 150 ft in width for cost estimating purposes.	A6, A7, A10	3	2	S	Owner	Beach Park
3b.13.2	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and removing numerous debris jams according to the American Fisheries Society guidelines.*	A1, A10, C3	1	3	S	Owner	Beach Park, BPDD
3b.13.3	Beach Park	*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3b.13.4	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	Beach Park SMC
3b.13.5	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park SMC
3b.13.6	Beach Park	Inspect footbridges and armored / concrete-lined banks and remediate if found to be negatively impacting the stream.	A1, A10, A11	3	3	S	Owner	Beach Park, BPDD
3b.13.7	Beach Park	*Restore channel reach near Wilson Avenue by installing pool and riffle structures and stabilizing streambanks.*	A1, A6, A9, A10, C3, E5, G2	1	3	M	Owner	Beach Park BPDD
3b.13.8	Beach Park	Remove concrete debris dumping / fill just upstream of Beach Rd culvert from property / operation at Tewes and Beach.	A10, A11, B4	2	2	S	Beach Park	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.13.9	Beach Park	*Remediate significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD
3b.13.10	Beach Park	*Inspect and assess fencing across channel and rock wall armoring and remove if found to impair the conveyance of water.*	A1, A10, A11	1	1	S	Owner	Beach Park BPDD
3b.13.11	Beach Park	*Remove concrete from channel and restore stream channel by stabilizing streambanks and installing habitat features such as pools and riffles and rootwads. Assumes 150 lf of stream channel needs attention for cost estimation purposes.*	A10, A11, A11, B4	1	3	S	Owner	Beach Park BPDD
3b.13.12	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, A11, B4	1	2	S	Owner	Beach Park BPDD
3b.13.13	Beach Park	*Remove debris and sediment from culvert under Beach Road.*	A10, A11, C3, E1, E7, E8, F7	1	3	S	Owner	Beach Park BPDD
3b.13.14	Beach Park	*Address failed concrete wall armoring and major erosion behind the armoring by removing the concrete and using bioengineering stabilization measures. Assumes 100lf of stream channel needs attention for cost estimation purposes.*	A1, A3, A11	1	3	S-M	Owner	Beach Park BPDD
3b.13.15	Beach Park	*Repair or replace broken concrete and corrugated metal pipe culvert and remove debris obstructing flow.*	A1, A3, A11, C3	1	3	S-M	Owner	Beach Park BPDD
3b.13.16	Beach Park	*Stabilize erosion at and below outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park BPDD
3b.13.17	Beach Park	*Repair failed clay outfall pipe and address erosion around outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park BPDD
3b.14.1	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	Beach Park BPDD
3b.14.2	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park BPDD
3b.14.3	Beach Park	*Conduct major channel restoration by removing debris and restoring a natural channel to this concrete-lined drainage ditch.*	A1, A10, A11, C3	1	3	S	Owner	Beach Park BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.15.10	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD
3b.15.11	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD, Waukegan
3b.15.12	Beach Park	*Remove debris at the outfall discharge points.*	A10, A11, B4	1	2	S	Owner	Beach Park BPDD, Waukegan
3b.17.1	Beach Park	Restore stream channel and improve instream habitat by enhancing pools and riffles.	A1, A10, C3	3	3	S	Owner	Beach Park BPDD
3b.17.2	Beach Park	Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD
3b.17.3	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	
3b.17.4	Beach Park	Inspect footbridges and armored / concrete-lined banks along this reach for impacts on the stream corridor and remediate if necessary.	A1, A10, A11, C3	3	3	S	Owner	Beach Park BPDD
3b.17.5	Beach Park	Remove broken concrete slab streambank armoring and restore channel to natural channel condition. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	A1, A10, A11, C3	2	3	S	Owner	Beach Park BPDD
3b.17.6	Beach Park	Restore a minimum 5 foot wide, deep-rooted native plant buffer to the stream edge within the golf course.	A6, C3	2	1	S	Waukegan Park District	
3b.17.7	Beach Park	Remove debris at outfall.	A10, A11, B4	2	2	S	Owner	Beach Park BPDD
3b.17.8	Beach Park	Stabilize significant erosion and bank slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	A1, A3, A7, C3, E1	1	3	M	Owner	Beach Park BPDD
3b.17.9	Beach Park	Remove debris blocking culvert and repair, remediate, and/or stabilize the exposed culvert.	A10, A11, B4	2	3	S-M	Owner	Beach Park BPDD
3b.17.10	Beach Park	Stabilize erosion undermining the culvert, preferably using bioengineering stabilization measures but also using more structural measures if necessary.	A1, A3, A5, A8, A11, C3, E1	2	3	S-M	Waukegan Park District	Beach Park BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.0.9	Beach Park	FPAI site 20-02, in the Village of Beach Park, experiences flooding due to inadequate outlets and poor drainage. There is a backyard drainage ditch between Beach and Howard, Sheridan and Geraghty (depressional storage #49) and extending along Coolidge Rd to the north (depressional storage #50) that are likely part of the cause of flooding. Investigate whether the new storm sewer along Coolidge Avenue has eliminated flooding in this location. If flooding persists, additionial solutions may include improvement of drainage overland flow paths and installation of additional storm sewer capacity to alleviate the problem.	B4, F7	3	1	S	Beach Park	
3c.0.10	Beach Park	Monitor past IDOT-recorded flooding locations at Sheridan and Wadsworth, Sheridan and Talmadge / Michigan, and Sheridan and Beach Rd. to determine whether flooding is still occuring at these sites. If so, develop and implement flood mitigation strategies.	B4, F7	3	1	S		IDOT
3c.0.14	Beach Park	Stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Owner	
3c.0.15	Beach Park	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2	S-M	Owner	
3c.0.16	Beach Park	Retrofit as wet / wetland basin; stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Owner	
3c.0.18	Beach Park	Plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	1	S-M	Owner	
3c.7.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner, Bull Creek Stakeholder Assn.	
3c.7.4	Beach Park	Assess side slope seeps for restoration potential. Restore if possible.	C3	1	3	S	Owner, SMC	
3c.7.5	Beach Park	Remove massive debris jam approximately 300' downstream of Sheridan Road and stabilize channel.	A10, A11, B4	2	3	S	Beach Park, Bull Creek Stakeholder Assn., SMC	
3c.8.1	Beach Park	*Address High streambank erosion along entire reach, some threatening homes and property, using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.8.2	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.8.3	Beach Park	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3c.8.4	Beach Park	*Repair broken cement outfall pipe and stabilize surrounding erosion using bioengineering stabilization measures. Location is approximately 300' upstream of Sheridan Rd.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Beach Park	Beach Park, BPDD
3c.8.5	Beach Park	*Stabilize streambank erosion across from the sewer / manhole stabilization project along the reach near the Garaghty / California intersection. Length of problem is unknown; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD, NSSD, USACE,
3c.8.6	Beach Park	*Stabilize minor channel erosion and downcutting of channel outfall using bioengineering stabilization measures and energy dissipation measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.8.7	Beach Park	*Stabilize major erosion behind headwall and below outfall preferably using bioengineering stabilization measures but may also require more structural measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.8.8	Beach Park	*Stabilize moderate channel erosion and downcutting using bioengineering stabilization measures and, if necessary, check dams.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.8.9	Beach Park	*Address major erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.8.10	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.8.11	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.8.12	Beach Park	*Monitor sewer manhole, which rises 6 feet above stream elevation, for leakage and infiltration problems.*	F7	1	1	S	NSSD	
3c.8.13	Beach Park	*Stabilize major erosion and slumping of ravine bank using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.8.14	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.1	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.*	A1, A10, C3	1	3	S	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.9.2	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.9.3	Beach Park	*Restore the native riparian buffer (manage native riparian plant communities within this reach: control invasive species, plant native species, thin shrub layer to allow more understory growth, and manage vegetation such as through prescribed burning.)*	A6, A10, B1, C3, E1	1	2	S	Owner	
3c.9.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3c.9.5	Beach Park	*Stabilize major erosion with slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.9.6	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.7	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.8	Beach Park	*Remove debris around plastic outfall pipe.*	A10, A11, B4	1	2	S-M	Owner	Beach Park, BPDD
3c.9.9	Beach Park	*Stabilize major erosion on the left bank using bioengineering stabilization measures.*	A1, A10, A11, C3	1	3	M	Owner	Beach Park, BPDD
3c.9.10	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.11	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.12	Beach Park	*Stabilize major erosion and slumping of the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1, E5	1	3	M	Owner	Beach Park, BPDD
3c.10.1	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation within this reach.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.10.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.10.3	Beach Park	*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.10.4	Beach Park	*Stabilize erosion around capped outfall pipe using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.11.1	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.11.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	
3c.11.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park
3c.11.4	Beach Park	Remove debris obstructing culverts.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.11.5	Beach Park	Remove debris from outfall channel and assess armoring for impact on stream; if negative impact is found, remove armoring and stabilize with bioengineering approach.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.11.6	Beach Park	*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.11.7	Beach Park	*Repair / remediate erosion below outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.11.8	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.11.9	Beach Park	*Stabilize major erosion occurring behind armoring on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.11.10	Beach Park	*Assess wood armoring / retention wall for stability and feasibility of bioengineered approach to bank stabilization. Assumes 100lf of stream channel, both sides for cost estimation purposes.*	A1, A3, C3	1	3	M	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.19.1	Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.19.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	
3c.19.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park
3c.19.4	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.19.5	Beach Park	*Stabilize significant erosion and slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.19.6	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams or other grade stabilization measures if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.19.7	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.20.1	Beach Park	Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.	A1, A10, C3	3	3	S	Owner	Beach Park, BPDD
3c.20.2	Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.20.3	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	2	2	S	Owner	
3c.20.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3c.20.5	Beach Park	*Stabilize significant erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.20.6	Beach Park	*Stabilize significan erosion and attempted stabilization debris around culvert using bioengineering stabilization measures*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.20.7	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.20.8	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.20.9	Beach Park	*Stabilize erosion around culvert using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.20.10	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park, BPDD
3c.20.11	Beach Park	Repair or remediate cracked concrete armoring at outfall.	A1, A3, A5, A8, A11, C3, E1	2	3	M	Owner	Beach Park, BPDD
3c.24.1	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	Beach Park, BPDD
3c.24.2	Beach Park	Remove debris including tires.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
4.0.1	Beach Park	Preserve and restore the ravine within the open Category 1 green infrastructure area between Ganster Road and Sheridan Road, just east of Lyons Woods Forest Preserve.	B1, C1, C2, C3, G2, G4	1	3	L	Owner	Beach Park
4.0.6	Beach Park	Expand / enlarge detention basins #28, #75, and #76 to reduce IDOT-recorded flooding locations along Sheridan Road north of Blanchard.	B4, F7	2	1	S	DOT	
4.0.9	Beach Park	Inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrients by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2	S-M	FPD	
4.05.3	Beach Park	Remove debris / bricks in channel.	A10, A11, B4	2	3	S	Owner	Beach Park, BPDD
4.05.4	Beach Park	*Stabilize bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	2	M	Owner	Beach Park, BPDD

Table 5.12 Site Specific Action Plan for the City of Waukegan

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.7	Waukegan	Preserve and restore the green infrastructure areas in the southwest corner of the SMU, east of the Union Pacific rails and west of industrial land uses (Midwest Generation, North Shore Sanitary District, and Outboard Marine Corporation). This area has been identified by the City of Waukegan for restoration as the 'Waukegan Moorlands'.	B1, C1, C2, C3, G2, G4	1	3	S	Waukegan	Owner
1.0.10	Waukegan	Investigate the wetlands adjacent to the Johns Manville lagoons for restoration and remediation potential and as a possible water quality improvement facility for water runoff from nearby industrial sites. Cost reflects standard wetland restoration and management rather than clean up and remediation.	B1, C3, C5, E1, E2, G4	3	3	S	IDNR	
1.1.1	Waukegan	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner, Utility, C&NW RR	Waukegan
1.1.3	Waukegan	*Restore stream channel and instream habitat by reducing / remediating channelization, possibly through a remeandering and other restoration projects such as installing boulders, large rocks, and / or rootwads.*	A1, A10, C3	1	3	S	Owner/ Utility	Waukegan
1.1.5	Waukegan	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	A10, A11, C3, E1, E7, E8, F7	3	3	S	C&NW RR	SMC
1.1.6	Waukegan	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	A10, A11, C3, E1, E7, E8, F7	3	3	S	C&NW RR	SMC
3b.0.12	Waukegan	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	Owner	
3b.0.15	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
3b.0.16	Waukegan	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	HOA	
3b.16.5	Waukegan	*Stabilize the eroding, 4 foot deep cut channel within the turf grass landscape at the upstream end of BL16, just downstream of the Beach Rd. culvert.*	A1, A3, A6, C3, G2	1	3	S	Owner	
3b.16.6	Waukegan	*Repair or replace the steel Beach Road culvert that is eroding around the edges and beneath, possibly due in part to the additional plastic drain pipe.*	A3, A11	1	3	S-M	Waukegan	
3c.0.3	Waukegan	For Waukegan Airport property, implement the spill prevention and response plan and reduce the use of salt and/or deicers. Install filtration and infiltration BMPs to capture and treat runoff from airport landscapes, particularly impervious surfaces such as runways and fueling areas, before being discharged to the stream system of Bull Creek.	E1, E2, E5, E10	2	3	S	Waukegan Port District	

Table 5.12 Site Specific Action Plan for the City of Waukegan (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.0.17	Waukegan	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Owner	
4.0.5	Waukegan	Improve swale and other surface stormwater drainage systems within the developed areas of the SMU, particularly those residential areas off Miraflores and Montesano, with lot level stormwater filtration and infiltration BMPs. Details reflect 28,000 lf (approximately 6.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	E1, E2, E7, E9, G1	1	3	S	Waukegan, Owner	
4.0.7	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
4.0.8	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
4.05.5	Waukegan	*Stabilize and strengthen the incised discharge channel.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Waukegan
5.0.1	Waukegan	Preserve the ravine within the 7-acre open Category 1 green infrastructure area between Circle Court and the Amstutz Expressway.	A6, B1, C2, C3, G2, G4	1	3	L	Owner/ Utility	
5.0.2	Waukegan	Preserve and restore wetland complexes where these resource remain, including those along the entire length of reach BL04 and those adjacent to Lake County Gardens (depressional storage areas #22 and #23). Wetland / depressional area #23, bordered by Pine, Lorraine, Wilson, and the McClory Bike Trail, contains some elements of a decent quality wetland indicative of good restoration potential. Two additional potential restoration areas are the small park between Butrick and Yeoman and the upstream drainage corridor north of and paralleling Rice St.	A6, B1, C2, C3, G2, G4	1	3	S-L	Waukegan, Owner, Utility	
5.0.3	Waukegan	Preserve the wetlands / stream corridor within Category 1 and 2 open green infrastructure areas between Rice and MacArthur, west of Lewis Avenue, and the area between Pine, Wilson, and the McClory bike path.	A6, B1, C2, C3, G2, G4	1	3	L		
5.0.4	Waukegan	*Install filtration BMPs for commercial and institutional uses along Greenwood Avenue and at the York House Rd / Lewis Ave intersection to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S43, and S73. Details reflect 10,000 lf (approximately 2.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontage.*	E1, E2, E7, E9, G1	1	3	S	Waukegan, Owner	
5.0.5	Waukegan	*Install lot level filtration and infiltration BMPs, to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S39, S43, and S73. Details reflect 228,000 lf (approximately 52 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	E1, E2, E7, E9, G1	1	3	S	Waukegan	

Table 5.12 Site Specific Action Plan for the City of Waukegan (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
5.0.6	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Golf Course	
5.0.7	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2	S-M	Golf Course	
5.0.8	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Golf Course	
5.0.9	Waukegan	Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Waukegan, Owner	
5.0.10	Waukegan	*Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and address turbidity / sedimentation by naturalizing the basin. This may reduce pollutant loading within potential pollutant loading hotspot S39.*	E1, E2, E9	2	2	S-M	Owner	
5.0.11	Waukegan	*Inventory detention basin and identify resolutions to any noted functional problems.his may reduce pollutant loading within potential pollutant loading hotspot S14.*	-	3	1	S-M	SMC	
5.2.1	Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. Restoration and management of Bowen Park and the residential areas along Miraflores is important to enhance the habitat quality of this reach.	A6, A10, B1, C3, E1	2	2	S	State of IL/ Waukegan Park District, Owner, Utility	
5.2.2	Waukegan	Reduce impacts of surrounding golf course and park property such as landscape waste dumping, turf grass stream edges. Filter and infiltrate runoff from parking lots, such as those within Bowen Park, with BMPs. Details reflect installation of lot level BMPs.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1	S	State of IL/ Waukegan Park District, Owner	
5.2.3	Waukegan	Reduce impacts of residential homes along Miraflores: cease yard waste dumping, replace mown turf grass to the edge of the stream with a minimum 10 foot native vegetation buffer, infiltrate runoff discharge from roof or footing drains with rain gardens or rain barrels, and naturalize the stream channel by replacing poured concrete and rip rap with bioengineering stabilization measures.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1	S	Owner	
5.2.4	Waukegan	Gully erosion occurring in the ravines of Bowen Park should be remediated through ravine woodland restoration and management along reach BL02. Assumes 4000 lf of stream reach by 500' width. Costs reflect woodland restoration; load reduction reflects Moderate erosion stabilization.	A6, A10	1	2	S	State of IL/ Waukegan Park District, Owner	

Table 5.12 Site Specific Action Plan for the City of Waukegan (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
5.2.5	Waukegan	Stabilize erosion around the Sheridan Road culvert and replace the broken stormsewer that is discharging to the opposite streambank.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Waukegan	
5.2.6	Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Waukegan	Waukegan Park District, SMC, Owner
5.2.7	Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Waukegan	Waukegan Park District, SMC
5.2.8	Waukegan	Stabilize typical 2-4 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.	A1, A3, A8, C3, E1	2	3	M		Waukegan Park District, SMC
5.2.9	Waukegan	Stabilize minor erosion of open discharge channel using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	3	3	S-M	Waukegan Park District	
5.2.10	Waukegan	Stabilize significant erosion below outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Waukegan, Waukegan Park District	
5.2.11	Waukegan	Stabilize minor channel erosion below concrete lined channel outfall. Consider removing concrete and stabilizing channel with more habitat-appropriate measures.	A1, A3, A5, A8, A11, C3, E1	3	3	S-M	Waukegan	
5.2.12	Waukegan	Install energy dissipation measures to address the eroding plunge pool created by discharge from the elevated outfall.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Waukegan	
5.3.1	Waukegan	*Restore a 5 foot wide native riparian buffer and replace turf grass lawn edges to native riparian plant communities as is feasible within the golf course.*	A6, A10, B1, C3, E1	1	2	S	Owner	
5.3.2	Waukegan	Glen Flora Country Club: replace or remediate online detention, armored dams and wiers with more habitat appropriate structures that allow fish passage.	A1, A2	3	3	L	Owner	
5.3.3	Waukegan	*Stabilize erosion undercutting the concrete-lined channel outfall / dam; if feasible, remove concrete and replace with bioengineered channel stabilization measure.*	A1, A2, A3, A5, A10, A11	1	3	S-M	Owner	
5.4.1	Waukegan	Restore stream channel and improve instream habitat by reducing channelization, such as through a remeandering project.	A1, A10, C3	3	3	S	Waukegan, Lake County DOT	
5.4.2	Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.	A4, A10, B1, C3, E1	1	2	S	Waukegan, Lake County DOT	

Table 5.12 Site Specific Action Plan for the City of Waukegan (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
5.4.3	Waukegan	Implement the mitigation planfor FPAI site 20-06, in the City of Waukegan, Lake County Gardens subdivision. There also may be opportunities to increase the detention and/or drainage capacity of the drainage system in this area, particularly within the community park to the north. However, improvement of the wetlands to increase their storage capacity may also be an option.	B1, B2, B3. B4	2	3	S	Waukegan	
5.4.4	Waukegan	Restore the upper end of this reach, a fairly undefined channel that is choked with cattails, through invasive species removal and management.	A1, A6, C3	3	2	S	Waukegan, Owner	
6.0.1	Waukegan	*Manage and restore the wooded ravine, wetland, and depressional area #3 that lies between the Amstutz and Sheridan Road for storage. Load reduction details reflect impact of restored wetland.*	A6, A7, A10, G4	1	3	S	Owner	Waukegan
6.0.3	Waukegan	Open and partially open Category 1 green infrastructure areas between the waste water treatment plant and the Union Pacific tracks should be restored and integrated into the planned Waukegan Moorlands area to the north. Details reflect natural area restoration.	C2, C3	1	3	L	Waukegan, Owner	
6.0.4	Waukegan	*Install filtration BMPs for commercial, industrial, and institutional uses in the eastern and southwestern portions of the SMU to help improve water quality in potential pollutant loading hotspot S10, S11, and S75. Details reflect approximately 15,000 lf (approximately 3.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontages of these land uses.*	E1, E2, E7, E9, G1	1	3	S	Waukegan	Owner
6.0.5	Waukegan	*This SMU is primarily sewerd but undetained. Install source controls and lot level filtration and infiltration BMPs, including detention basin improvements, which may help address pollutant loading in potential pollutant loading hotspot S10, S11, and S75. Details reflect 96,000 lf (approximately 22 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	E1, E2, E7, E9, G1	1	3	S	Waukegan, Owner	

Table 5.13 Site Specific Action Plan for the Illinois Department of Natural Resources

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.2	IDNR	Develop and implement habitat restoration and management plans for Illinois Beach State Park, including all wetlands, waterways, beach ridge, dune and swale systems, and T&E species habitat.	A8, C3, C4, C5, C6, E1, E7, G4	1	3	S	IDNR	-
1.0.5	IDNR	Restore hydrologic connectivity of Dead River to Lake Michigan and remove those created to carry wastewater to the lake. Assumes that 4 hydrologic connections need to be restored or removed.	C3, C6, G4	3	3	S	IDNR	
1.0.16	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.17	IDNR	Stabilize / regrade shoreline using bioenginnering practices and address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2	S-M	IDNR	
1.0.18	IDNR	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	IDNR	
1.0.19	IDNR	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	IDNR	
1.0.20	IDNR	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	IDNR	
1.0.21	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.22	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.25	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.26	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	

Table 5.14 Site Specific Action Plan for Lake County

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.0.6	Lake County	Depressional storage area #78, within the Thunderhawk Golf Club Forest Preserve, may be able to be expanded to provide additional storage if needed, and may also be retrofitted / restored to improve runoff quality from the golf course, provided that runoff can be directed into this area, treated, and then discharged to a receiving water body. Costs reflect restoration of this wet / hydric area.	B1, C1, C2, C3, E1, E2, E4, E9, G2, G4	2	3	S-L	FPD	
3a.0.18	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2	S-M	FPD	
3c.0.11	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2	S-M	FPD	
3c.0.12	Lake County	Stabilize / regrade shoreline using bioenginnering practices.	E1, E2, E9	2	2	S-M	FPD	
3c.0.13	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2	S-M	FPD	
3c.23.1	Lake County	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	FPD	
4.0.3	Lake County	Manage and restore the natural resources, including ADID wetland #1831, in the northeastern corner of Lyons Woods Forest Preserve. The southern portion of depressional storage area #28 is within the Forest Preserve boundary and may be used to relieve past IDOT-recorded flooding at Sheridan and York House Road. ADID wetland is approximately 46 acres (4000' by 500' wide) and the total area of Lyons Woods is 264 acres.	B1, C3, E1, E7, G2, G4	2	3	S-L	FPD	

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.4	Waukegan, IDNR, Lake County	Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park.	C3, C5, F1, F6	1	3	S	Owner IDNR EPA	Waukegan
1.0.6	Beach Park, Waukegan	Preserve Category 1 open green infrastructure areas including a portion of depressional storage area #17 and the utility corridor that can serve as a green infrastructure connector between Illinois Beach State Park to Lyons Woods Forest Preserve.	A7, B1, C1, C2, C3, G2	1	3	L	Owner/ Utility	LCFPD IDNR
1.0.11	Zion, Waukegan, IDNR	Manage the Lake Michigan shoreline and beaches to minimize beach erosion. Details reflect 28000 lf of shoreline at an average width of 150 feet.	C3, C4, C5, E1, E6	3	3	S	Zion, Waukegan, IDNR	
1.0.12	Zion, Waukegan, IDNR	Manage the Lake Michigan shoreline and beaches to minimize E. coli contamination that leads to beach closures. Details reflect 28000 lf of shoreline at an average width of 150 feet.	C3, C4, C5, E1, E6	3	3	S	LCHD	Zion, Waukegan, IDNR
1.0.13	Zion, Beach Park, Waukegan, IDNR	Install drainage swale improvements or other lot level / source control BMPs to capture and treat runoff from commercial and industrial land uses within Critical Subbasins #15, #74, and #76, identified as potential Pollution Hot Spot Critical Areas. Cost estimate reflects the installation of swales (10' wide) or other treatment measures along perimeter of these land uses, approximately 35,000 lf of treatment area.	E1, E2, E7, E9, G1	1	3	S	Waukegan, Zion	Utility
1.1.2	Waukegan, IDNR, Lake County	Restore the natural connection and habitat quality of this reach to Lake Michigan by removing the lagoons through which the reach runs and disconnecting the reach from the Dead River to the north. Since these lagoons may be a component of a remedation or clean up plan, this should be considered a long term recommendation to be implemented when the contamination issues at Johns Manville have been adequately remediated. Details reflect major channel restoration.	A1, A6, A8, C3, C5, C6, E7, G2, G4	1	3	S-L	Owner	IDNR EPA Waukegan
1.1.4	Waukegan, Lake County	Address potential hazardous / toxic runoff from industrial uses to the east through filter strips and other filtration and infiltration techniques installed between the reach and these land uses, or by containing and remediating runoff on site through other means. Cost estimate reflects the installation of 2000 lf of 20' wide infiltration and filtration BMPs.	E1, E2, E7, E9, G1	2	3	S	Owner EPA	
1.6.1	Beach Park, Lake County	Restore stream channel and improve instream habitat by installing pools and riffles and installing boulders, large rocks, and / or rootwads.	A1, A10, C3	3	3	S	FPD Owner	Beach Park, BPDD
1.6.2	Beach Park, Lake County	Restore native riparian buffer by controlling invasive species, planting native species, thinning forest and shrub canopy, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	FPD Owner	Beach Park, BPDD

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
2.0.1	Zionion Beach Park	Category 1 and 2 green infrastructure areas along the western boundary of Illinois Beach State Park and bordering the Union Pacific rails to the west should be preserved as components of the green infrastructure / greenway system that includes Ophir Park, Carmel Park, and Illinois Beach State Park. These areas contain significant low lying depressional storage areas (#55, #56, and #57) that could be used for water quality improvement, wetland / hydric soil complexes, and steep slopes that are unsuitable for development.	A6, A7, B1, C1, C2, C3, G2, G4	1	3	L	Owner, IDNR, Zion Park District	
2.0.2	Zion, Beach Park	Convert the depressional storage complex of #55, #56, and #57 to improve water quality for Critical Subbasin #2, identified as a potential Pollutant Loading Hotspot. Assumes runoff can be directed into this area, treated, and discharged to the Illinois Beach State Park stream and wetland system. Estimated area to be converted is 7000lf by 400ft wide.	B1, C1, C2, C3, E1, E2, G2, G4	1	3	L	Owner, IDNR, Zion Park District	
2.0.4	Zion, Beach Park	Reduce pollutant loading to Critical Subbasin #2, a potential pollutant loading hotspot, by improving swales and other surface stormwater drainage systems and installing stormwater filtration and infiltration BMPs to capture and treat runoff from parking lots, utilities, rooftops, storage areas, and other areas that may contribute pollutants to the stream. Cost estimate assumes 130,000 lf (approximately 30 acres) of 10 foot wide drainage swale improvements as a proxy for on-site source control BMPs.	E1, E2, E7, E9, G1	1	3	S	Beach Park, Zion	
3a.0.1	Zion, Beach Park	Manage and restore the wooded ravine along reaches BL25, BL26, and BL27. Average 5000' x 250' wide.	A6, A7, A10	3	2	M	Owner	Beach Park, Zion
3a.0.2	Zion, Beach Park	Preserve and restore wetlands along drainage channel upstream of the McClory Bike Path and the complex northwest of Lewis and 29th St., wetland #4 east of Lewis Avenue, and wetland #3 in Hermon Park (56 acres total). Regional storage area #77 and the associated wetlands (9 acres) could be restored and / or used to provide storage for this SMU if needed when the upstream area develops. Implementation details reflect wetland / hydric soils preservation and restoration.	A6, B1, C2, C3, G2, G4	1	3	S-L	Zion Park District, Owner	Beach Park, Zion
3a.0.4	Zion, Beach Park	Preserve and restore T&E habitat within the area bounded by Lebanon St., the McClory Bike Path, and 31st St.	A1, A10, C3	3	2	S	Zion Park District, IDNR	

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.0.5	Zion, Beach Park	Improve any swale and other surface stormwater drainage systems and/or install source controls and lot level stormwater filtration and infiltration BMPs within the developed areas of the SMU. These practices may help reduce pollutant loading in potential pollution hotspot subasins S1, S3, S4, and S48. In order to generate cost and pollutant load reduction estimates, road swales are used as a proxy for individual site BMPs. Details reflect 252,000 lf (approximately 58 acre) of 10 foot wide drainage swale improvements on both side of all roads.	E1, E2, E7, E9, G1	1	3	S	Beach Park, Zion	Owner Developer
3a.25.1	Zion, Beach Park	Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD, Zion
3a.25.2	Zion, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	A6, A7, A10, B1, C3, E1	2	2	S	Owner	
3a.25.3	Zion, Beach Park	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1	S	Owner	
3a.25.5	Zion, Beach Park	Inspect hydraulic structure for possible erosion problems and stabilize using bioengineering practices if needed.	A1, A3, A5, A8, A11, C3, E1	3	1	S	Owner	Beach Park, BPDD, Zion
3a.27st.1	Zion, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Zion Park District	
3b.0.1	Beach Park, Waukegan	Preserve and restore wetlands where these resource remain along drainage channel BL15, BL16, BL17, and along the daylit portions of the Wilson Avenue Tributary. Area is 10,000 lf by 300' wide.	A6, B1, C2, C3, G2, G4	1	3	S	Beach Park Waukegan	Owner
3b.0.4	Beach Park, Waukegan	Preserve greenway easements on Category 1 and 2 green infrastructure areas along BL16, which may help reduce pollution loading in potential pollution hotspot S57. Cost estimate assumes easements of 2000 lf by 100 ft wide (4.5 acres).	B1, C1, C2, C3, G2, G4	1	3	L	Owner	Beach Park Waukegan

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.0.6	Beach Park, Waukegan	Depressional storage areas #32 and #43, currently undeveloped and containing current or former wetlands, could be enhanced to improve water quality of runoff from surrounding residential uses within this Critical Subbasin #57, identified as a potential pollutant loading hotspot. Depressional area #43 lies in an open Category 1 green infrastructure area that could be preserved for water quality improvement. Details reflect restoration and enhancement of both areas as wetlands.	B1, C1, C2, C3, E1, E2, G2	1	3	L	Owner	
3b.0.7	Beach Park, Waukegan	Improve swales and other surface stormwater drainage systems and install source controls and lot level BMPs, including detention basin improvements, within the developed areas of potential pollutant loadin hotspots S57, S59, and S63. Details reflect 165,000 lf (approximately acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	E1, E2, E7, E9, G1	1	3	S	Beach Park Waukegan	
3b.15.1	Beach Park, Waukegan	Restore stream channel and improve instream habitat by enhancing pools and riffles.	A1, A10, C3	3	3	S	Owner	Beach Park BPDD, Waukegan
3b.15.2	Beach Park, Waukegan	Address High streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD, Waukegan
3b.15.3	Beach Park, Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	
3b.15.4	Beach Park, Waukegan	Inspect footbridges and armored / concrete-lined banks for impacts on the stream corridor and remediated if necessary.	A1, A10, A11, C3	3	3	S	Owner	Beach Park BPDD, Waukegan
3b.15.5	Beach Park, Waukegan	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park BPDD, Waukegan
3b.15.6	Beach Park, Waukegan	Inspect and, if necessary, repair the culvert under the McClory Bike Trail, which is partially collapsed.	A11	2	3	S	LCDOT	
3b.15.7	Beach Park, Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	1	2	S	Owner	Beach Park BPDD, Waukegan
3b.15.8	Beach Park, Waukegan	Stabilize typical 4-6 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD, Waukegan

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.15.9	Beach Park, Waukegan	Stabilize erosion of the Beach Road steel culvert experiencing erosion around and underneath using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Beach Park Waukegan	Beach Park BPDD, Waukegan
3b.15.13	Beach Park, Waukegan	Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD, Waukegan
3b.15.14	Beach Park, Waukegan	Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD, Waukegan
3b.15.15	Beach Park, Waukegan	Stabilize erosion around clay drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park BPDD, Waukegan
3b.16.1	Beach Park, Waukegan	Restore stream channel and improve instream habitat by enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.	A1, A10, C3	1	3	S	Owner	Beach Park BPDD, Waukegan
3b.16.2	Beach Park, Waukegan	Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD, Waukegan
3b.16.3	Beach Park, Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	1	2	S	Owner	
3b.16.4	Beach Park, Waukegan	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3b.15.16	Beach Park, Waukegan	Stabilize erosion around two plastic drain pipe outfalls using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD
3b.15.17	Beach Park, Waukegan	Stabilize erosion around concrete drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Beach Park Waukegan	Beach Park BPDD
3b.18.1	Beach Park, Waukegan	BL18 flows through and near several publicly owned, open and partially open areas on or adjacent to the Waukegan Regional Airport property sourthwest of the Wadsworth Rd / Lewis Ave intersection. These areas include depressional storage area #34, which could be expanded and enhanced for stormwater storage and to capture and cleanse water runoff from airport property, which lies in Critical Subbasin #69, a potential pollutant loading hotspot.	B1, C1, C2, C3, E1, E2, G2	1	3	L	Waukegan Port District	

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.18.2	Beach Park, Waukegan	Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Waukegan Port District, Owner	Beach Park BPDD, Waukegan
3b.18.3	Beach Park, Waukegan	The culvert draining Waukegan Airport is covered with wire fencing, presumably for security or to prevent animal invasion. However, investigate source and necessity, and remove if fencing impedes flow. It appears that strong flows exit the Airport property in this location.	A10, A11	3	1	S	Waukegan Port District	
3c.0.2	Beach Park, Zion	Manage and restore the wooded ravine along reaches BL07, BL08, BL09, BL10, BL11, BL19, BL20, BL21. Assumes 18,600 lf of stream by average 250' wide.	A6, A7, A10	1	2	S	Owner	Beach Park, Zion
3c.0.4	Beach Park, Zion	Preserve and restore wetlands along drainage channels BL21, BL22, BL23, BL24. Assumes 10,300 lf by 350' wide.	A6, B1, C2, C3, G2, G4	1	3	S	Owner	Beach Park, Zion
3c.0.5	Beach Park, Zion	Preserve Category 1 green infrastructure area bounded by the McClory Bike Path, Clover, Wadsworth, and 34th St. that borders the stream channel to the north. Also preserve three separate areas through which the stream corridor runs: one along BL07 within the ravine, the second at the confluence of BL08, BL09, and BL19, and the third just upstream of this confluence along BL09.	A6, B1, C2, C3, G2, G4	1	3	S-L	Owner	Beach Park, Zion
3c.0.6	Beach Park, Zion, Waukegan	Install filtration BMPs for commercial, industrial, and institutional uses along Sheridan Road, Wadsworth, and Lewis Avenue, which will help reduce pollutant loading in potential pollution hotspot subbasin #64. Details reflect 12,000 lf of road frontage along these uses to be treated with improved, 10' swales (approximately 2.75 acres.)	E1, E2, E7, E9, G1	1	3	S	Beach Park, Waukegan, Zion, Owner	
3c.0.7	Beach Park, Zion, Waukegan	Install lot level filtration and infiltration BMPs within potential pollution hotspot subbasin #64. Details reflect 208,000 lf (approximately 48 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	E1, E2, E7, E9, G1	1	3	S	Beach Park, Waukegan, Zion	
3c.0.8	Beach Park, IDNR	Preserve the Category 1 open green infrastructure area that contains depressional storage area #45 along the west side of the Union Pacific rails.	B1, C2, G2	1	3	L	Beach Park	
3c.7.1	Beach Park, IDNR	Stabilize High streambank erosion along approximately 25% of this reach not included in the previous stabilization project, some threatening homes and property, using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner, Beach Park	
3c.7.2	Beach Park, IDNR	Manage native riparian plant communities within this reach: control invasive species, plant native species, and manage vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	1	2	S	Bull Creek Stakeholder Assn.	
3c.21.1	Beach Park, Zion	Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD, Zion

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.21.2	Beach Park, Zion	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	1	2	S	Owner	Beach Park, BPDD, Zion
3c.21.3	Beach Park, Zion	Repair the discharge point / failed headwall approximately 200' upstream of the McClory Bike Path.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD, Zion
3c.21.4	Beach Park, Zion	Stabilize channel erosion at outfall, and consider replacing rip rap control measure with bioengineering stabilization practices.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD, Zion
3c.21.5	Beach Park, Zion	Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park, BPDD, Zion
3c.21.6	Beach Park, Zion	Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park, BPDD, Zion
4.0.2	Waukegan, Beach Park	Manage and restore the woodland ravine along reach BL05. Assumes 5000' by 500' area for cost estimation purposes.	A6, A7, A10	1	2	S	Owner	Beach Park Waukegan
4.0.4	Waukegan, Beach Park	Preserve and restore the wetland complex within the open, Category 1 green infrastructure area along the eastern boundary of SMU 4 west of the Union Pacific rail line. This area creates a physical land connection between Lyons Woods and Illinois Beach State Park, and would also preserve regional storage area #17.	B1, C1, C2, C3, G2, G4	1	3	S-L	Owner/ Utility	
4.05.1	Waukegan, Beach Park	Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
4.05.2	Waukegan, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	1	2	S	Owner	
6.0.2	Waukegan, IDNR, Lake County	Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park. This may help address potential pollutant loading hotspot S75	C3, C5, F1, F6, G4	1	3	S-L	Waukegan, IDNR, EPA	

5 prioritized action plan

Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- 10 Critical Region
- 52 Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- 152 Critical Subbasins
- KC1 Stream Reach
- KC1 Critical Stream Reach
- 1.0.1 Action Recommendations
- 2 Subwatershed Management Unit
- 20-07 FPAI Site

This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
Lake County Stormwater Management Commission
September, 2007

DATA SOURCES:
Lake County Stormwater Management
Lake County Department of Information And Technology, GIS & Mapping Division

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CONSERVATION DESIGN FORUM
STORMWATER MANAGEMENT COMMISSION
MWH

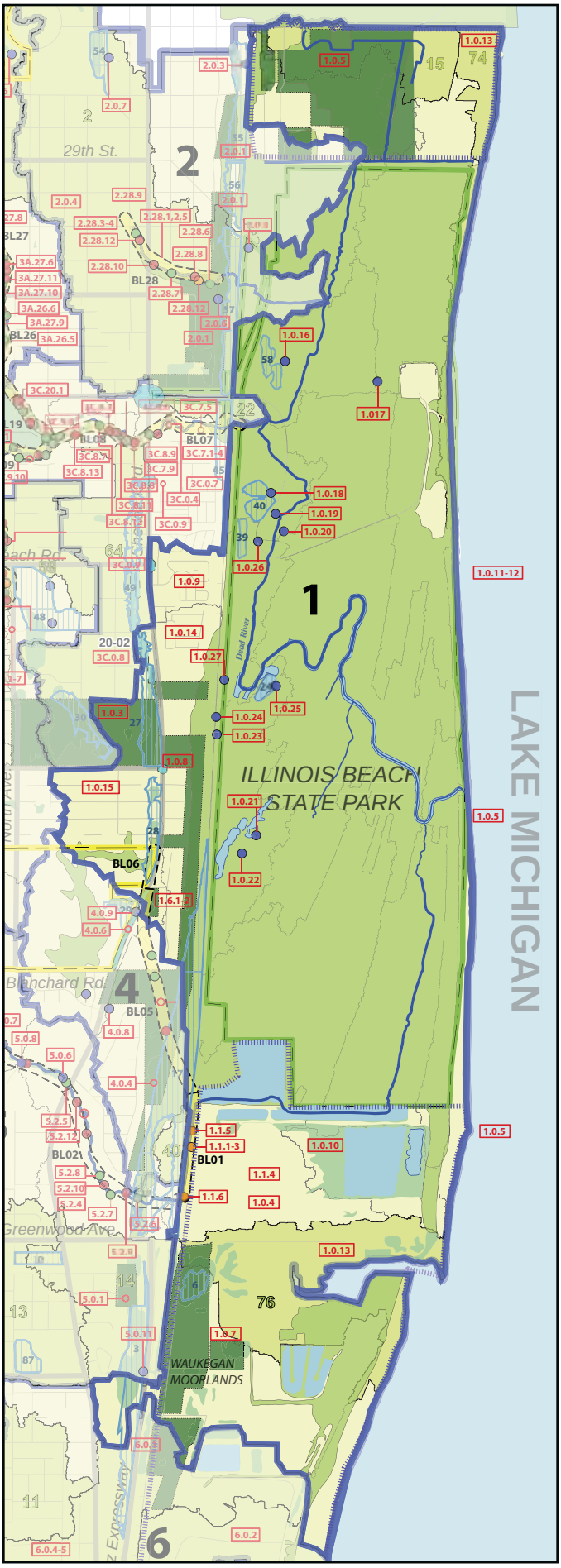
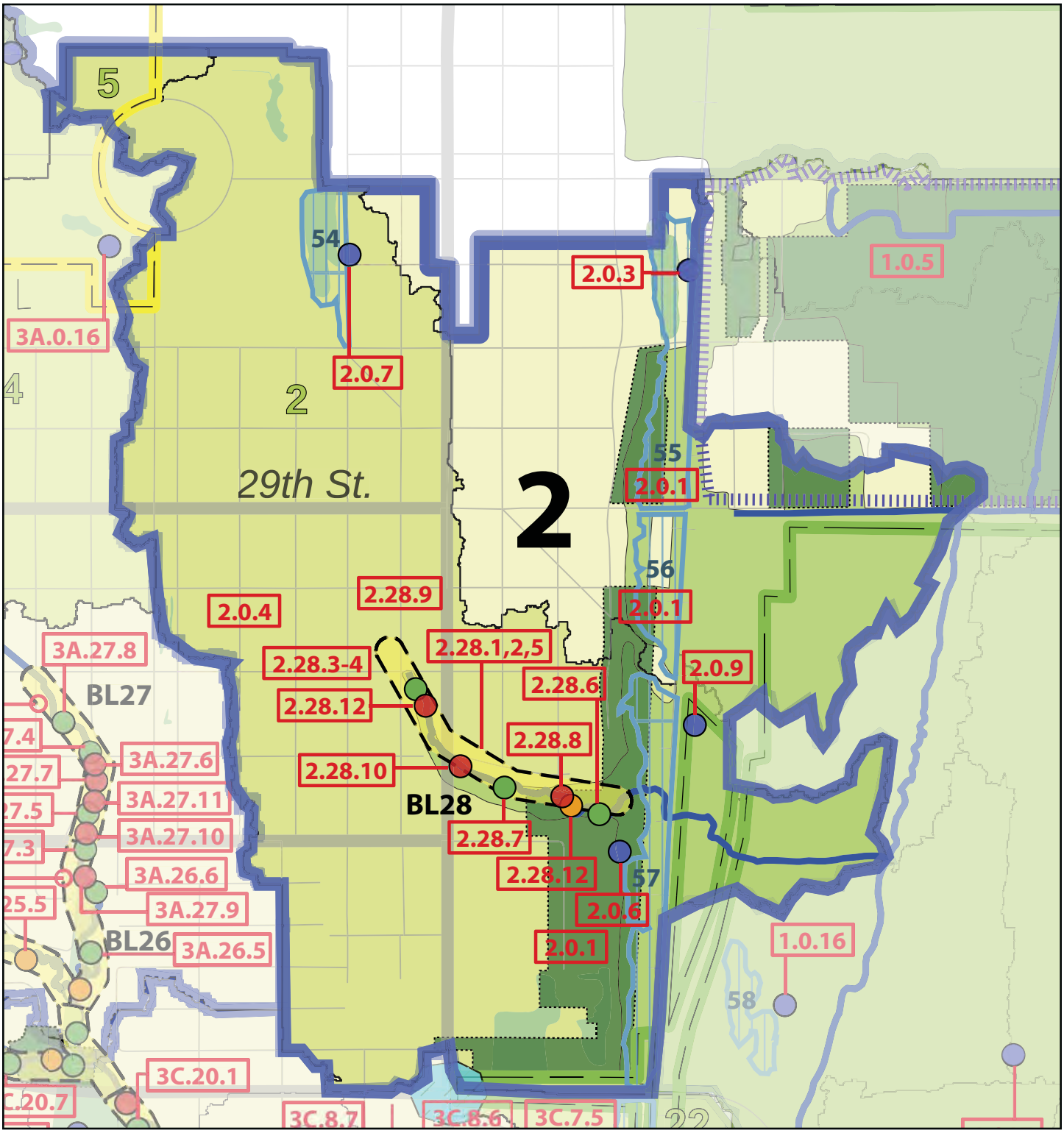


FIGURE 5.2 SUBWATERSHED MANAGEMENT UNIT 1



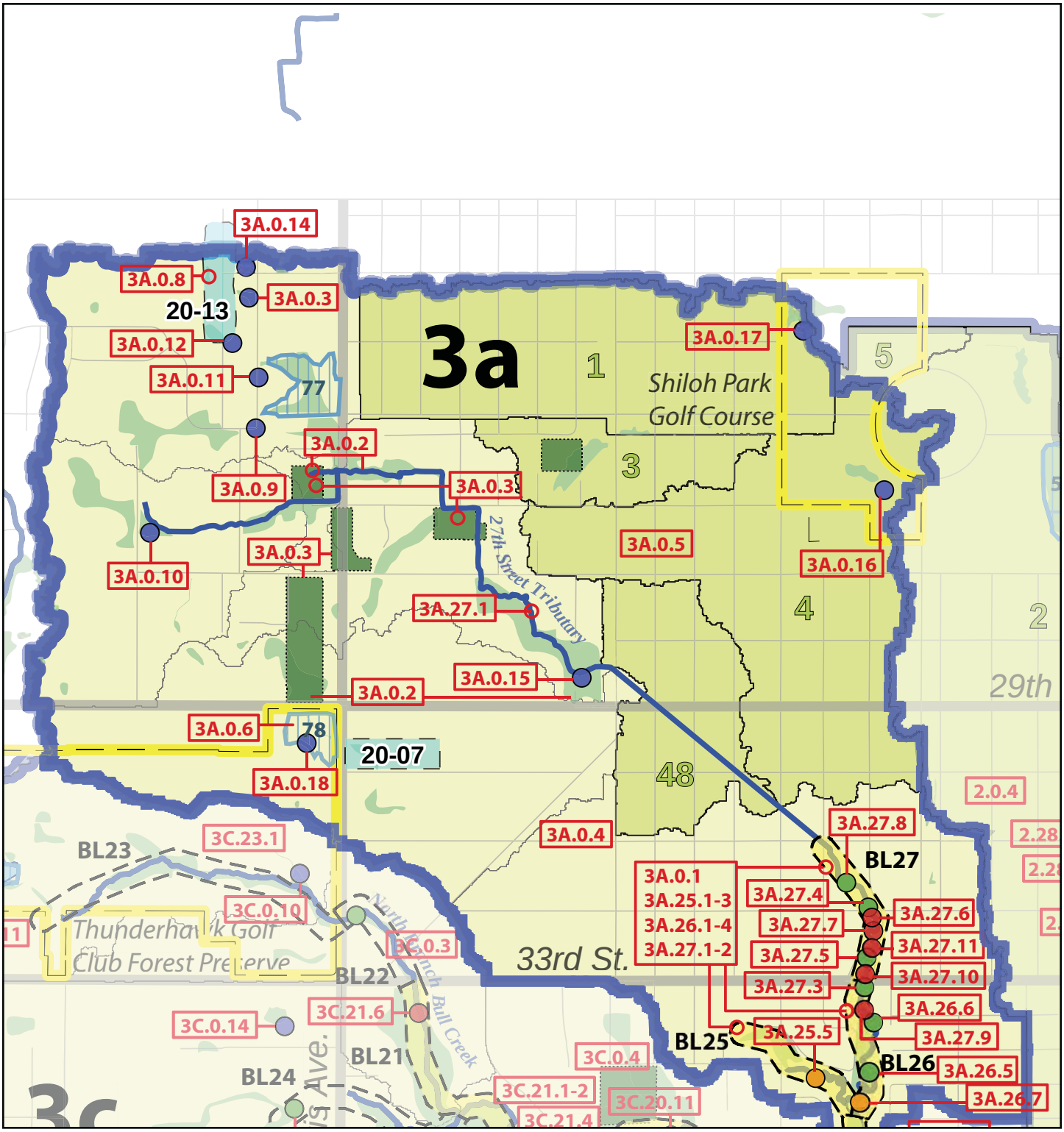
Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins
- Stream Reach
- Critical Stream Reach
- Action Recommendations
- Subwatershed Management Unit
- FPAI Site

This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
Lake County Stormwater Management Commission
September, 2007

DATA SOURCES:
Lake County Stormwater Management
Lake County Department of Information And Technology, GIS & Mapping Division

FIGURE 5.3 SUBWATERSHED MANAGEMENT UNIT 2



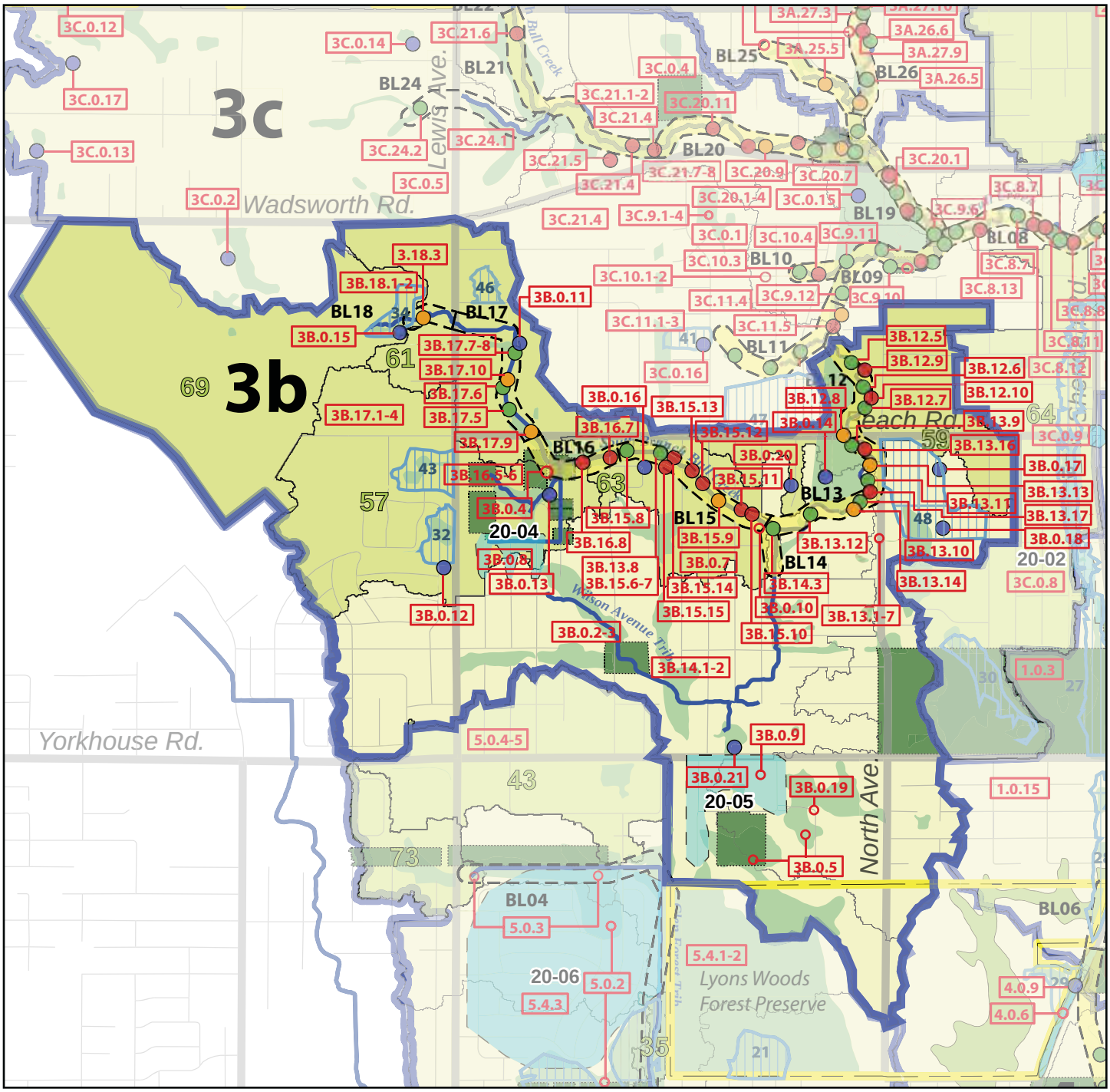
Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins
- Stream Reach
- Critical Stream Reach
- Action Recommendations
- Subwatershed Management Unit
- FPAI Site

This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
Lake County Stormwater Management Commission
September, 2007

DATA SOURCES:
Lake County Stormwater Management
Lake County Department of Information And Technology, GIS & Mapping Division

FIGURE 5.4 SUBWATERSHED MANAGEMENT UNIT 3A



Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins
- Stream Reach
- Critical Stream Reach
- Action Recommendations
- Subwatershed Management Unit
- FPAI Site

This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
Lake County Stormwater Management Commission
September, 2007

DATA SOURCES:
Lake County Stormwater Management
Lake County Department of Information And Technology, GIS & Mapping Division

FIGURE 5.5 SUBWATERSHED MANAGEMENT UNIT 3B

5 prioritized action plan

While Chapter 4 identifies types of best management practices that can be used in the Dead River watershed, this chapter presents specific recommended action items developed jointly by the watershed stakeholders, Lake County Stormwater Management Commission, and the consultant planning team. This chapter begins by describing the implementation partners (Section 5.1), followed by recommended action items that presented in three sections. The Programmatic Action Plan (5.2) provides general recommendations that should be applied watershed-wide and may also apply to large sites such as the Waukegan Regional Airport and the Zion Nuclear Plant. The Site Specific Action Plan (5.3) presents detailed recommendations for specific problem areas within the watershed as identified during the inventory and assessment. The Information and Education Plan (5.4) specifically identifies the recommended actions that will likely need more outreach and education in order to be implemented.

As a reminder, the eleven most important recommendations are summarized as follows:

1. Stabilize streambanks and ravine slopes to reduce erosion, protect property and infrastructure, improve water quality, and improve habitat.
2. Restore and manage stream corridors by restoring native riparian buffers, reducing the density of trees, removing excessive debris, and stabilizing the stream bed with practices that also enhance habitat.
3. Manage, retrofit, and stabilize the stormwater management system including detention basins and culverts, with focused attention on stormwater discharge points (pipes and ditches), to reduce runoff rate and volume and to improve water quality in the streams and Lake Michigan.
4. Preserve and restore priority green infrastructure areas to provide natural surface water storage areas, provide space for installing best management practices, and preserve an ecologically functioning network of open space, wetlands, streams, and natural areas as part of an interconnected system.
5. Manage and restore watershed natural areas including wetlands, former wetlands / hydric soil areas, and especially Lyons Woods Forest Preserve and Illinois Beach State Park.
6. Develop positive and creative new uses for the Zion Nuclear Power Plant and Waukegan Harbor areas, ensuring that these uses are compatible with protecting and improving watershed resources and Lake Michigan.
7. Remediate existing flood problems and prevent future flooding by reducing stormwater runoff and preserving areas for surface water storage and absorption such as floodplains, depressional storage areas, and wetlands, which also provide water quality improvement benefits.
8. Use better stormwater management, conservation design, and low impact development practices for new and existing development that slows, filters, infiltrates, cools, and cleanses stormwater runoff, especially in Critical Subbasins. This includes source controls and lot level best management practices such as vegetated swales, naturalized detention basins, rain gardens, stream buffers, filter strips, and reduced use of lawn chemicals and fertilizers.
9. Modify and use planning and development standards, policies, and capital improvement plans and budgets to protect and enhance water quality.
10. Provide public education and outreach to enhance understanding and apprciation of watershed resources and problems, to provide solutions, and to provide opportunities for people to get involved in watershed improvement activities.
11. Monitor and evaluate watershed plan implementation and physical watershed conditions to guage progress towards watershed goals.

5.1 IMPLEMENTATION PARTNERS

Throughout the prioritized action plan tables and narrative, responsible parties are suggested for taking the lead or providing a supporting role in plan implementation. This section presents the responsible parties as well as a brief description of their role. Where the roles are identified within tables, parties indicated with bold lettering are the lead party, and non-bold parties providing support. Table 5.1provides a concise reference or key for reviewing the programmatic and site specific action plan tables that follow.

Beach Park Drainage District (BPDD)

The Beach Park Drainage District maintains drainage ways and addresses local drainage problems within a boundary that covers portions of Beach Park and small portions of other communities as well. The drainage district first tries to address drainage and flooding problems that may cause damage to property and/or structures and then removes debris from stream channels as a secondary goal. Thus, issues related to channel and stormwater management infrastructure should include the BPDD as an implementation partner.

Chicago Metropolitan Agency for Planning (CMAP)

Formerly the Northeastern Illinois Planning Commission (NIPC) and the Chicago Area Transportation Study (CATS), CMAP provides technical and planning assistance to watershed protection groups. CMAP has developed model ordinances tailored to the region for stormwater management, sediment control, streams and wetlands, and floodplains. CMAP also offers technical assistance and training opportunities to local governments and watershed groups and helps local governments apply for state and federal funding programs.

Corporate and Business Landowners (CBL)

The active participation of CBLs in the planning process can lead to significant positive impacts on the quality of the Dead River watershed. Businesses can become involved by retrofitting existing facilities, managing their grounds, roof runoff, and parking lots to reduce runoff volume and pollutant loadings, and sponsoring watershed events. With an up front commitment from the CBL community, new development can also be designed to minimize runoff and pollutant loadings.

Developers & Homebuilders (DH)

The practices of developers can significantly impact a watershed. Developers should be encouraged or required to employ sustainable development techniques such as conservation subdivision development and other practices described in the Best Management Practice Toolbox. Homebuilders should use BMPs during the construction process, especially those related to soil erosion and sedimentation control. Failure to use BMPs, or improper use, can lead to soil erosion and other pollutant discharges.

Federal Emergency Management Agency (FEMA)

FEMA is the principal federal agency involved in flood mitigation and flood disaster response. Among its duties, FEMA is responsible for the National Flood Insurance program, helps municipalities develop and enforce floodplain ordinances, develops floodplain maps, and administers funding for flood mitigation plans and projects.

Golf Courses (GC)

Golf courses are important potential sites for the use of BMPs, primarily due to their location along the stream and their potential impact as sources of pollutants and their contribution as a green infrastructure element. Golf courses can help reduce pollutant loadings, especially nutrients, as well as runoff volume by incorporating BMPs into their golf course management programs.

Illinois Department of Natural Resources (IDNR)

Several offices within IDNR provide services that will be key to the implementation of the Dead River watershed plan for issues related to water resource management, habitat protection and management, wildlife management, invasive species control, wetland management, and hunting and fishing permitting.

- The IDNR manages Illinois Beach State Park and is responsible for issues relating to water, hydrology and hydrologic connections to Lake Michigan, natural resources, wildlife, wetlands, and beach management in the park as well as North Point Marina.
- The Office of Water Resources (OWR) is the state's lead organization for the regulation of floodplain development as well as for the implementation and funding of structural flood control and mitigation.
- The Office of Realty and Environmental Planning (OREP) is responsible for natural resource and outdoor recreation planning. It also administers the Conservation 2000 Ecosystems Program, which provides technical and financial assistance through a grant program to natural resource protection partnerships (e.g., Lake Michigan Watershed Ecosystem Partnership).
- The Office of Resource Conservation (ORC) reviews Clean Water Act Section 404 wetland permits for

Table 5.1 Implementation Partners

Acronym	Responsible Party	General Responsibility
BPDD	Beach Park Drainage District	Drainage system management and maintenance.
CMAP	Chicago Metropolitan Agency for Planning	Technical and planning assistance, training, and funding assistance.
CBL	Corporate and Business Landowners	Grounds management and maintenance.
DH	Developers & Homebuilders	Land development, stormwater management system design and construction.
FEMA	Federal Emergency Management Agency	National Flood Insurance Program, floodplain mapping and enforcement, and mitigation funding.
GC	Golf Courses	Grounds management and maintenance.
IDNR	Illinois Department of Natural Resources	Natural area preservation and management, research, technical and financial assistance.
CMP	IDNR Coastal Management Program	Preserve and manage Lake Michigan coastal resources (if established).
IDOT	Illinois Department of Transportation	Road and highway planning, construction, and maintenance.
IEMA	Illinois Emergency Management Agency	Flood and disaster planning, emergency response, and hazard mitigation.
IEPA	Illinois Environmental Protection Agency	Water resource monitoring, pollution regulation and control, project funding.
LC	Lake County	Land use planning for unincorporated areas, natural resources, drainage system management.
LCFPD	Lake County Forest Preserve District	Manage and maintain green infrastructure, natural areas, and open space.
LCHD	Lake County Health Department	Monitor, manage, and provide technical support for water resources.
LCSMC	Lake County Stormwater Management Commission	Technical and financial assistance for flooding, watershed planning, and water quality.
LMEP	Lake Michigan Ecosystem Partnership	Watershed advocacy and education, technical and financial assistance.
LMGLO	Lake Michigan / Great Lakes Organizations	Great Lakes and Lake Michigan water resource management, education, and outreach.
M	Municipalities (all departments)	Land use and development, technical and financial support, and drainage system management.
NGRREC	National Great Rivers Research & Education Center	Stream, lake, wetland, and coastal data collection, watershed education and outreach.
NRCS / SWCD	Natural Resources Conservation Service / Soil and Water Conservation Districts	Provide natural resource management technical and financial assistance.
PD	Parks and Recreation Districts	Management and maintenance of parks and open space.
PRL / RL	Private Residential / Riparian Landowners	Land management and maintenance including stream channels and riparian corridors.
NSSD	North Shore Sanitary District	Maintain sanitary sewer system infrastructure, stream monitoring.
T	Townships	Road maintenance and support for watershed improvement projects.
USACE	U.S. Army Corps of Engineers	Wetland protection and regulation, wetland restoration funding.
USDA	U.S. Department of Agriculture	Farmland and natural resoruce technical and financial assistance.
USEPA	U.S. Environmental Protection Agency	Lake Michigan and Great Lakes management and restoration.
USFWS	U.S. Fish and Wildlife Service	Threatened and endangered species, technical and funding assistance for habitat restoration.
CAG	Waukegan Harbor Citizens Advisory Group	Organize and coordinate activities related to Waukegan Harbor contamination and cleanup.
WPC	Watershed Planning Committee	Coordinate watershed plan implementation, education and outreach.

impacts on fish and wildlife resources; it manages threatened and endangered species issues; it also protects fisheries and other aquatic resources through regulation, ecological management and public education.

- The Office of Capital Development (OCD) administers state and federal grants for open space programs.
- The Office of Scientific Research and Analysis (OSRA) conducts research and data collection provides this information to planners and formulates natural resource protection policy.

IDNR Coastal Management Program (CMP)

The IDNR is the lead state agency responsible for establishing the Illinois Coastal Management Program (CMP), which is funded through the National Ocean and Atmospheric Administration (NOAA). If established, the program will support and coordinate partnerships among local, state and federal agencies, and local organizations, share information on coastal care efforts, and preserve, restore, and where possible, enhance coastal resources in Illinois. Upon CMP approval, Illinois will be eligible to receive approximately $2 million/year, which will fund a grant program to implement local projects. Local and state agencies and non-profit organizations would be eligible to apply for and receive funds. Potential projects that may receive funding under the CMP program include beach access and recreation, waterfront development, shore and bluff stabilization, wetland and natural resource protection and restoration, coastal waters protection (i.e., water pollution control), erosion control, and education and interpretation.

Illinois Department of Transportation (IDOT)

IDOT is responsible for the planning, construction, and maintenance of portions of the transportation network that covers the Dead River watershed. Incorporation of best management practices and sustainable management measures into IDOT projects can help lead to improvements in the environmental quality of the watershed.

Illinois Emergency Management Agency (IEMA)

In Illinois, IEMA is the state agency responsible for flood and disaster planning, emergency response, and hazard mitigation. IEMA works with local governments on flood mitigation plans and provides operational support during floods. IEMA also administers FEMA-funded programs in the state, including flood mitigation grant programs.

Illinois Environmental Protection Agency (IEPA) Bureau of Water

Under the federal Clean Water Act and state legislation, IEPA is responsible for the protection of the state's water resources and ensuring that Illinois' rivers, streams and lakes will support all uses for which they are designated including protection of aquatic life, recreation and drinking water supplies. Several IEPA activities are important to this plan:

- Monitoring: IEPA oversees data collection at various sites (rivers, streams, lakes, etc.) across the state, including the Dead River watershed. The Illinois Water Quality Report (305(b)) summarizes these monitoring efforts.
- Funding: IEPA administers several state and federal grant programs. A primary example is Section 319 funding under the Clean Water Act, which helps local governments, nonprofit entities, and numerous other state, federal, and local partners to reduce nonpoint source pollution through technical and financial support.
- Regulation: IEPA regulates point and nonpoint source pollution discharges into the state's waters through regulatory and non-regulatory programs.

Lake County

The Dead River flows through Lake County, which plays a role in land use planning, development, natural resource protection, and drainage system management in the unincorporated areas of the watershed. Working with the County and its public works, health, and transportation departments, can help ensure that the Dead River enjoys responsible, sustainable land use planning, road and sewer maintenance, and public health policies.

Lake County Forest Preserve District (LCFPD)

The Forest Preserve District of Lake County owns and manages a number of acres of green infrastructure / open space within the Dead River watershed. Issues related to the protection and management of these and potential future

FPD holdings will rely in part on the FPD.

Lake County Health Department (LCHD)

The LCHD Lakes Management Unit provides technical expertise essential to the management and protection of Lake County surface waters. The goal of the LMU is to monitor the quality of the county's surface water in order to maintain or improve water quality and alleviate nuisance conditions, promote healthy and safe lake conditions, and protect and improve ecological diversity. To this end, the LDHC monitors the watershed lakes and has also begun monitoring water quality conditions to provide data on stream health and quality. The LCHD is also responsible for septic system management programs and well testing and monitoring.

Lake County Stormwater Management Commission (SMC)

SMC's mission is to coordinate the stormwater activities of over 90 jurisdictions throughout the county. SMC provides technical assistance, local knowledge and problem-solving skills to coordinate flood damage reduction, flood hazard mitigation, watershed planning, water quality enhancements and natural resource protection projects and programs. The 2002 Comprehensive Stormwater Management Plan Update guides agency programs and projects. Major components of the Plan include: a) implementation of countywide minimum standards for new development (Watershed Development Ordinance); b) projects to reduce existing flooding and water pollution problems; c) rehabilitation of the existing drainage system; d) flood hazard mitigation; e) interjurisdictional coordination and technical assistance; f) public information.

Lake Michigan Watershed Ecosystem Partnership (LMWEP)

LMWEP is a public–private cooperative of watershed stakeholders formed in 2005 to preserve, protect, and enhance local natural systems and integrate them into the life and future of the community through coordination and cooperation. The partnership can help with advocacy, management of watershed projects, grant applications and review, and general coordination of watershed activities. The LMWEP includes the involvement of the Great Lakes Alliance, which is described below.

Lake Michigan / Great Lakes Management Organizations and Programs (LMGLO)

The Great Lakes Alliance focuses its policy, management, and restoration programs on water quality, water conservation, habitat recovery, land use, and education and outreach. The Great Lakes Regional Collaboration, which includes the EPA-led federal agency task force, the Great Lakes states, local communities, tribes, non-governmental organizations, and other interests in the Great Lakes region, is focused on restoring and protecting the Great Lakes. The Great Lakes Initiative is a plan agreed upon by EPA and the Great Lake states to restore the health of the Great Lakes.

Municipalities (all departments) (M)

Municipalities (i.e., local elected officials and local agency staff) have the principal responsibility for land use and development planning, establishing legislative and administrative policies, adopting ordinances and resolutions, setting zoning standards, establishing the annual budget, appropriating funds, and setting tax rates. There are also opportunities to make others aware of the watershed management planning process through local government newsletters and presentations at board meetings, which are often televised on local cable television networks. Municipalities are therefore crucial to watershed protection efforts. By partnering with municipalities and encouraging the adoption of sustainable zoning and development practices, a watershed protection group can check the increase of water quality impairments. Municipalities are also a key part of any watershed protection strategy because they are responsible for the enforcement of local land use and development ordinances.

The National Great Rivers Research & Education Center (NGRREC)

The NGRREC's RiverWatch program, formerly under the Illinois DNR, relies on a volunteer base to monitor, collect and record stream, lake, wetland, and coastal data for the state database. It is also a valuable educational resource that can be used to educate others about watershed issues and concerns.

Natural Resources Conservation Service (NRCS) / Soil

and Water Conservation Districts (SWCD)

NRCS and SWCD provide technical expertise and education on conservation, development, management, and wise use of natural resources to landowners and land managers, county and local governments, and local organizations. Areas of expertise include streambank stabilization and soil erosion/ sediment control, wetland and habitat restoration, community planning, environmental education, agricultural conservation, water quality protection, nonpoint source pollution, stream health, conservation planning, and natural resource maps and reports. NRCS and SWCD also administer several cost-share programs targeted to water quality, wetland restoration, and other watershed priorities.

As part of its watershed protection effort, NRCS administers the USDA Watershed Program (under Public Law 83-566). The purpose of the program is to assist federal, state, and local agencies; local government sponsors; tribal governments; and other program participants in protecting watersheds from damage caused by erosion, floodwater, and sediment; restoring damaged watersheds; conserving and developing water and land resources; and solving natural resource and related economic problems on a watershed basis. The program provides technical and financial assistance to local people or project sponsors, builds partnerships, and requires local and state funding contributions.

Parks and Recreation Districts (PD)

Park and recreation districts often control a large amount of open space in a watershed and maintain recreational facilities and parks. Parks also contain many recreational opportunities and trails, several bordering the Dead River. Partnerships with local park districts can help ensure the preservation of open space while also facilitating recreational and other community opportunities that can help increase support for watershed protection efforts.

Private Residential Landowners and Homeowners Associations (PRL)

The activities of residential landowners, often unknowingly, can have a significant impact of the quality of a watershed. Practices such as excess lawn fertilization, connection of downspouts to the sewer system, or destruction of riparian buffers can be significant sources of nonpoint pollution. Watershed protection efforts should educate residents on the consequences of their actions and present alternatives. More positively, political pressure from local residents on municipal or county officials can lead to increased emphasis on watershed protection. And many local residents play important roles in watershed planning and protection efforts.

North Shore Sanitary District (NSSD)

The North Shore Sanitary District is a municipal government that provides wastewater treatment service for watershed communities. The NSSD maintains the sanitary sewer system in the watershed, which in some cases follows the alignment of the stream channel, and has also begun a stream monitoring protocol for Kellogg Creek and Dead River watersheds.

Townships (T)

While unincorporated townships generally play a secondary role in watershed protection, they often have responsibility for road upkeep and occasionally sponsor drainage system improvement projects. The use of BMPs by townships, especially for road maintenance, can help improve water quality within the watershed.

U.S. Army Corps of Engineers (USACE)

USACE plays a major role in wetland protection and regulation through Section 404 of the Clean Water Act, which requires USACE to administer permit applications for alterations to wetlands. The USACE Chicago district has also established a Wetlands Restoration Fund, which may be available to the Dead River watershed communities.

U.S. Department of Agriculture (USDA)

USDA's Farm Services Agency (FSA) has several programs that support watershed protection and restoration efforts. Under the Conservation Reserve Program (CRP), farmers receive annual rental payments, cost sharing, and technical assistance to plant vegetation for land they put into reserve for 10 to 15 years. The Conservation Reserve Enhancement Program (CREP) targets state and federal funds to achieve shared environmental goals of national and state significance. The program uses financial incentives to encourage farmers and ranchers to voluntarily protect soil, water, and wildlife

resources. The Grassland Reserve Program (GRP) uses 30-year easements and rental agreements to improve management of, restore, or conserve up to 2 million acres of private grasslands. The Conservation Security Program (CSP) is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands.

U.S. Environmental Protection Agency (USEPA)
The USEPA oversees the environmental protection efforts of the IEPA and is the ultimate source for Section 319 and other environmental improvement programs. Section 404 of the Clean Water Act, which regulates the dredging and filling of wetlands, is jointly administered by USEPA and the U.S. Army Corps of Engineers.

U.S. Fish and Wildlife Service (USFWS)
The USFWS provides technical assistance to local watershed protection groups. It also administers several grant and cost-share programs that fund wetland and aquatic habitat restoration. The USFWS also administers the federal Endangered Species Act and supports a program called Endangered Species Program Partners, which features formal or informal partnerships for protecting endangered and threatened species and helping them to recover. These partnerships include federal partners as well as states, tribes, local governments, nonprofit organizations, and individual landowners.

Solid Waste Management
Many local governments have solid waste programs that address the disposal of solid waste and yard waste. They might also handle the recycling, illegal dumping, and household hazardous waste programs.

Waukegan Harbor Citizens Advisory Group (CAG)
The Waukegan Harbor Citizens Advisory Group was organized in 1990 to help citizens and business leaders concerned about the harbor environment develop plans to identify and clean up contaminated harbor properties. The CAG is composed of business, fishing, recreation, environmental, government, and other interested groups and individuals. They formed a partnership with the Illinois Environmental Protection Agency to develop the Waukegan Harbor Remedial Action Plan, detailing use impairments and how these impairments could be restored through a cooperative effort. The Waukegan CAG has been instrumental in obtaining cooperation from local parties involving additional investigations. Groundwater monitoring from local parties is being conducted in an area south of the harbor. The CAG helped obtain access from private businesses and federal grant money to install the monitoring wells. A federally funded 319 grant has been released to the Waukegan CAG to develop a watershed plan to reduce nonpoint source pollution and improve water quality in the Waukegan River watershed.

Watershed Planning Committee (WPC)
The WPC, composed of watershed stakeholders, organizes, coordinates, and advises project partners on watershed planning methods and issues, demonstration project selection and provides technical assistance. The WPC also is responsible for helping coordinate the implementation of the watershed plan.

5.2 PROGRAMMATIC ACTION PLAN

To supplement the Watershed Best Management Practice Toolbox, 77 programmatic action recommendations were identified that apply generally throughout the watershed, including measures related to stream and riparian corridors, water quality and stormwater management, drainage, and retention, planning and development standards, green infrastructure, natural areas, land management, flood management, and coordination. This Programmatic Action Plan should be considered as general guidance for all watershed stakeholders and plan implementers. Parties that have lead and supporting responsibility for implementing the Programmatic Action Plan are identified for each action recommendation. This Programmatic Action Plan includes remedial, preventative, regulatory, and maintenance action items that are applicable throughout the watershed. An expanded programmatic action plan is included in Appendix G.

5.2.1 STREAMS AND RIPARIAN CORRIDORS

Stabilization, restoration, and management of the stream channel, streambank, and riparian corridor are needed throughout the watershed to improve and protect water quality, maintain floodplain functions, and reduce property loss caused by erosion. Of particular importance are remediating the impairments and problems that were identified during the watershed inventory and assessment and preserving the beneficial characteristics of the stream channel such as healthy stream substrates. Streambank and ravine erosion is threatening property, damaging infrastructure, and degrading water quality and habitat. This problem includes significant erosion around and near stormwater outfall and discharge points and hydraulic structures. The most severe streambank erosion problems in terms of threats to property damage are those where the ravine slope is also the streambank. Aquatic and riparian habitat are also in need of restoration, including restoring instream habitat such as pools and riffles, removing excessive debris from the stream channel, establishing naturalized streambanks with native plants, and managing stream corridors by restoring native riparian buffers and reducing the density of trees.

Presently, private landowners, including golf courses, are responsible for maintaining the stream as if crosses their property or flows along a property line. This includes all aspects of management and maintenance, such as debris removal, invasive species control, streambank stabilization, and management of private stormwater outfall pipes. Since problems within the stream and riparian corridor can be the result of land use and other activities upstream of a particular property, it is in everyone's best interest to help ensure that this plan is implemented watershed-wide.

Exceptions to private landowner responsibility exist where the stream passes through public land, including Illinois Department of Natural Resources holdings, or areas within the jurisdiction of the Beach Park Drainage District, which are the responsibility of these public entities. Municipalities have primary responsibility for land use and development decisions within their jurisdiction, including the allowable quantity and quality of stormwater discharge, which dramatically affects the quality of the stream corridor. Municipalities also are responsible, in part, for maintaining drainage system infrastructure, which includes most stormwater discharge points. Within the Beach Park Drainage District boundary, fees assessed to property owners are used to repair and maintain Bull Creek as a drainage system. The Drainage District is primarily concerned with conveyance and flooding issues, but are also responsible for the maintenance and upkeep of the channel within a 50-foot easement on each streambank. The Lake County Stormwater Management Commission addresses stormwater management issues on a watershed basis throughout the county and can help coordinate multi-jurisdictional stormwater management projects, including those within the stream channel, and provide technical assistance to parties implementing these recommendations. The Illinois and Lake County Departments of Transportation are responsible for maintaining some culverts and bridges along the stream corridor.

Programmatic actions for streams and riparian corridors are listed in Table 5.2.

Table 5.2 Stream and Riparian Corridor Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
1	Stabilize and retrofit stormwater outfall structures and the associated streambanks and channel. Install flow attenuation and outlet protection measures to reduce erosion and improve filtration of stormwater runoff entering the stream.	M BPDD RL	SMC	S
2	Stabilize eroding streambanks, toe, and side slopes using bioengineering practices with deep-rooted native plants to reduce erosion and sediment loads downstream and to reduce property loss. Bioengineering practices include A-Jacks, lunkers, fiber rolls, geotextile mats, live stakes, fascines, brush and branch layers, cribwalls, and vegetated geogrid lifts.	RL BPDD GC	SMC IEPA	M
3	Where feasible, replace failing or crude armoring and concrete lined channels with more sustainable, natural and habitat friendly stabilization measures.	RL BPDD	SMC	L
4	Preserve, enhance or establish native riparian buffers along all unbuffered or inadequately buffered stream reaches using emergent wetland and wet prairie vegetation to stabilize streambanks, filter out pollutants, and enhance aquatic habitat. Development within buffer areas should be strictly limited.	RL BPDD GC	M	S
5	Restore stream channels, streambeds, and aquatic habitat to a healthy condition. This includes instream habitat features, such as natural channel substrates and pools & riffles, to improve water quality and aquatic biodiversity.	RL BPDD	IDNR SMC M	S
6	Where feasible, daylight and remeander streams that have been contained in ditches or moved underground into culverts or pipes.	RL BPDD	IDNR SMC M	L
7	Modify bridges, culverts, and other hydraulic structures that are directing flow into the streambanks, eroding around the edges, blocking flows and fish passage or otherwise problematic.	RL M BPDD DOT GC	SMC	M
8	Restore hydrologic connections to Lake Michigan to promote recolonization of the aquatic community.	IDNR	CMP	L
9	Develop and implement a regular stream inspection and maintenance program among the Beach Park Drainage District, municipalities, homeowners, and SMC to remove accumulated woody debris and other debris and litter and to target restoration needs.	SMC	BPDD M RL	S
10	For moderately and severely eroded stream reaches, develop a stream restoration plan and cost estimate.	M BPDD RL	SMC	S

5.2.2 WATER QUALITY AND STORMWATER MANAGEMENT

As described in the introduction and the watershed inventory, stormwater runoff is one of the primary sources of water quality impairment. The causes and sources of water quality problems in the Dead River watershed are primarily urban in nature. These problems are the result of many years of modification of the watershed landscape as it changed from natural to agricultural to urban. These changes have included modification of the stream channel, floodplain, wetlands, riparian corridor, and other water resource-related landscape features. Other changes are the result of the increased watershed impervious cover (e.g., paving, concrete, rooftops) that has led to an increase in the volume and rate of runoff in the watershed. The increased quantity of runoff has caused problems such as excessive stream bank erosion and the deepening of the stream channel due to channel erosion. This erosion causes increased levels of Total Suspended Solids that settle out in the lower gradient reaches within Illinois Beach State Park and impair aquatic habitat. The efficient stormwater system also causes decreased baseflows during the drier summer and fall months, which can result in low dissolved oxygen levels that impair aquatic habitat. Conductivity levels, an indicator of chlorides within the water column (also referred to as Total Dissolved Solids or TDS), were also shown to be high, indicating that salt applied to roads for snow and ice control are impairing water quality. Lake Michigan beaches exhibit ongoing problems with fecal contamination due to high gull populations.

To improve this situation, the use of stormwater best management practices and the preservation and natural buffering of the natural drainage system (overland flow paths, streams, wetlands, lakes and floodplain) should be required in all new development and encouraged in areas that are already developed. Drainage and detention in existing developed areas also should be retrofitted to better control runoff rates and to improve water quality. Natural hydrologic regimes and drainage systems should be preserved and/or restored to the extent practicable to reduce the impact of development and hydrologic modification on flooding and water quality and to help achieve aquatic habitat objectives.

All landowners and stakeholders within the watershed can contribute to water quality improvement by managing land and property to prevent or remove pollutants from the landscape before they can be washed into the stream. Management and maintenance of the stormwater management system is primarily the responsibility of municipalities and the Beach Park Drainage District, including both the conveyance system (pipes and drainage swales) and detention ponds, unless management of these features has been assumed by a homeowners association or other party. The implementation of green infrastructure best management practices (BMPs) is the responsibility of all landowners (for existing development) and developers and homebuilders (for new development). However, municipalities must require or encourage these practices to be installed. Preservation of remaining natural drainage and storage (green infrastructure) features of the landscape is the responsibility of municipalities.

Programmatic actions for water quality and stormwater management are listed in Table 5.3.

Table 5.3 Water Quality and Stormwater Management Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
11	Use green infrastructure BMPs such as natural stormwater drainage, infiltration, and detention practices and lot level BMPs in new and existing development to reduce surface runoff volumes, to filter pollutants from stormwater runoff, and to improve infiltration of precipitation into the ground. Stormwater BMPs should use, to the extend possible, native plants that are appropriate for the location in which they are being planted. Reducing runoff rate and volume will also minimize sediment loadings from in-stream and surface erosion and riparian habitat degradation .	M PRL CBL DH	SMC IEPA PD LC	M
11a	Where feasible, convert existing swales and open drainage ways to infiltrate runoff with natural landscaping.	M BPDD DOT	SMC PRL CBL DH LC	S
11b	Retrofit curb and gutter areas along roadways, parking lots, and other impervious surfaces to allow stormwater to enter swales or other naturalized filtration and infiltration measures such as parking lot and roadside rain gardens.	M CBL DH DOT	LC	M
11c	Install bioswales into parking lots as construction and reconstruction occurs.	M CBL DH DOT	LC	M
11d	Install vegetated filter strips or rain gardens where sheet flow leaves impervious surface to capture pollutants and infiltrate runoff.	M CBL DH DOT	LC	S
11e	Install sand filters, filtration basins, treatment wetlands, other bioretention practices, or other filtration practices downstream of industrial, commercial facilities and other land uses potentially generating a heavy load of pollutants. Install sand filters, appropriate proprietary water treatment units, or settling basins at the storm sewer inlets in parking lots	M CBL DH DOT	LC	M
11f	Install green roofs where feasible to capture, filter, and evaporate stormwater.	PRL CBL DH	M	L
11g	Reduce the hydraulic connectivity of impervious surfaces by disconnecting roof downspouts from discharging to impervious areas and instead directing the flow into a lawn or naturally landscaped area, raingarden, filter strip, rain barrel, or dry well. Substitute swale and raingarden systems for curbs and gutters to increase infiltration.	PRL CBL DH	M LC	S
11h	When replacing existing pavement, or installing newly paved areas, use pervious or porous pavement or permeable paving blocks for parking lots, emergency access roads, driveways and streets where appropriate to increase infiltration and reduce runoff volumes and pollutant loads.	PRL CBL DH DOT M	PD LC	M
12	Utilize naturalized wet bottom or wetland detention basin designs and retrofit existing single function dry bottom detention basins to provide multiple benefits including reduced pollutant loads, and to provide habitat. Upgrade and maintain existing stormwater detention basins and online water storage ponds to provide water quality benefits and slower release rates where feasible.	M PRL CBL DH GC	DOT SMC BPDD	M
12a	Stabilize eroding shorelines and replace rip rap, concrete and turf pond and detention basin edges with deep-rooted native landscaping for shorelines and buffers.	M PRL CBL DH GC	DOT SMC BPDD	M
12b	Install settling basins upstream of wet and wetland detention where feasible and where the catchment area contains a large amount of impervious surface to capture sediment in runoff. Where settling basins can not be installed upstream, install a forebay in the basin and remove accumulated sediment to maintain detention capacity.	M PRL CBL DH GC	DOT SMC BPDD	M
12c	Monitor, maintain, and clean out stormwater detention facilities, storm drains, and catch basins to ensure effective operation and provide maximum detention, water quality benefits and habitat. Develop a monitoring and maintenance plan that identifies who is responsible, a maintenance schedule, budget and funding source.	M PRL CBL DH GC	DOT SMC BPDD	S
12d	Where possible, restrict discharge rates from detention basins to mimic natural instream flow rates.	M PRL CBL DH GC	DOT SMC BPDD	M
13	Preserve and protect natural drainage and storage (green infrastructure) features of the landscape to filter and infiltrate runoff and to reduce the threat of flood damage, including native vegetation, natural riparian buffers, floodplains, flood prone areas, natural depressional and regional storage areas, and wetlands. Prevent fill, excavation, development, and other modifications. Smaller depressional areas may potentially be incorporated into development as raingardens, bioswales, and other measures that retain runoff rather than releasing it offsite.	M DH PRL	SMC LC	L
14	Maintain the drainage system conveyance including cleaning out catch basins, channel maintenance, swale maintenance, culverts, and removing excess debris, trash, and other obstructions to improve aesthetics maintain flow capacity, and minimize erosion. Some natural elements such as rocks and woody debris should be left as in-stream habitat features.	M BPDD RL	DOT SMC	S

5.2.3 PLANNING AND DEVELOPMENT STANDARDS

The Dead River watershed is largely built out, meaning that a very limited amount of developable land remains. The existing developed landscape has and continues to impact watershed resources primarily due to the conversion (and loss) of the natural landscape to urban uses, alteration of the natural drainage and water retention features of that landscape, and the rate, volume, and quality of stormwater runoff.

The Lake County Watershed Development Ordinance provides good standards and practices for addressing some of these impacts, however, the jurisdictional scope of the County is limited, and watershed municipalities, as the primary land use and development decision-making entities, are responsible for adopting and enforcing many of the planning, zoning, subdivision, and development standards that will affect watershed resources. Current municipal planning and development standards do not adequately identify, prioritize, or preserve valuable landscape features nor require (and in some cases, they do not even allow) the use of conservation design, low impact development, or stormwater best management practices.

Watershed and green infrastructure recommendations should be integrated into local policies, plans, and budgets. Standards and policies that protect the natural drainage system from hydrologic modification activities such as clearing, compaction, draining, filling, dredging, and straightening, such as providing overlay zoning for high priority green infrastructure, are needed. These development standards may include changes to zoning regulations, subdivision, commercial, and industrial standards, to include conservation and low impact development techniques by right (rather than as an exception), natural buffers, and green infrastructure protection/management programs.

The parties that are responsible for implementing planning and development standards are primarily those responsible for land use decisions. Thus, the primary responsibility lies with the municipalities and Lake County.

Programmatic actions for planning and development standards are listed in Table 5.4.

Table 5.4 Planning and Development Standards Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
15	Lake County, municipalities, park districts, the Forest Preserve District and other local governments units should incorporate the goals and recommendations of the watershed plan into comprehensive land use plans, development policies (zoning and subdivision regulations) capital improvement plans and budgets, and land preservation/acquisition strategies.	M	BPDD LCFPD SMC T LC	S
16	Use the site development planning and approval process to encourage watershed-friendly development practices and designs that protect watershed resources and water quality by right rather than by exception.	M	LC	S
17	Establish incentive programs for developers to implement conservation and low impact development planning and design practices and techniques. These incentives could include expedited permitting and review procedures, density bonuses, tax credits, cost-share, or fee reductions for early projects that serve as demonstrations and free technical assistance.	M LC		M
18	Make it easy for developers and builders to incorporate best management practices recommended by this watershed plan into new developments or redeveloped areas. Modify zoning and development standards to facilitate implementation of the watershed plan recommendations. This could include the following: review and update development standards, add incentives such as density bonuses, park and open space donation credits, and other incentives, for preserving the green infrastructure system. Within new developments, easements or deed restrictions should be placed on lands identified as Category 1 parcels on the Green Infrastructure Plan.	M	LC	M
19	Establish and adopt bluff-and-ravine protection standards.	M LC		S
19a	Establish a 30' minimum buffer distance between bluff edges and development.	M LC		S
19b	Require appropriate deep-rooted native plants as ground cover to help stabilize erodable soils on ravine slopes, edges, and buffers. Erodable soils are found in reaches BL02, BL05, BL07, BL08. BL09, BL10, BL11, BL13, BL19, BL20, BL21, BL25, BL26, and BL27. Allow cutting of trees on ravine slopes where appropriate for ground cover vegetative restoration. Require proper removal and proper disposal of cut trees.	M		S
19c	Prohibit dumping of grass clippings, leaves, or other natural or man-made fill or debris that may damage underlying vegetation or prevent re-vegetation on ravine slopes.	M		S
19d	Encourage the use of on site infiltration techniques to reduce direct stormwater flow from impervious surfaces into the ravines. Where stormwater can not be infiltrated on site, prohibit downspout pipe and/or sump pump outlets on or within 10 feet of or on steep ravine slopes. Allow discharge at the bottom of the ravine.	M LC SMC		S
19e	Limit concentrated stormwater discharges to ravines to storm events larger than the 1-year frequency. Level spreaders may be required to distribute concentrated flows across a large area.	M SMC		M
20	Adopt and enforce flexible local zoning and subdivision standards that allow adaptable, nontraditional designs for development that minimize negative impacts from stormwater runoff and nonpoint source pollution. Standards should limit runoff volume increases, minimize impervious surface area, manage stormwater on site using BMPs, and minimize land disturbance during and following construction. This action is most relevant for Highly Vulnerable Critical Subbasin #35, which is at risk for land use conversion that may result in significantly higher imperviousness.	M	LC	M
20a	Reduce minimum street widths to those necessary to carry the expected average traffic volume rather than the maximum traffic volume.	M	LC	L
20b	Use alternative parking lot designs including: ensure that the number of spaces built reflects actual, everyday demand rather than infrequently needed maximums; reduce the dimensions of the normal parking spaces where feasible; convert parking lot islands and landscaping to depressed bioretention areas; allow shared parking between adjacent facilities with alternating times of parking needs (e.g., a church and an office building).	M	LC	M
20c	Allow permeable paving practices for plazas and pedestrian areas, parking, driveways and low volume traffic streets.	M	LC	M
20d	Allow reduced street setbacks, frontages, and lot sizes in areas where riparian or sensitive natural areas need protection and to reduce the impervious surface area for streets and driveways.	M	LC	M
20e	Allow cluster / conservation design development to reduce the disturbed area and preserve green infrastructure (open land) for infiltration and treatment of runoff.	M	LC	M

5.2.4 GREEN INFRASTRUCTURE

The green infrastructure network of the Dead River watershed, outside of Illinois Beach State Park, is neither extensive nor well connected. Some large open parcels have been protected as natural areas, such as Illinois Beach State Park (IBSP) and Lyons Woods Forest Preserve, and others are protected for more active use, such as Thunderhawk Golf Club Forest Preserve and Shiloh Park in Zion. While these public holdings form good, large green infrastructure hubs, the connections between those hubs, particularly along the stream corridors where they are most needed, are largely nonexistent. In many cases, the opportunity does not exist to preserve these areas--they are privately owned and already developed. However, a few open parcels do remain, as illustrated in Figure 5.1. The preservation of this green infrastructure system is not only important for preserving environmental resources, but makes good economic sense for the community as well. Green infrastructure helps protect the natural conveyance system, absorb flood waters reducing flood damage, can reduce the continued degradation of stream resources needing expensive remediation, and can preserve high value resources making the community a healthy and desirable place to live.

A connected green infrastructure network throughout the watershed should be protected and enhanced or restored to improve its functional value. The watershed green infrastructure network primarily consists of the natural drainage system including open parcels along the stream corridor and those prioritized as Category 1 (highest priority) sites. Municipalities, which are primarily responsible for preserving green infrastructure parcels, should identify these areas as important within community plans, policies, and budgets, avoid extending gray infrastructure (roads and utilities) in a way that would impact green infrastructure parcels, and take action to preserve them using planning and development standards described above. Other parties that can support land preservation efforts include the Lake County Forest Preserve District and, for parcels of higher biological quaility, the Illinois Department of Natural Resources.

Programmatic actions for green infrastructure are listed in Table 5.5. Prioritized green infrastructure areas, which are describedin greater detail in Tables 5.6 through 5.11, are shown in Figure 5.1.

Table 5.5 Green Infrastructure Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
21	Land planning jurisdictions such as municipalities, park districts etc. adopt the Green Infrastructure Plan to use as a tool in prioritizing and implementing green infrastructure preservation and restoration programs.	M PD LCFPD	LC	S
21a	Clearly identify and designate areas prioritized in the Green Infrastructure Plan as green infrastructure conservation areas in county, park district and municipal comprehensive plans and maps.	M PD LCFPD	LC	S
21b	Identify and conserve connecting greenways, especially along streams and other water features. Provide passage and remove or mitigate barriers to fish & wildlife movement (such as highways, dams, and weirs) throughout the corridors and between the green hubs.	M PD LCFPD	LC	L
21c	Avoid development and installation of gray infrastructure through Category 1 green infrastructure system parcels wherever possible.	M	LC T DOT	S
21d	For lands not readily protected through land use planning and zoning, develop a preservation strategy to prioritize and purchase or otherwise protect Category 1 Green Infrastructure parcels and the natural drainage system of stream corridors, and wetland complexes. The strategy may include purchase funds, developer fees and donation funds, conservation easements, purchase of development rights programs, or other measures.	M PD LCFPD	LC	S
22	Actively manage, restore, buffer and expand Category 1 and 2 Green Infrastructure Parcels by controlling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer. These areas may include Illinois Natural Areas Inventory sites, forest preserve holdings, private conservation lands, and other public agency lands such as park districts.	PRL CBL M	PD IDNR LCFPD	L

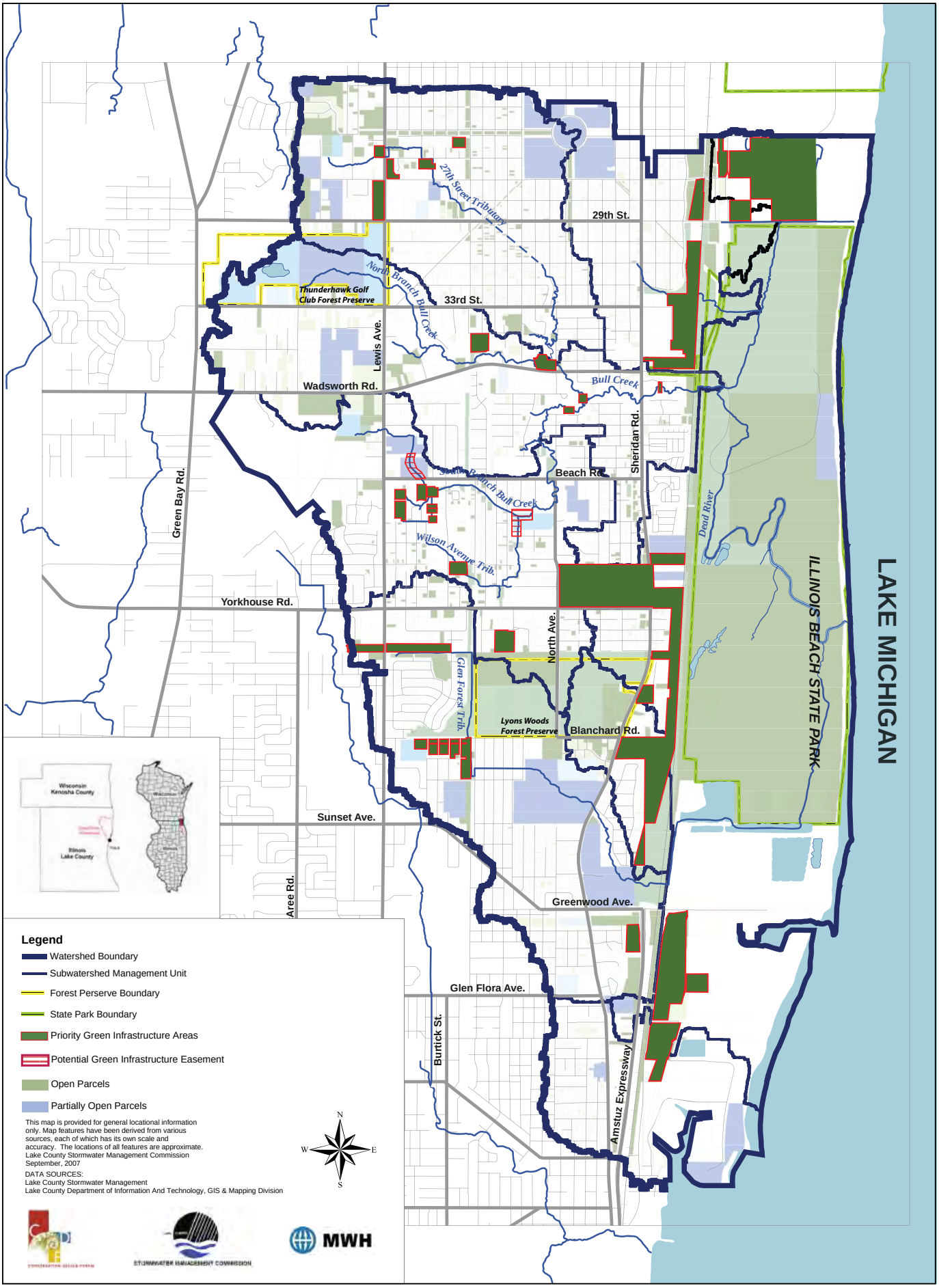


FIGURE 5.1 PRIORITIZED GREEN INFRASTRUCTURE AREAS

5.2.5 NATURAL AREAS

Natural areas such as stream and riparian corridors, wetlands, forest preserves, and some of the open and partially open green infrastructure parcels that remain in a natural state provide flood water retention and natural buffering for streams, but are also important to preserve the biological heritage of the watershed, conserve unique habitat found no where else on earth, and serve as passive and active recreational spaces for watershed residents and visitors.

Natural areas within the Dead River watershed include Illinois Beach State Park, Lyons Woods Forest Preserve, and parts of Thunderhawk Golf Club Forest Preserve. Lyons Woods and IBSP are some of the most biologically diverse ecosystems in the State of Illinois. The state park has one of the last remaining reaches of natural Lake Michigan shoreline in Illinois. These holdings significant and form a strong foundation for the green infrastructure network. Outside of these areas, natural areas are sparse and found primarily along the Union Pacific railroad corridor, with three remaining open parcels bounded by Yorkhouse Road, North Avenue, and Sheridan Road. Nonetheless, landowners along the stream corridor are responsible for restoring and managing the stream and riparian areas, which are very important to the natural health of the watershed.

Wetland protection, management, and restoration are needed to protect the natural conveyance system, improve water quality, provide stormwater storage, and other natural resource benefits. As recipients of drainage from the entire Dead River watershed upstream, IBSP and Lyons Woods are being degraded by that runoff and are in critical need of restoration and management to protect and enhance their high quality wetlands and natural areas. Upstream watershed management that restores a more natural hydrology and reduces erosion, pollution, and sediment loads to the park and forest preserve will help stabilize the hydrology and preserve rare and highly valued natural communities in the park and forest preserve downstream.

Erosion of the Lake Michigan shoreline is a problem related to the disruption of the natural transport and deposition of sand that under natural conditions replenishes the beach. While a number of actions have been taken to help reduce erosion and replenish the sand, they have resulted in very limited and temporary success.

Programmatic actions for natural areas are listed in Table 5.6.

Table 5.6 Natural Area Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
23	Actively manage, restore, buffer and expand natural areas (riparian zones, wetlands, and high quality habitat sites) by controlling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer. These areas may include Illinois Natural Areas Inventory sites, forest preserve holdings, private conservation lands, and other public agency lands such as park districts.	M IDNR PD LCFPD	CBL PRL	L
24	Protect, and restore degraded, drained, and/or farmed wetlands to improve water quality, provide surface water storage, and improve habitat. Vegetative management, prescriptive burning, invasive species management, and hydrologic restoration can all be used to help improve wetland quality. The strategic removal and/or blockage of wetland drainage tiles, flood control structures, or other drainage structures can help restore wetland hydrology. Approximately 754 acres are available as potential wetland restoration sites.	M LCFPD PRL	IDNR PD	L
25	Restore stream channels to natural state by preserving and/or installing pools and riffles, removing excessive debris, stabilizing steam banks and the stream bed.	RL	BPDD IDNR	L
26	Stabilize upstream hydrology to reduce erosion, pollution runoff, and sediment loading to downstream natural areas and preserve valuable and unique resources within Illinois Beach State Park and Lyons Woods Forest Preserve.	M PRL		L
27	Replenish and stabilize the Lake Michigan shoreline to protect this valuable and unique habitat.	IDNR CMP	USACE USFWS	L
28	On private lands, actively manage, restore, buffer and expand on-site natural areas by controling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer.	PRL RL CBL		L

5.2.6 LAND MANAGEMENT

In any watershed, the way that land is managed, developed, grown, and otherwise acted upon by the residents and others in the watershed affects the quality of watershed resources. Land uses such as transportation, industrial, and commercial, with large areas of impervious surfaces such as rooftops, roads, and parking lots, contribute significant amounts of pollutants to streams and other water resources. Management of the turf grass areas of residential and other land uses such as schools and parks contribute fertilizers and pesticides, and the disposal of yard waste in or near the stream or other water feature impacts these resources by contributing decomposing organic matter, which reduces dissolved oxygen levels in water. Animal populations, including pets, deer, and gulls along the Lake Michigan shoreline contribute bacterial contamination to the stream and beaches, making them unsuitable for human contact. Construction activities can result in significant site erosion, which sends sediment into the stream system. All of these pollutants eventually end up in Lake Michigan, the source of drinking water and recreation for millions of people.

Appropriate land management practices can help reduce pollutant loading at the source, before pollutants reach streams and other water resources. Road and parking lot maintenance, including street sweeping and the reduction of road salt application in winter, can help prevent toxic materials, sediment, and chlorides from flowing to the stream and impairing water quality. Soil erosion and sediment control practices installed during the development and construction process can significantly reduce the contribution of sediment from these sites. Appropriate landscape maintenance, such as reduced application of fertilizers and pesticides, installation of native landscapes, and appropriate disposal of yard waste, can reduce the concentration of landscaping pollutants in stormwater runoff and the stream. Installing best management practices such as riparian buffers and filter strips can remove pollutants from runoff before they can reach the stream. For example, stream riparian buffers have the potential to remove 75% of sediment and 50% of phosphorous from stormwater runoff. Naturalized swales can remove up to 80% of total suspended solids and 30% of phosphorous.

Three sites within the Dead River watershed present unique challenges and opportunities for land managment. The Waukegan Regional Airport, which is planning to expand within the next 10 years, is partially covered by impervious surfaces and requires the use of fluids and chemicals to support the airport activities, some of which are toxic or otherwise harmful to water quality and habitat. The airport implements a Storm Water Pollution Prevention Plan and Spill Prevention, Control and Countermeasure Plan that it should continue to update and apply. The airport should also consider implementing the road and parking lot maintenance recommendations, as well as those related to turf grass and grounds management for those areas not covered by impervious surfaces.

The Zion Nuclear Power Station is scheduled to be decommissioned over the next 10 years and the City of Zion plans the future land use of this area to be single family residential. If feasible, and if all contamination or other nuclear legacy issues can be adequately addressed, this land should be remediated, restored to a natural state, and re-integrated into Illinois Beach State Park and the unique resources found there.

Property owners within the Waukegan Harbor Area of Concern, which includes the harbor and the industrial land uses to the north and surrounding the harbor, should take special land management precautions. Property should be kept clean of debris, fluids, chemicals, and other materials that have the potential to leach or otherwise migrate into streams, Lake Michigan, or other areas. Material piles or storage areas also should be covered or contained.

Programmatic actions for land management are listed in

Table 5.7 Land Management Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
29	Improve road maintenance practices, such as street and parking lot sweeping and reduce application of de-icing salt, to reduce the flow of particulates, sediment, chlorides, and other pollutants into the stormwater system, stream, and ultimately Lake Michigan.	M DOT CBL	T	S
30	Investigate and address potential contamination issues in Illinois Beach State Park and the Dead River. Remediate, cap, cover, or install other controls for any potential sources of toxic or other pollutants including waste storage piles, landfills or facilities, hazardous materials, nuclear contamination sites, and salt piles to prevent stormwater contact or to capture runoff if stormwater contact does occur.	IDNR CMP USEPA IEPA	LCHD CAG LMGLO	L
31	Reduce fecal coliform contamination on Lake Michigan beaches by controlling gull populations, human sewage, and other contributing sources. Further study is needed to identify the non-gull sources of fecal coliform contamination.	LCHD IDNR	IEPA LMGLO	S
32	Use sustainable site and land management practices (including golf courses and agricultural operations).	PRL CBL GC	M PD LCFPD	S
32a	Avoid disposal or burning of yard waste in or near the stream or riparian buffer, which adds excess nutrients to the stream system and kills the plant buffer that stabilizes the streambanks and filters runoff to the stream. Properly dispose of yard and pet wastes, household chemicals, and trash. Do not dispose of these in stormsewers, roadside swales, or the stream.	PRL GC	CBL M PD LCFPD	S
32b	Utilize deep-rooted native vegetation wherever possible for landscaping rather than turf grass to increase stormwater infiltration and evapotranspiration, reduce the need for watering, pesticides and fertilizers, filter pollutants from surface runoff, and provide habitat for native species. Plant native trees appropriate to the local area to increase interception, evapotranspiration, and uptake of precipitation.	PRL CBL GC PD	M	S
33	Protect water resources from sedimentation due to construction site erosion by inspecting and enforcing soil erosion and sediment control standards as required by the Lake County Watershed Development Ordinance. Require an approved SESC plan to help protect water resources from sedimentation by filtering and trapping sediments out of stormwater before it leaves a development site. Assess erosion and sediment control practices after storm events and ensure SESC plan implementation.	M DH LC	NRCS/SWCD	S
33a	Minimize soil compaction, clearing and mass grading to only where absolutely necessary to build and provide access to structures and infrastructure (site fingerprinting). Avoid clearing and grading in or immediately adjacent to water resources and steep slopes. Clearing should be done immediately before construction, rather than leaving soils exposed for months or years.	M DH LC	NRCS/SWCD	S
33b	During construction protect and retain existing vegetation to decrease concentrated flows, maintain site hydrology, and control erosion.	M DH LC	NRCS/SWCD	S
33c	Limit soil exposure by phasing construction so that only a portion of the site is disturbed at any one time to complete the needed building in that phase. Other portions of the site are not cleared and graded until exposed soils from the earlier phase have been stabilized and the construction is nearly completed.	M DH LC	NRCS/SWCD	S
33d	Stabilize / revegetate exposed and disturbed soils including soil stockpiles within 14 days after disturbance with seeding, mulch cover, erosion control blankets, or other stabilization practices. Topsoil stockpiles can be reapplied as a soil amendment to reestablish vegetation following construction.	M DH LC	NRCS/SWCD	S
33e	Employ a soil erosion sediment control treatment train, and install perimeter controls and risers as a last line of defense to retain and filter sediments before runoff exits the site.	M DH LC	NRCS/SWCD	S
34	The Waukegan Regional Airport should continue to update and implement the Storm Water Pollution Prevention Plan and Spill Prevention, Control and Countermeasure Plan, sweep impervious surfaces regularly, and find more environmentally-friendly de-icing compounds for airplanes and runways.	Waukegan Regional Airport		S

Table 5.7.

5.2.7 FLOOD MANAGEMENT

Flooding and risk of flooding are fairly common in northeastern Illinois and Lake County, primarily due to the impact of urban development, which increases impervious surfaces, increases the rate and volume of stormwater runoff, and modifies and builds in natural storage and floodplain areas. These factors, coupled with a flat Illinois landscape where excess water tends to spread out over a wide area, has resulted in flooding problems. For this reason, it is important to preserve and not modify existing flood storage capacity of the landscape including depressional areas, wetlands, and floodplains.

While Flood Problem Area Inventory (FPAI) sites within the watershed are not extensive in terms of affected area, flooding within these areas can be extremely destructive and disruptive to those suffereing from flood damage. Flooding of roads and intersections, such as those reported by the Illinois Department of Transportation, disrupt travel and economic activity. In addition to these identified flooding problems, potential flood areas have also been identified that may affect up to 270 structures in the 100-year floodplain and 682 structures in the 500-year floodplain.

Addressing current and potential flood problems is important for those affected and for the overall impact of flood damage to society in general. Current flooding issues were due either to a local drainage problem, meaning that the size of the drainage system, whether underground sewer, ditch, or overland flow path, is insufficient to carry the volume of water required, or to sanitary sewer or septic failure, as in the Lake County Gardens Subdivision.

None of these locations fall within the 100-year floodplain, and flood insurance is not an option for these landowners. Increasing the local drainage capacity for these areas will probably require installation of new or larger sewer pipes, larger culverts, or improving or increasing the capacity of the ditch or overland flow path. Installing or increasing local flood storage, such as through installation of detention basins, is another potential solution. Floodproofing options, such as raising the structure above the level of flooding, protection using the surrounding land such as levees, sealing basement windows and doorways in homes, and application of floodproofing materials to buidling foundations also exist for these locations.

For sewer backup problems, one-way flow valves are available that allow flow to leave a structure via the sewer pipe but do not allow flow to enter a structure through the same pathway.

For landowners with structures within the 10- or 100-year floodplain boundary, options include flood insurance to help repair damages due to flooding, floodproofing such as raising a structure, and flood buyouts, where a property owner voluntarily sells the land and structure. Under flood butyouts, the structure is typically removed from the property and floodplain and the land is no longer available for development.

Programmatic actions for flood management are listed in Table 5.8.

Table 5.8 Flood Management Programmatic Actions

#	Flood Management Programmatic Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
35	Adopt and continue to enforce floodplain protection standards within zoning, subdivision, and building codes or a 'stand-alone' floodplain protection standard that prohibits new building and roadway development, fill, or other encroachment within the floodplain.	M LC SMC		M
36	Address Flood Problem Area Inventory and Illinois Department of Transportation flooding sites, and avoid potential flood damage within 10- and 100-year floodplains.	M PRL FEMA DOT	LC SMC	L
36a	Preserve riparian and depressional floodplain and wetlands as open and undeveloped to maximize flood storage and conveyance.	M LC		L
36b	Mitigate flood damages through floodproofing of at-risk structures such as raising the structure, sealing basement windows and doors, floodplain buyouts, and installing landscape features such as floodwalls or levees.	PRL CBL	M LC FEMA	L
36c	Mitigate sanitary sewer backup flood damages through remediation / correction of infiltration and cross connections with the sanitary sewer system and installation of one-way valves.	PRL NSSD		L
36d	Mitigate local drainage capacity flood damage by providing additional flood storage and or maintaining / improving local drainage system through installation of new or larger sewer pipes, larger culverts, or improving or increasing the conveyance capacity of ditches and overland flow path.	PRL M	LC SMC	L

5.2.8 STAKEHOLDER COORDINATION

Activities within one area of the watershed can impact watershed resources in areas of the watershed that seem distant or unconnected. For example, appropriate stormwater management practices applied in the western headwaters of the watershed can improve aquatic resources as far away as Illinois Beach State Park and Lake Michigan, and can reduce flooding and streambank erosion problems for downstream communities and landowners. And just as the actions of one stakeholder can impact distant resources, the participation, coordination, and action of all of the stakeholders is needed to create real and lasting improvement of watershed resources. No single party, stakeholder, jurisdiction, or discipline can effectively implement this watershed plan alone.

Coordination across property and jurisdictional lines is critical for implementing plan recommendations that require multiple funding sources and coordination of time and effort beyond a single stakeholder's resources. For example, municipalities must adopt the green infrastructure plan and coordinate implementation efforts and resources to achieve the most efficient and effective results. Neighbors must work together to address streambank erosion issues that threaten their properties. A strong coalition of dedicated watershed stakeholders, including representatives from all of the municipalities, the county, and residents and landowners must form a new Dead River watershed-based organization to help coordinate and lead watershed plan implementation efforts, provide education and assistance to watershed stakeholders, and make recommendations for project funding. Local, state, and federal agency programs, including voluntary education initiatives, technical and financial support for planning and best management practice projects, and regulatory programs that permit or restrict development activities, can be combined and leveraged for multiple benefits.

Programmatic actions for stakeholder coordination are listed in Table 5.9.

Table 5.9 Stakeholder Coordination Programmatic Actions

#	Actions	Lead Implementation Responsibility	Supporting Implementation Responsibility	Timeframe
37	Form a watershed organization to coordinate and lead watershed plan implementation activities.	SMC M	WPC IEPA	S
38	Coordinate watershed restoration projects and develop cost-share funding for best management practices.	SMC	M WPC	S
39	Establish regular (e.g., quarterly) stakeholder coordination meetings to discuss projects, watershed plan implementation, and land use planning and development activities.	SMC	M WPC	S
40	Incorporate plan recommendations into regional, county, and municipal plans and budgets.	M LC CMAP		S

5.3 SITE SPECIFIC ACTION PLAN

In addition to the programmatic recommendations, which generally apply watershed wide, site specific action items and recommendations are tied to a particular location in the watershed: one of the Subwatershed Management Units, one of the stream reaches, or a specific point on the stream. As with the programmatic actions, these site specific recommendations were developed to address watershed problems, to improve watershed resources, and to achieve the watershed goals and objectives.

The process of identifying specific sites that are in need of, or suited to, watershed improvement projects has been ongoing during the planning process and will continue throughout plan implementation. Watershed improvement projects in the site specific plan range from small maintenance and repair tasks, to large wetland restoration and green infrastructure preservation projects.

During development of the watershed-baed plan, several methods were used to identify project sites.

1. Members of the Watershed Planning Committee provided site and project recommendations to the planning team during meetings.
2. Sites were identified based on results of previous watershed studies such as the Flood Problem Area Inventory and 2001 Stream Inventory.
3. New data was collected during the field assessment conducted by the planning team.
4. Extensive map analysis using existing data including land use, wetlands, soil, floodplain and green infrastructure overlays. These analyses included green infrastructure prioritization, identification of critical areas, and non-point source pollution loading.

This action plan (Tables 5.10 through 5.15) is organized by the jurisdiction in which the recommendation falls, and includes the information listed below. This structure should allow jurisdictional representatives to easily identify which recommendations are within their sphere of influence and control. The action recommendations have been located on the Subwatershed Management Unit Maps found in Figures 5.2 through 5.10 and are identified by the three-digit Recommendation ID#. Tables 5.10 through 5.15 are subsets of a more detailed action plan table that is included in Appendix H. Chapter 6 identifies a number of implementation details, such as area and cost, that are essential for understanding the difficulty and extent of putting these recommendations into effect.

Recommendation Identification # (ID#): each action is identified by a three-number identification label: (1) SMU, (2) stream reach, and (3) identification number for each action. For example, 2.27.4 would refer to Action #4 along Reach 27 within SMU 2. These ID numbers correspond to those on the SMU maps in Figures 5.2 through 5.10.

Jurisdiction: identifies the jurisdiction within which the recommendation falls. Individual jurisdictions are listed first, followed by multi-jurisdictional recommendations.

Recommendation Description: narrative explanation of the action recommendation. Those recommendations that address Critical Areas (identified in Chapter 3 Section 17) are shown in italics.

Goal-Obj: the Goal and Objective the action item is intended to address.

Priority: priority refers to the rank importance of the action. A "1" indicates high priority and "3" indicates lower priority.

Ease of Implementation: indicator of how difficult the recommended action is to implement, with "1" indicating a fairly simple action and "3" more complex or difficult action to implement.

Time frame: indicator of when the action recommendation is intended to be implemented: Short (1-5 years), Medium (5-10 years), or Long (10+ years).

Implementation Responsibility: indicates the lead party that will most likely be responsible for implementing the action recommendation as well as any supporting parties.

The site-specific recommendations in Tables 5.10 through 5.15 reflect the opportunity sites identified by stakeholders, past studies and inventories, and other components of the watershed assessment. However, they do not include all of the opportunities for best management practice projects in the watershed. Figures 5.2 through 5.10 illustrate the location of the site specific recommendations included in Tables 5.10 through 5.15.

Table 5.10 Site Specific Action Plan for the City of Zion

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.1	Zion	Preserve Category 1 and 2 green infrastructure open space areas to connect the North and South units of Illinois Beach State Park, enhance recreational opportunities, and expand and restore important rare habitat. Decommission and remove the power plant and associated structures. Acreage count includes private / utility owned land within the area. It is assumed that restoration would address the potential pollutant loading hotspots identified as Critical Subbasins #15 and #74.	C1, C2, C3, E1, E2	1	3	L	IDNR/Utility	Zion
2.0.3	Zion	*Manage / minimize runoff impacts of commercial land uses along Sheridan Road, particularly at Sheridan and 33rd St and Sheridan and 27th, 28th, and 29th along the stream. Cost estimate assumes 8400 lf of Sheridan Road frontage treated with improved, 10' swales (approximately 2 acres) as a proxy for on-site source control BMPs.*	E1, E2, E7, E9, G1	1	3	S	Zion	Owner Developer
2.0.6	Zion	*Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin; remove excess debris.*	E1, E2, E9	2	2	S-M	Owner	
2.0.7	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin; remove excess debris. This is depressional area #54.	E1, E2, E9	2	2	S-M	Zion Park District	
2.0.8	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2	S-M	Zion Park District	
2.0.9	Zion	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	Owner	Zion
2.28.1	Zion	Restore stream channel and improve instream habitat by installing pools and riffles.	A1, A10, C3	3	3	S	Zion Park District	
2.28.2	Zion	*Restore and manage the channel, native riparian buffers, and ravine woodland system, particularly the reach running through Ophir Park west of Sheridan Road, and Carmel Park east of Sheridan Road. Management practices include controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.*	A1, A3, A5, A6, A10, C3, E2, E4	1	2	S	Zion Park District	
2.28.3	Zion	*Stabilize and reduce downcutting of the incised channel through Ophir Park, and install a naturalized riparian buffer. Cost estimate assumes stabilization of streambanks with Moderate erosion problem.*	A6, A10, A11, B1, B4, C3, E1	1	2	S	Zion Park District	
2.28.4	Zion	Manage the culvert outflow at the upstream end of the reach for energy dissipation and pollutant removal, possibly with a settling basin or small constructed wetland.	A10, A11, B4	2	3	S	Zion Park District	

Table 5.10 Site Specific Action Plan for the City of Zion (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
2.28.5	Zion	*Stabilize Moderate streambank erosion along the entire reach using bioengineering stabilization measures, which will help reduce the instream silt / sedimentation load within this reach.*	A1, A3, A8, C3, E1	1	3	M	Zion Park District, Owner	
2.28.6	Zion	Remove debris, tires, and logs using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	SMC
2.28.7	Zion	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	SMC
2.28.8	Zion	Remove concrete debris and remove or repair failed headwall and outfall pipe.	A10, A11, B4	2	3	S-M	Zion Park District	Zion
2.28.9	Zion	*Stabilize major erosion, bank slumping / blowout, and headwall failure at upstream end of the reach near the culvert. Use bioengineering stabilization measures if possible, and more structural measures if necessary. Cost estimate reflects stabilization of severe erosion problem.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
2.28.10	Zion	*Stabilize 4 foot diameter plunge pool erosion below outfall. If feasible use bioengineering measures, though rip rap and structural measures may be necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
2.28.11	Zion	*Stabilize bank erosion caused by stormwater outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
2.28.12	Zion	Inspect and, if necessary, repair five culverts under trail, which may be crushed and/or failing.	A10, A11, B4	3	3	S	Zion Park District	Zion
3a.0.3	Zion	Preserve approximately 21 acres of wetland and stream corridor open and partially open Category 1 green infrastructure areas and greenways within the headwaters of the 27th St tributary. Target areas are located (1) southwest of 25th St and Galilee, (2) south of Jethro and 26th Street, (3) west of 26th and Lewis, (4) southeast of 26th and Lewis, (5) northwest of 29th and Lewis.	A6, B1, C2, C3, G2, G4	1	3	L	Zion Park District, Zion, Owner	
3a.0.7	Zion	Manage the golf course grounds and detention / water features in Shiloh Park, in the northeast corner of the SMU for water quality and habitat benefits, including installation of a 5 foot riparian buffer along shoreline / banks of water features.	B1, C3, E1, E2, E4, E9, G2, G4	2	1	S	Zion Park District	
3a.0.8	Zion	FPAI site 20-13 experiences local drainage problems due to runoff from the west. Retrofit David Park and the school property west of the problem area with detention or infiltration practices to reduce runoff rate and volume.	B4	2	3	S	Zion	SMC
3a.0.9	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a minimum 5 ft buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2	S-M	HOA	Zion
3a.0.10	Zion	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	

Table 5.10 Site Specific Action Plan for the City of Zion (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.0.11	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	HOA	
3a.0.12	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	E1, E2, E9	2	2	S-M	HOA	
3a.0.13	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; retrofit bottom concrete channel.	E1, E2, E9	2	2	S-M	HOA	
3a.0.14	Zion	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; remove excess debris.	E1, E2, E9	2	1	S-M	HOA	
3a.0.15	Zion	Stabilize / regrade shoreline using bioenginnering practices and native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2	S-M	Zion Park District	Zion
3a.0.16	Zion	Stabilize / regrade shoreline and plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation.	E1, E2, E9	2	2	S-M	Zion Park District	
3a.0.17	Zion	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	1	S-M	Zion Park District	
3a.27.1	Zion	Restore and manage the native riparian buffer plant communities along this reach within Sharon Park by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer may be appropriate in the lower parts of the reach.	A6, A10, B1, C3, E1	2	2	S	Zion Park District	
3a.27.2	Zion	Address High streambank erosion along entire reach using bioengineering stabilization measures, some of which may threaten buried sewer lines.	A1, A3, A8, C3, E1	1	3	M	Zion Park District	
3a.27.3	Zion	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Zion Park District	SMC
3a.27.4	Zion	*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream.*	A1, A3, A8, C3, E1	1	3	M	Zion Park District	
3a.27.5	Zion	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Zion Park District	SMC
3a.27.6	Zion	*Stabilize significant erosion and exposure of manhole and sewer infrastructure using bioengineering stabilization measures and other hardscape solutions to ensure protection of the infrastructure elements. Length difficult to determine from photo; assume 100 lf for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Zion	NSSD?, Zion Park District

Table 5.10 Site Specific Action Plan for the City of Zion (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.27.7	Zion	*Stabilize erosion creating open channel at discharge point using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion	Owner (Bd. Of Edu.)
3a.27.8	Zion	*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 150 lf for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Zion Park District	
3a.27.9	Zion	*Stabilize erosion at outfall that is creating an open channel using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
3a.27.10	Zion	*Stabilize major erosion, headwall, and outfall pipe failure using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	Zion
3a.27.11	Zion	*Stabilize minor channel erosion using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Zion Park District	
3c.22.1	Zion	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	
3c.22.2	Zion	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Zion	SMC

Table 5.11 Site Specific Action Plan for the Village of Beach Park

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.3	Beach Park	Preserve and restore open and partially open green infrastructure bounded by North Ave, York House Road, Sheridan Road, and residential areas to the north (spanning SMUs #1, #3b, and #3c) for natural resource restoration and management and recreation. Preserving two corridors (19 acres) east of Sheridan Road would connect this piece to the larger Illinois Beach State Park system. The area also contains storage area #30 and potential storage area #27, which may help reduce flooding in the area of FPAI 20-02 along Coolidge Ave.	B1, C1, C2, C3, G2, G4	1	3	L	Owner	Beach Park
1.0.8	Beach Park	Monitor IDOT-recorded flooding location at Sheridan and York House Road for further problems.	B4, F7	3	1	S	IDOT	SMC
1.0.9	Beach Park	Monitor IDOT-recorded flooding locations at Sheridan and Beach Road for further problems.	B4, F7	3	1	S	IDOT	SMC
1.0.14	Beach Park	Install filtration and infiltration BMPs for existing commercial properties along Sheridan Road. Cost estimate reflects 10' wide swale improvements (as a proxy for lot level / source control BMPs) along 1500 lf of Sheridan Road frontage.	E1, E2, E7, E9, G1	2	3	S	Beach Park	Owner Developer
1.0.15	Beach Park	Improve any swale and other surface stormwater drainage systems within the developed areas of the western part of this SMU, which is mostly unsewered, and install stormwater filtration and infiltration BMPs. Details reflect 54,000 lf (approximately 12.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of roads within this part of the SMU.	E1, E2, E7, E9, G1	1	3	S	Beach Park	
1.0.23	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.24	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.27	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
2.0.5	Beach Park	Monitor past IDOT-recorded flooding at Sheridan and Wadsworth for further problems and remediate if flooding continues.	B4, F7	3	1	S	IDOT	
3a.25.4	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3a.26.1	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	A6, A10, B1, C3, E1	2	2	S	Owner	
3a.26.2	Beach Park	Restore stream channel and improve instream habitat by installing & enhancing pools and riffles.	A1, A10, C3	3	3	S	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.26.3	Beach Park	*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt and sediment load.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3a.26.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3a.26.5	Beach Park	Remove chain link fence placed across stream channel.	A1, A10, B4	2	1	S	Owner	Beach Park, BPDD
3a.26.6	Beach Park	*Remediate significant erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3a.26.7	Beach Park	Investigate and remediate collapsed pedestrian bridge in the stream channel.	A10, A11	2	2	S	Owner	Beach Park, BPDD
3b.0.2	Beach Park	Consider daylighting and restoring as much of the Wilson Avenue Tributary (not inventoried) as possible through the residential areas. Daylighting and restoration should address concerns about the tank cars and transite pipes that are reported to transmit the flow below ground in this location.	A1, A6, C3, G2	3	3	L	Beach Park	Owner
3b.0.3	Beach Park	Buffer the Wilson Avenue Tributary from encroachment by preserving open Category 2 green infrastructure areas.	B1, C1, C2, C3, G2, G4	1	3	L	Owner	Beach Park
3b.0.5	Beach Park	Restore and manage the wetlands within the open and partially open Category 1 Green Infrastructure areas just north of Lyons Woods Forest Preserve; reconnect these wetlands to the Lyons Woods system.	B1, C1, C2, C3, E1, E2, G2	3	3	L	Owner	SMC
3b.0.8	Beach Park	FPAI site 20-04, in the Village of Beach Park, experiences sewer backup into homes due to an inadequate drainage system. Investigate whether the remedial measure, a large pipe and ditch installed as part of the Monarch Point development to the north, fixed the problem. If not, remedial action should be taken, which may include working with the open areas identified on the SMU map to relieve drainage issues.	B2, B3	2	3	S	Beach Park	SMC
3b.0.9	Beach Park	"FPAI site 20-05, in the Village of Beach Park, experiences road, home, and backyard flooding due to inadequate conveyance capacity of the open ditch and culvert, particularly the culvert under Yorkhouse Road. Remedial action may include retrofit / restoration of open green infrastructure areas to help absorb / store flood water.	B1, B2, B4	2	3	S	Beach Park	SMC

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.0.10	Beach Park	The area where BL13, BL14, and BL15 come together is in need of a stream restoration plan to remediate the buildup of debris, concrete lined channels, underground culverts and railroad tank cars, yard waste in the stream channel, and other impacts from nearby residential areas.	A1, A6, A10, A11, C3, E5, E9, G2	1	3	S	Beach Park SMC Owner	
3b.0.11	Beach Park	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2	S-M	Waukegan Park District	
3b.0.13	Beach Park	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	2	S-M	Owner HOA	
3b.0.14	Beach Park	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	HOA	
3b.0.17	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
3b.0.18	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
3b.0.19	Beach Park	Plant banks with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	E1, E2, E9	2	1	S-M	HOA	
3b.0.20	Beach Park	Convert to wet or wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	2	S-M	HOA	
3b.0.21	Beach Park	Plant banks and a surrounding buffer with native vegetation; remove excess debris.	E1, E2, E9	2	1	S-M	Owner	
3b.12.1	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.*	A1, A10, C3	1	3	S	Owner	Beach Park, BPDD
3b.12.2	Beach Park	*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3b.12.3	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	
3b.12.4	Beach Park	Investigate / inspect failed / broken concrete dam along west of Cheney / North Ave. for impact on stream, and remove impacting dam elements if found be have a negative impact.	A1, A2, A11, C3	3	1	S-L	Owner	Beach Park, BPDD
3b.12.5	Beach Park	*Stabilize typical 1-2 foot erosion on right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.12.6	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3b.12.7	Beach Park	*Stabilize significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3b.12.8	Beach Park	*Remove debris and sediment from culvert under Beach Road.*	A10, A11, C3, E1, E7, E8, F7	1	3	S	Owner	Beach Park, BPDD
3b.12.9	Beach Park	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3b.12.10	Beach Park	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3b.13.1	Beach Park	Manage and restore the wooded ravine along reach BL13. Assumes an area 2500 lf by 150 ft in width for cost estimating purposes.	A6, A7, A10	3	2	S	Owner	Beach Park
3b.13.2	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and removing numerous debris jams according to the American Fisheries Society guidelines.*	A1, A10, C3	1	3	S	Owner	Beach Park, BPDD
3b.13.3	Beach Park	*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3b.13.4	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	Beach Park SMC
3b.13.5	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park SMC
3b.13.6	Beach Park	Inspect footbridges and armored / concrete-lined banks and remediate if found to be negatively impacting the stream.	A1, A10, A11	3	3	S	Owner	Beach Park, BPDD
3b.13.7	Beach Park	*Restore channel reach near Wilson Avenue by installing pool and riffle structures and stabilizing streambanks.*	A1, A6, A9, A10, C3, E5, G2	1	3	M	Owner	Beach Park BPDD
3b.13.8	Beach Park	Remove concrete debris dumping / fill just upstream of Beach Rd culvert from property / operation at Tewes and Beach.	A10, A11, B4	2	2	S	Beach Park	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.13.9	Beach Park	*Remediate significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD
3b.13.10	Beach Park	*Inspect and assess fencing across channel and rock wall armoring and remove if found to impair the conveyance of water.*	A1, A10, A11	1	1	S	Owner	Beach Park BPDD
3b.13.11	Beach Park	*Remove concrete from channel and restore stream channel by stabilizing streambanks and installing habitat features such as pools and riffles and rootwads. Assumes 150 lf of stream channel needs attention for cost estimation purposes.*	A10, A11, A11, B4	1	3	S	Owner	Beach Park BPDD
3b.13.12	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, A11, B4	1	2	S	Owner	Beach Park BPDD
3b.13.13	Beach Park	*Remove debris and sediment from culvert under Beach Road.*	A10, A11, C3, E1, E7, E8, F7	1	3	S	Owner	Beach Park BPDD
3b.13.14	Beach Park	*Address failed concrete wall armoring and major erosion behind the armoring by removing the concrete and using bioengineering stabilization measures. Assumes 100lf of stream channel needs attention for cost estimation purposes.*	A1, A3, A11	1	3	S-M	Owner	Beach Park BPDD
3b.13.15	Beach Park	*Repair or replace broken concrete and corrugated metal pipe culvert and remove debris obstructing flow.*	A1, A3, A11, C3	1	3	S-M	Owner	Beach Park BPDD
3b.13.16	Beach Park	*Stabilize erosion at and below outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park BPDD
3b.13.17	Beach Park	*Repair failed clay outfall pipe and address erosion around outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park BPDD
3b.14.1	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	Beach Park BPDD
3b.14.2	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park BPDD
3b.14.3	Beach Park	*Conduct major channel restoration by removing debris and restoring a natural channel to this concrete-lined drainage ditch.*	A1, A10, A11, C3	1	3	S	Owner	Beach Park BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.15.10	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD
3b.15.11	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD, Waukegan
3b.15.12	Beach Park	*Remove debris at the outfall discharge points.*	A10, A11, B4	1	2	S	Owner	Beach Park BPDD, Waukegan
3b.17.1	Beach Park	Restore stream channel and improve instream habitat by enhancing pools and riffles.	A1, A10, C3	3	3	S	Owner	Beach Park BPDD
3b.17.2	Beach Park	Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD
3b.17.3	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	
3b.17.4	Beach Park	Inspect footbridges and armored / concrete-lined banks along this reach for impacts on the stream corridor and remediate if necessary.	A1, A10, A11, C3	3	3	S	Owner	Beach Park BPDD
3b.17.5	Beach Park	Remove broken concrete slab streambank armoring and restore channel to natural channel condition. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	A1, A10, A11, C3	2	3	S	Owner	Beach Park BPDD
3b.17.6	Beach Park	Restore a minimum 5 foot wide, deep-rooted native plant buffer to the stream edge within the golf course.	A6, C3	2	1	S	Waukegan Park District	
3b.17.7	Beach Park	Remove debris at outfall.	A10, A11, B4	2	2	S	Owner	Beach Park BPDD
3b.17.8	Beach Park	Stabilize significant erosion and bank slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	A1, A3, A7, C3, E1	1	3	M	Owner	Beach Park BPDD
3b.17.9	Beach Park	Remove debris blocking culvert and repair, remediate, and/or stabilize the exposed culvert.	A10, A11, B4	2	3	S-M	Owner	Beach Park BPDD
3b.17.10	Beach Park	Stabilize erosion undermining the culvert, preferably using bioengineering stabilization measures but also using more structural measures if necessary.	A1, A3, A5, A8, A11, C3, E1	2	3	S-M	Waukegan Park District	Beach Park BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.0.9	Beach Park	FPAI site 20-02, in the Village of Beach Park, experiences flooding due to inadequate outlets and poor drainage. There is a backyard drainage ditch between Beach and Howard, Sheridan and Geraghty (depressional storage #49) and extending along Coolidge Rd to the north (depressional storage #50) that are likely part of the cause of flooding. Investigate whether the new storm sewer along Coolidge Avenue has eliminated flooding in this location. If flooding persists, additionial solutions may include improvement of drainage overland flow paths and installation of additional storm sewer capacity to alleviate the problem.	B4, F7	3	1	S	Beach Park	
3c.0.10	Beach Park	Monitor past IDOT-recorded flooding locations at Sheridan and Wadsworth, Sheridan and Talmadge / Michigan, and Sheridan and Beach Rd. to determine whether flooding is still occuring at these sites. If so, develop and implement flood mitigation strategies.	B4, F7	3	1	S		IDOT
3c.0.14	Beach Park	Stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Owner	
3c.0.15	Beach Park	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2	S-M	Owner	
3c.0.16	Beach Park	Retrofit as wet / wetland basin; stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Owner	
3c.0.18	Beach Park	Plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	1	S-M	Owner	
3c.7.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner, Bull Creek Stakeholder Assn.	
3c.7.4	Beach Park	Assess side slope seeps for restoration potential. Restore if possible.	C3	1	3	S	Owner, SMC	
3c.7.5	Beach Park	Remove massive debris jam approximately 300' downstream of Sheridan Road and stabilize channel.	A10, A11, B4	2	3	S	Beach Park, Bull Creek Stakeholder Assn., SMC	
3c.8.1	Beach Park	*Address High streambank erosion along entire reach, some threatening homes and property, using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.8.2	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.8.3	Beach Park	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3c.8.4	Beach Park	*Repair broken cement outfall pipe and stabilize surrounding erosion using bioengineering stabilization measures. Location is approximately 300' upstream of Sheridan Rd.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Beach Park	Beach Park, BPDD
3c.8.5	Beach Park	*Stabilize streambank erosion across from the sewer / manhole stabilization project along the reach near the Garaghty / California intersection. Length of problem is unknown; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD, NSSD, USACE,
3c.8.6	Beach Park	*Stabilize minor channel erosion and downcutting of channel outfall using bioengineering stabilization measures and energy dissipation measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.8.7	Beach Park	*Stabilize major erosion behind headwall and below outfall preferably using bioengineering stabilization measures but may also require more structural measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.8.8	Beach Park	*Stabilize moderate channel erosion and downcutting using bioengineering stabilization measures and, if necessary, check dams.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.8.9	Beach Park	*Address major erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.8.10	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.8.11	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.8.12	Beach Park	*Monitor sewer manhole, which rises 6 feet above stream elevation, for leakage and infiltration problems.*	F7	1	1	S	NSSD	
3c.8.13	Beach Park	*Stabilize major erosion and slumping of ravine bank using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.8.14	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.1	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.*	A1, A10, C3	1	3	S	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.9.2	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.9.3	Beach Park	*Restore the native riparian buffer (manage native riparian plant communities within this reach: control invasive species, plant native species, thin shrub layer to allow more understory growth, and manage vegetation such as through prescribed burning.)*	A6, A10, B1, C3, E1	1	2	S	Owner	
3c.9.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3c.9.5	Beach Park	*Stabilize major erosion with slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.9.6	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.7	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.8	Beach Park	*Remove debris around plastic outfall pipe.*	A10, A11, B4	1	2	S-M	Owner	Beach Park, BPDD
3c.9.9	Beach Park	*Stabilize major erosion on the left bank using bioengineering stabilization measures.*	A1, A10, A11, C3	1	3	M	Owner	Beach Park, BPDD
3c.9.10	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.11	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2	S	Owner	Beach Park, BPDD
3c.9.12	Beach Park	*Stabilize major erosion and slumping of the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1, E5	1	3	M	Owner	Beach Park, BPDD
3c.10.1	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation within this reach.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.10.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.10.3	Beach Park	*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.10.4	Beach Park	*Stabilize erosion around capped outfall pipe using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.11.1	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.11.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	
3c.11.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park
3c.11.4	Beach Park	Remove debris obstructing culverts.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.11.5	Beach Park	Remove debris from outfall channel and assess armoring for impact on stream; if negative impact is found, remove armoring and stabilize with bioengineering approach.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.11.6	Beach Park	*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.11.7	Beach Park	*Repair / remediate erosion below outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.11.8	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.11.9	Beach Park	*Stabilize major erosion occurring behind armoring on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.11.10	Beach Park	*Assess wood armoring / retention wall for stability and feasibility of bioengineered approach to bank stabilization. Assumes 100lf of stream channel, both sides for cost estimation purposes.*	A1, A3, C3	1	3	M	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.19.1	Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.19.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner	
3c.19.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park
3c.19.4	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.19.5	Beach Park	*Stabilize significant erosion and slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.19.6	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams or other grade stabilization measures if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.19.7	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.20.1	Beach Park	Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.	A1, A10, C3	3	3	S	Owner	Beach Park, BPDD
3c.20.2	Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
3c.20.3	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	2	2	S	Owner	
3c.20.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3c.20.5	Beach Park	*Stabilize significant erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD

Table 5.11 Site Specific Action Plan for the Village of Beach Park (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.20.6	Beach Park	*Stabilize significan erosion and attempted stabilization debris around culvert using bioengineering stabilization measures*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.20.7	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
3c.20.8	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.20.9	Beach Park	*Stabilize erosion around culvert using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD
3c.20.10	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park, BPDD
3c.20.11	Beach Park	Repair or remediate cracked concrete armoring at outfall.	A1, A3, A5, A8, A11, C3, E1	2	3	M	Owner	Beach Park, BPDD
3c.24.1	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	Beach Park, BPDD
3c.24.2	Beach Park	Remove debris including tires.	A10, A11, B4	2	2	S	Owner	Beach Park, BPDD
4.0.1	Beach Park	Preserve and restore the ravine within the open Category 1 green infrastructure area between Ganster Road and Sheridan Road, just east of Lyons Woods Forest Preserve.	B1, C1, C2, C3, G2, G4	1	3	L	Owner	Beach Park
4.0.6	Beach Park	Expand / enlarge detention basins #28, #75, and #76 to reduce IDOT-recorded flooding locations along Sheridan Road north of Blanchard.	B4, F7	2	1	S	DOT	
4.0.9	Beach Park	Inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrients by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2	S-M	FPD	
4.05.3	Beach Park	Remove debris / bricks in channel.	A10, A11, B4	2	3	S	Owner	Beach Park, BPDD
4.05.4	Beach Park	*Stabilize bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	2	M	Owner	Beach Park, BPDD

Table 5.12 Site Specific Action Plan for the City of Waukegan

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.7	Waukegan	Preserve and restore the green infrastructure areas in the southwest corner of the SMU, east of the Union Pacific rails and west of industrial land uses (Midwest Generation, North Shore Sanitary District, and Outboard Marine Corporation). This area has been identified by the City of Waukegan for restoration as the 'Waukegan Moorlands'.	B1, C1, C2, C3, G2, G4	1	3	S	Waukegan	Owner
1.0.10	Waukegan	Investigate the wetlands adjacent to the Johns Manville lagoons for restoration and remediation potential and as a possible water quality improvement facility for water runoff from nearby industrial sites. Cost reflects standard wetland restoration and management rather than clean up and remediation.	B1, C3, C5, E1, E2, G4	3	3	S	IDNR	
1.1.1	Waukegan	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2	S	Owner, Utility, C&NW RR	Waukegan
1.1.3	Waukegan	*Restore stream channel and instream habitat by reducing / remediating channelization, possibly through a remeandering and other restoration projects such as installing boulders, large rocks, and / or rootwads.*	A1, A10, C3	1	3	S	Owner/ Utility	Waukegan
1.1.5	Waukegan	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	A10, A11, C3, E1, E7, E8, F7	3	3	S	C&NW RR	SMC
1.1.6	Waukegan	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	A10, A11, C3, E1, E7, E8, F7	3	3	S	C&NW RR	SMC
3b.0.12	Waukegan	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	Owner	
3b.0.15	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
3b.0.16	Waukegan	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	HOA	
3b.16.5	Waukegan	*Stabilize the eroding, 4 foot deep cut channel within the turf grass landscape at the upstream end of BL16, just downstream of the Beach Rd. culvert.*	A1, A3, A6, C3, G2	1	3	S	Owner	
3b.16.6	Waukegan	*Repair or replace the steel Beach Road culvert that is eroding around the edges and beneath, possibly due in part to the additional plastic drain pipe.*	A3, A11	1	3	S-M	Waukegan	
3c.0.3	Waukegan	For Waukegan Airport property, implement the spill prevention and response plan and reduce the use of salt and/or deicers. Install filtration and infiltration BMPs to capture and treat runoff from airport landscapes, particularly impervious surfaces such as runways and fueling areas, before being discharged to the stream system of Bull Creek.	E1, E2, E5, E10	2	3	S	Waukegan Port District	

Table 5.12 Site Specific Action Plan for the City of Waukegan (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.0.17	Waukegan	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Owner	
4.0.5	Waukegan	Improve swale and other surface stormwater drainage systems within the developed areas of the SMU, particularly those residential areas off Miraflores and Montesano, with lot level stormwater filtration and infiltration BMPs. Details reflect 28,000 lf (approximately 6.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	E1, E2, E7, E9, G1	1	3	S	Waukegan, Owner	
4.0.7	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
4.0.8	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
4.05.5	Waukegan	*Stabilize and strengthen the incised discharge channel.*	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Waukegan
5.0.1	Waukegan	Preserve the ravine within the 7-acre open Category 1 green infrastructure area between Circle Court and the Amstutz Expressway.	A6, B1, C2, C3, G2, G4	1	3	L	Owner/ Utility	
5.0.2	Waukegan	Preserve and restore wetland complexes where these resource remain, including those along the entire length of reach BL04 and those adjacent to Lake County Gardens (depressional storage areas #22 and #23). Wetland / depressional area #23, bordered by Pine, Lorraine, Wilson, and the McClory Bike Trail, contains some elements of a decent quality wetland indicative of good restoration potential. Two additional potential restoration areas are the small park between Butrick and Yeoman and the upstream drainage corridor north of and paralleling Rice St.	A6, B1, C2, C3, G2, G4	1	3	S-L	Waukegan, Owner, Utility	
5.0.3	Waukegan	Preserve the wetlands / stream corridor within Category 1 and 2 open green infrastructure areas between Rice and MacArthur, west of Lewis Avenue, and the area between Pine, Wilson, and the McClory bike path.	A6, B1, C2, C3, G2, G4	1	3	L		
5.0.4	Waukegan	*Install filtration BMPs for commercial and institutional uses along Greenwood Avenue and at the York House Rd / Lewis Ave intersection to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S43, and S73. Details reflect 10,000 lf (approximately 2.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontage.*	E1, E2, E7, E9, G1	1	3	S	Waukegan, Owner	
5.0.5	Waukegan	*Install lot level filtration and infiltration BMPs, to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S39, S43, and S73. Details reflect 228,000 lf (approximately 52 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	E1, E2, E7, E9, G1	1	3	S	Waukegan	

Table 5.12 Site Specific Action Plan for the City of Waukegan (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
5.0.6	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Golf Course	
5.0.7	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2	S-M	Golf Course	
5.0.8	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Golf Course	
5.0.9	Waukegan	Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation.	E1, E2, E9	2	2	S-M	Waukegan, Owner	
5.0.10	Waukegan	*Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and address turbidity / sedimentation by naturalizing the basin. This may reduce pollutant loading within potential pollutant loading hotspot S39.*	E1, E2, E9	2	2	S-M	Owner	
5.0.11	Waukegan	*Inventory detention basin and identify resolutions to any noted functional problems.his may reduce pollutant loading within potential pollutant loading hotspot S14.*	-	3	1	S-M	SMC	
5.2.1	Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. Restoration and management of Bowen Park and the residential areas along Miraflores is important to enhance the habitat quality of this reach.	A6, A10, B1, C3, E1	2	2	S	State of IL/ Waukegan Park District, Owner, Utility	
5.2.2	Waukegan	Reduce impacts of surrounding golf course and park property such as landscape waste dumping, turf grass stream edges. Filter and infiltrate runoff from parking lots, such as those within Bowen Park, with BMPs. Details reflect installation of lot level BMPs.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1	S	State of IL/ Waukegan Park District, Owner	
5.2.3	Waukegan	Reduce impacts of residential homes along Miraflores: cease yard waste dumping, replace mown turf grass to the edge of the stream with a minimum 10 foot native vegetation buffer, infiltrate runoff discharge from roof or footing drains with rain gardens or rain barrels, and naturalize the stream channel by replacing poured concrete and rip rap with bioengineering stabilization measures.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1	S	Owner	
5.2.4	Waukegan	Gully erosion occurring in the ravines of Bowen Park should be remediated through ravine woodland restoration and management along reach BL02. Assumes 4000 lf of stream reach by 500' width. Costs reflect woodland restoration; load reduction reflects Moderate erosion stabilization.	A6, A10	1	2	S	State of IL/ Waukegan Park District, Owner	

Table 5.12 Site Specific Action Plan for the City of Waukegan (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
5.2.5	Waukegan	Stabilize erosion around the Sheridan Road culvert and replace the broken stormsewer that is discharging to the opposite streambank.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Waukegan	
5.2.6	Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Waukegan	Waukegan Park District, SMC, Owner
5.2.7	Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2	S	Waukegan	Waukegan Park District, SMC
5.2.8	Waukegan	Stabilize typical 2-4 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.	A1, A3, A8, C3, E1	2	3	M		Waukegan Park District, SMC
5.2.9	Waukegan	Stabilize minor erosion of open discharge channel using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	3	3	S-M	Waukegan Park District	
5.2.10	Waukegan	Stabilize significant erosion below outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Waukegan, Waukegan Park District	
5.2.11	Waukegan	Stabilize minor channel erosion below concrete lined channel outfall. Consider removing concrete and stabilizing channel with more habitat-appropriate measures.	A1, A3, A5, A8, A11, C3, E1	3	3	S-M	Waukegan	
5.2.12	Waukegan	Install energy dissipation measures to address the eroding plunge pool created by discharge from the elevated outfall.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Waukegan	
5.3.1	Waukegan	*Restore a 5 foot wide native riparian buffer and replace turf grass lawn edges to native riparian plant communities as is feasible within the golf course.*	A6, A10, B1, C3, E1	1	2	S	Owner	
5.3.2	Waukegan	Glen Flora Country Club: replace or remediate online detention, armored dams and wiers with more habitat appropriate structures that allow fish passage.	A1, A2	3	3	L	Owner	
5.3.3	Waukegan	*Stabilize erosion undercutting the concrete-lined channel outfall / dam; if feasible, remove concrete and replace with bioengineered channel stabilization measure.*	A1, A2, A3, A5, A10, A11	1	3	S-M	Owner	
5.4.1	Waukegan	Restore stream channel and improve instream habitat by reducing channelization, such as through a remeandering project.	A1, A10, C3	3	3	S	Waukegan, Lake County DOT	
5.4.2	Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.	A4, A10, B1, C3, E1	1	2	S	Waukegan, Lake County DOT	

Table 5.12 Site Specific Action Plan for the City of Waukegan (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
5.4.3	Waukegan	Implement the mitigation planfor FPAI site 20-06, in the City of Waukegan, Lake County Gardens subdivision. There also may be opportunities to increase the detention and/or drainage capacity of the drainage system in this area, particularly within the community park to the north. However, improvement of the wetlands to increase their storage capacity may also be an option.	B1, B2, B3. B4	2	3	S	Waukegan	
5.4.4	Waukegan	Restore the upper end of this reach, a fairly undefined channel that is choked with cattails, through invasive species removal and management.	A1, A6, C3	3	2	S	Waukegan, Owner	
6.0.1	Waukegan	*Manage and restore the wooded ravine, wetland, and depressional area #3 that lies between the Amstutz and Sheridan Road for storage. Load reduction details reflect impact of restored wetland.*	A6, A7, A10, G4	1	3	S	Owner	Waukegan
6.0.3	Waukegan	Open and partially open Category 1 green infrastructure areas between the waste water treatment plant and the Union Pacific tracks should be restored and integrated into the planned Waukegan Moorlands area to the north. Details reflect natural area restoration.	C2, C3	1	3	L	Waukegan, Owner	
6.0.4	Waukegan	*Install filtration BMPs for commercial, industrial, and institutional uses in the eastern and southwestern portions of the SMU to help improve water quality in potential pollutant loading hotspot S10, S11, and S75. Details reflect approximately 15,000 lf (approximately 3.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontages of these land uses.*	E1, E2, E7, E9, G1	1	3	S	Waukegan	Owner
6.0.5	Waukegan	*This SMU is primarily sewerd but undetained. Install source controls and lot level filtration and infiltration BMPs, including detention basin improvements, which may help address pollutant loading in potential pollutant loading hotspot S10, S11, and S75. Details reflect 96,000 lf (approximately 22 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	E1, E2, E7, E9, G1	1	3	S	Waukegan, Owner	

Table 5.13 Site Specific Action Plan for the Illinois Department of Natural Resources

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.2	IDNR	Develop and implement habitat restoration and management plans for Illinois Beach State Park, including all wetlands, waterways, beach ridge, dune and swale systems, and T&E species habitat.	A8, C3, C4, C5, C6, E1, E7, G4	1	3	S	IDNR	-
1.0.5	IDNR	Restore hydrologic connectivity of Dead River to Lake Michigan and remove those created to carry wastewater to the lake. Assumes that 4 hydrologic connections need to be restored or removed.	C3, C6, G4	3	3	S	IDNR	
1.0.16	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.17	IDNR	Stabilize / regrade shoreline using bioenginnering practices and address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2	S-M	IDNR	
1.0.18	IDNR	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	IDNR	
1.0.19	IDNR	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	IDNR	
1.0.20	IDNR	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1	S-M	IDNR	
1.0.21	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.22	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.25	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	
1.0.26	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1	S-M	SMC	

Table 5.14 Site Specific Action Plan for Lake County

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.0.6	Lake County	Depressional storage area #78, within the Thunderhawk Golf Club Forest Preserve, may be able to be expanded to provide additional storage if needed, and may also be retrofitted / restored to improve runoff quality from the golf course, provided that runoff can be directed into this area, treated, and then discharged to a receiving water body. Costs reflect restoration of this wet / hydric area.	B1, C1, C2, C3, E1, E2, E4, E9, G2, G4	2	3	S-L	FPD	
3a.0.18	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2	S-M	FPD	
3c.0.11	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2	S-M	FPD	
3c.0.12	Lake County	Stabilize / regrade shoreline using bioenginnering practices.	E1, E2, E9	2	2	S-M	FPD	
3c.0.13	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2	S-M	FPD	
3c.23.1	Lake County	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	FPD	
4.0.3	Lake County	Manage and restore the natural resources, including ADID wetland #1831, in the northeastern corner of Lyons Woods Forest Preserve. The southern portion of depressional storage area #28 is within the Forest Preserve boundary and may be used to relieve past IDOT-recorded flooding at Sheridan and York House Road. ADID wetland is approximately 46 acres (4000' by 500' wide) and the total area of Lyons Woods is 264 acres.	B1, C3, E1, E7, G2, G4	2	3	S-L	FPD	

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
1.0.4	Waukegan, IDNR, Lake County	Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park.	C3, C5, F1, F6	1	3	S	Owner IDNR EPA	Waukegan
1.0.6	Beach Park, Waukegan	Preserve Category 1 open green infrastructure areas including a portion of depressional storage area #17 and the utility corridor that can serve as a green infrastructure connector between Illinois Beach State Park to Lyons Woods Forest Preserve.	A7, B1, C1, C2, C3, G2	1	3	L	Owner/ Utility	LCFPD IDNR
1.0.11	Zion, Waukegan, IDNR	Manage the Lake Michigan shoreline and beaches to minimize beach erosion. Details reflect 28000 lf of shoreline at an average width of 150 feet.	C3, C4, C5, E1, E6	3	3	S	Zion, Waukegan, IDNR	
1.0.12	Zion, Waukegan, IDNR	Manage the Lake Michigan shoreline and beaches to minimize E. coli contamination that leads to beach closures. Details reflect 28000 lf of shoreline at an average width of 150 feet.	C3, C4, C5, E1, E6	3	3	S	LCHD	Zion, Waukegan, IDNR
1.0.13	Zion, Beach Park, Waukegan, IDNR	Install drainage swale improvements or other lot level / source control BMPs to capture and treat runoff from commercial and industrial land uses within Critical Subbasins #15, #74, and #76, identified as potential Pollution Hot Spot Critical Areas. Cost estimate reflects the installation of swales (10' wide) or other treatment measures along perimeter of these land uses, approximately 35,000 lf of treatment area.	E1, E2, E7, E9, G1	1	3	S	Waukegan, Zion	Utility
1.1.2	Waukegan, IDNR, Lake County	Restore the natural connection and habitat quality of this reach to Lake Michigan by removing the lagoons through which the reach runs and disconnecting the reach from the Dead River to the north. Since these lagoons may be a component of a remedation or clean up plan, this should be considered a long term recommendation to be implemented when the contamination issues at Johns Manville have been adequately remediated. Details reflect major channel restoration.	A1, A6, A8, C3, C5, C6, E7, G2, G4	1	3	S-L	Owner	IDNR EPA Waukegan
1.1.4	Waukegan, Lake County	Address potential hazardous / toxic runoff from industrial uses to the east through filter strips and other filtration and infiltration techniques installed between the reach and these land uses, or by containing and remediating runoff on site through other means. Cost estimate reflects the installation of 2000 lf of 20' wide infiltration and filtration BMPs.	E1, E2, E7, E9, G1	2	3	S	Owner EPA	
1.6.1	Beach Park, Lake County	Restore stream channel and improve instream habitat by installing pools and riffles and installing boulders, large rocks, and / or rootwads.	A1, A10, C3	3	3	S	FPD Owner	Beach Park, BPDD
1.6.2	Beach Park, Lake County	Restore native riparian buffer by controlling invasive species, planting native species, thinning forest and shrub canopy, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	FPD Owner	Beach Park, BPDD

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
2.0.1	Zionion Beach Park	Category 1 and 2 green infrastructure areas along the western boundary of Illinois Beach State Park and bordering the Union Pacific rails to the west should be preserved as components of the green infrastructure / greenway system that includes Ophir Park, Carmel Park, and Illinois Beach State Park. These areas contain significant low lying depressional storage areas (#55, #56, and #57) that could be used for water quality improvement, wetland / hydric soil complexes, and steep slopes that are unsuitable for development.	A6, A7, B1, C1, C2, C3, G2, G4	1	3	L	Owner, IDNR, Zion Park District	
2.0.2	Zion, Beach Park	Convert the depressional storage complex of #55, #56, and #57 to improve water quality for Critical Subbasin #2, identified as a potential Pollutant Loading Hotspot. Assumes runoff can be directed into this area, treated, and discharged to the Illinois Beach State Park stream and wetland system. Estimated area to be converted is 7000lf by 400ft wide.	B1, C1, C2, C3, E1, E2, G2, G4	1	3	L	Owner, IDNR, Zion Park District	
2.0.4	Zion, Beach Park	Reduce pollutant loading to Critical Subbasin #2, a potential pollutant loading hotspot, by improving swales and other surface stormwater drainage systems and installing stormwater filtration and infiltration BMPs to capture and treat runoff from parking lots, utilities, rooftops, storage areas, and other areas that may contribute pollutants to the stream. Cost estimate assumes 130,000 lf (approximately 30 acres) of 10 foot wide drainage swale improvements as a proxy for on-site source control BMPs.	E1, E2, E7, E9, G1	1	3	S	Beach Park, Zion	
3a.0.1	Zion, Beach Park	Manage and restore the wooded ravine along reaches BL25, BL26, and BL27. Average 5000' x 250' wide.	A6, A7, A10	3	2	M	Owner	Beach Park, Zion
3a.0.2	Zion, Beach Park	Preserve and restore wetlands along drainage channel upstream of the McClory Bike Path and the complex northwest of Lewis and 29th St., wetland #4 east of Lewis Avenue, and wetland #3 in Hermon Park (56 acres total). Regional storage area #77 and the associated wetlands (9 acres) could be restored and / or used to provide storage for this SMU if needed when the upstream area develops. Implementation details reflect wetland / hydric soils preservation and restoration.	A6, B1, C2, C3, G2, G4	1	3	S-L	Zion Park District, Owner	Beach Park, Zion
3a.0.4	Zion, Beach Park	Preserve and restore T&E habitat within the area bounded by Lebanon St., the McClory Bike Path, and 31st St.	A1, A10, C3	3	2	S	Zion Park District, IDNR	

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3a.0.5	Zion, Beach Park	Improve any swale and other surface stormwater drainage systems and/or install source controls and lot level stormwater filtration and infiltration BMPs within the developed areas of the SMU. These practices may help reduce pollutant loading in potential pollution hotspot subasins S1, S3, S4, and S48. In order to generate cost and pollutant load reduction estimates, road swales are used as a proxy for individual site BMPs. Details reflect 252,000 lf (approximately 58 acre) of 10 foot wide drainage swale improvements on both side of all roads.	E1, E2, E7, E9, G1	1	3	S	Beach Park, Zion	Owner Developer
3a.25.1	Zion, Beach Park	Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD, Zion
3a.25.2	Zion, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	A6, A7, A10, B1, C3, E1	2	2	S	Owner	
3a.25.3	Zion, Beach Park	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1	S	Owner	
3a.25.5	Zion, Beach Park	Inspect hydraulic structure for possible erosion problems and stabilize using bioengineering practices if needed.	A1, A3, A5, A8, A11, C3, E1	3	1	S	Owner	Beach Park, BPDD, Zion
3a.27st.1	Zion, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Zion Park District	
3b.0.1	Beach Park, Waukegan	Preserve and restore wetlands where these resource remain along drainage channel BL15, BL16, BL17, and along the daylit portions of the Wilson Avenue Tributary. Area is 10,000 lf by 300' wide.	A6, B1, C2, C3, G2, G4	1	3	S	Beach Park Waukegan	Owner
3b.0.4	Beach Park, Waukegan	Preserve greenway easements on Category 1 and 2 green infrastructure areas along BL16, which may help reduce pollution loading in potential pollution hotspot S57. Cost estimate assumes easements of 2000 lf by 100 ft wide (4.5 acres).	B1, C1, C2, C3, G2, G4	1	3	L	Owner	Beach Park Waukegan

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.0.6	Beach Park, Waukegan	Depressional storage areas #32 and #43, currently undeveloped and containing current or former wetlands, could be enhanced to improve water quality of runoff from surrounding residential uses within this Critical Subbasin #57, identified as a potential pollutant loading hotspot. Depressional area #43 lies in an open Category 1 green infrastructure area that could be preserved for water quality improvement. Details reflect restoration and enhancement of both areas as wetlands.	B1, C1, C2, C3, E1, E2, G2	1	3	L	Owner	
3b.0.7	Beach Park, Waukegan	Improve swales and other surface stormwater drainage systems and install source controls and lot level BMPs, including detention basin improvements, within the developed areas of potential pollutant loadin hotspots S57, S59, and S63. Details reflect 165,000 lf (approximately acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	E1, E2, E7, E9, G1	1	3	S	Beach Park Waukegan	
3b.15.1	Beach Park, Waukegan	Restore stream channel and improve instream habitat by enhancing pools and riffles.	A1, A10, C3	3	3	S	Owner	Beach Park BPDD, Waukegan
3b.15.2	Beach Park, Waukegan	Address High streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD, Waukegan
3b.15.3	Beach Park, Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2	S	Owner	
3b.15.4	Beach Park, Waukegan	Inspect footbridges and armored / concrete-lined banks for impacts on the stream corridor and remediated if necessary.	A1, A10, A11, C3	3	3	S	Owner	Beach Park BPDD, Waukegan
3b.15.5	Beach Park, Waukegan	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	Beach Park BPDD, Waukegan
3b.15.6	Beach Park, Waukegan	Inspect and, if necessary, repair the culvert under the McClory Bike Trail, which is partially collapsed.	A11	2	3	S	LCDOT	
3b.15.7	Beach Park, Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	1	2	S	Owner	Beach Park BPDD, Waukegan
3b.15.8	Beach Park, Waukegan	Stabilize typical 4-6 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD, Waukegan

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.15.9	Beach Park, Waukegan	Stabilize erosion of the Beach Road steel culvert experiencing erosion around and underneath using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Beach Park Waukegan	Beach Park BPDD, Waukegan
3b.15.13	Beach Park, Waukegan	Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD, Waukegan
3b.15.14	Beach Park, Waukegan	Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD, Waukegan
3b.15.15	Beach Park, Waukegan	Stabilize erosion around clay drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park BPDD, Waukegan
3b.16.1	Beach Park, Waukegan	Restore stream channel and improve instream habitat by enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.	A1, A10, C3	1	3	S	Owner	Beach Park BPDD, Waukegan
3b.16.2	Beach Park, Waukegan	Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park BPDD, Waukegan
3b.16.3	Beach Park, Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	1	2	S	Owner	
3b.16.4	Beach Park, Waukegan	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1	S	Owner	
3b.15.16	Beach Park, Waukegan	Stabilize erosion around two plastic drain pipe outfalls using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park BPDD
3b.15.17	Beach Park, Waukegan	Stabilize erosion around concrete drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Beach Park Waukegan	Beach Park BPDD
3b.18.1	Beach Park, Waukegan	BL18 flows through and near several publicly owned, open and partially open areas on or adjacent to the Waukegan Regional Airport property sourthwest of the Wadsworth Rd / Lewis Ave intersection. These areas include depressional storage area #34, which could be expanded and enhanced for stormwater storage and to capture and cleanse water runoff from airport property, which lies in Critical Subbasin #69, a potential pollutant loading hotspot.	B1, C1, C2, C3, E1, E2, G2	1	3	L	Waukegan Port District	

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3b.18.2	Beach Park, Waukegan	Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Waukegan Port District, Owner	Beach Park BPDD, Waukegan
3b.18.3	Beach Park, Waukegan	The culvert draining Waukegan Airport is covered with wire fencing, presumably for security or to prevent animal invasion. However, investigate source and necessity, and remove if fencing impedes flow. It appears that strong flows exit the Airport property in this location.	A10, A11	3	1	S	Waukegan Port District	
3c.0.2	Beach Park, Zion	Manage and restore the wooded ravine along reaches BL07, BL08, BL09, BL10, BL11, BL19, BL20, BL21. Assumes 18,600 lf of stream by average 250' wide.	A6, A7, A10	1	2	S	Owner	Beach Park, Zion
3c.0.4	Beach Park, Zion	Preserve and restore wetlands along drainage channels BL21, BL22, BL23, BL24. Assumes 10,300 lf by 350' wide.	A6, B1, C2, C3, G2, G4	1	3	S	Owner	Beach Park, Zion
3c.0.5	Beach Park, Zion	Preserve Category 1 green infrastructure area bounded by the McClory Bike Path, Clover, Wadsworth, and 34th St. that borders the stream channel to the north. Also preserve three separate areas through which the stream corridor runs: one along BL07 within the ravine, the second at the confluence of BL08, BL09, and BL19, and the third just upstream of this confluence along BL09.	A6, B1, C2, C3, G2, G4	1	3	S-L	Owner	Beach Park, Zion
3c.0.6	Beach Park, Zion, Waukegan	Install filtration BMPs for commercial, industrial, and institutional uses along Sheridan Road, Wadsworth, and Lewis Avenue, which will help reduce pollutant loading in potential pollution hotspot subbasin #64. Details reflect 12,000 lf of road frontage along these uses to be treated with improved, 10' swales (approximately 2.75 acres.)	E1, E2, E7, E9, G1	1	3	S	Beach Park, Waukegan, Zion, Owner	
3c.0.7	Beach Park, Zion, Waukegan	Install lot level filtration and infiltration BMPs within potential pollution hotspot subbasin #64. Details reflect 208,000 lf (approximately 48 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	E1, E2, E7, E9, G1	1	3	S	Beach Park, Waukegan, Zion	
3c.0.8	Beach Park, IDNR	Preserve the Category 1 open green infrastructure area that contains depressional storage area #45 along the west side of the Union Pacific rails.	B1, C2, G2	1	3	L	Beach Park	
3c.7.1	Beach Park, IDNR	Stabilize High streambank erosion along approximately 25% of this reach not included in the previous stabilization project, some threatening homes and property, using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner, Beach Park	
3c.7.2	Beach Park, IDNR	Manage native riparian plant communities within this reach: control invasive species, plant native species, and manage vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	1	2	S	Bull Creek Stakeholder Assn.	
3c.21.1	Beach Park, Zion	Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD, Zion

Table 5.15 Site Specific Action Plan for Mulitple Jurisdictions (continued)

ID# (SMU.REACH.ID)	JURISDICTION	RECOMMENDATION DESCRIPTION (THOSE ADDRESSING CRITICAL AREAS IN ITALICS)	GOAL-OBJ	PRIORITY	EASE OF IMPLEMENTATION	TIME FRAME	LEAD IMPLEMENTATION RESPONSIBILITY	SUPPORTING IMPLEMENTATION RESPONSIBILITY
3c.21.2	Beach Park, Zion	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	1	2	S	Owner	Beach Park, BPDD, Zion
3c.21.3	Beach Park, Zion	Repair the discharge point / failed headwall approximately 200' upstream of the McClory Bike Path.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD, Zion
3c.21.4	Beach Park, Zion	Stabilize channel erosion at outfall, and consider replacing rip rap control measure with bioengineering stabilization practices.	A1, A3, A5, A8, A11, C3, E1	1	3	S-M	Owner	Beach Park, BPDD, Zion
3c.21.5	Beach Park, Zion	Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park, BPDD, Zion
3c.21.6	Beach Park, Zion	Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	1	S-M	Owner	Beach Park, BPDD, Zion
4.0.2	Waukegan, Beach Park	Manage and restore the woodland ravine along reach BL05. Assumes 5000' by 500' area for cost estimation purposes.	A6, A7, A10	1	2	S	Owner	Beach Park Waukegan
4.0.4	Waukegan, Beach Park	Preserve and restore the wetland complex within the open, Category 1 green infrastructure area along the eastern boundary of SMU 4 west of the Union Pacific rail line. This area creates a physical land connection between Lyons Woods and Illinois Beach State Park, and would also preserve regional storage area #17.	B1, C1, C2, C3, G2, G4	1	3	S-L	Owner/ Utility	
4.05.1	Waukegan, Beach Park	Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation.	A1, A3, A8, C3, E1	1	3	M	Owner	Beach Park, BPDD
4.05.2	Waukegan, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	1	2	S	Owner	
6.0.2	Waukegan, IDNR, Lake County	Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park. This may help address potential pollutant loading hotspot S75	C3, C5, F1, F6, G4	1	3	S-L	Waukegan, IDNR, EPA	

5 prioritized action plan

Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- 10 Critical Region
- 52 Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- 152 Critical Subbasins
- KC1 Stream Reach
- KC1 Critical Stream Reach
- 1.0.1 Action Recommendations
- 2 Subwatershed Management Unit
- 20-07 FPAI Site

This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
Lake County Stormwater Management Commission
September, 2007

DATA SOURCES:
Lake County Stormwater Management
Lake County Department of Information And Technology, GIS & Mapping Division

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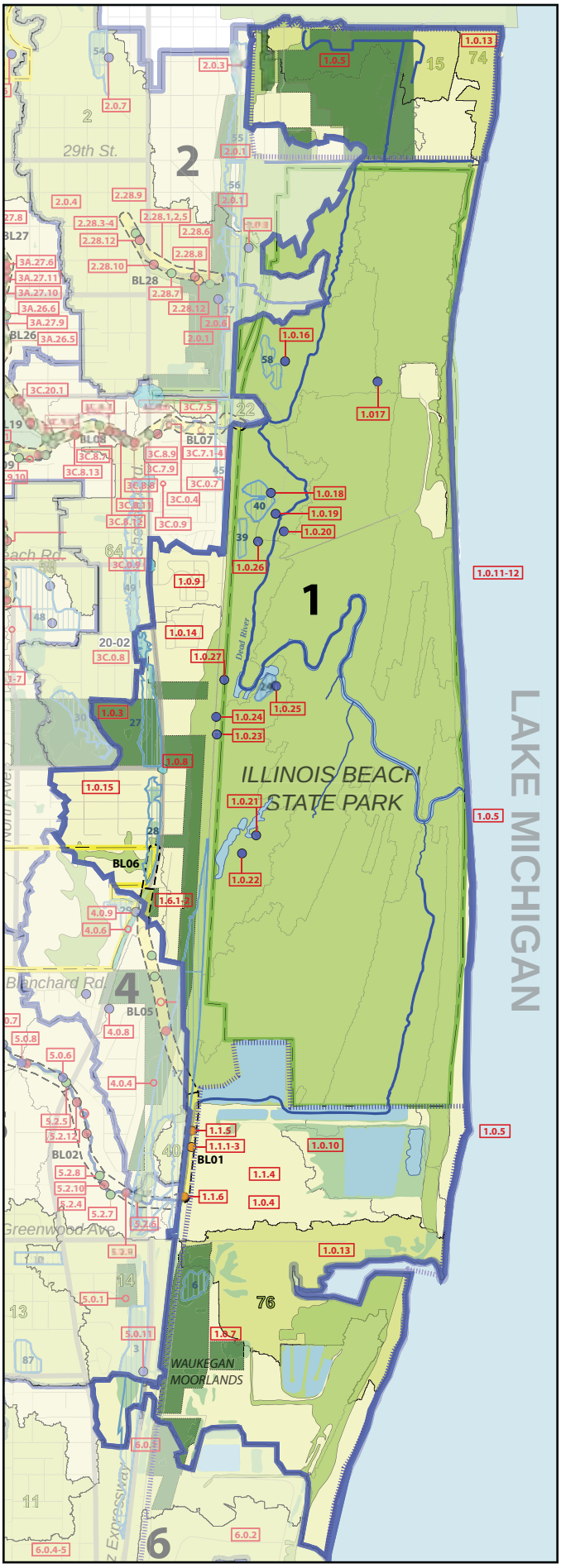
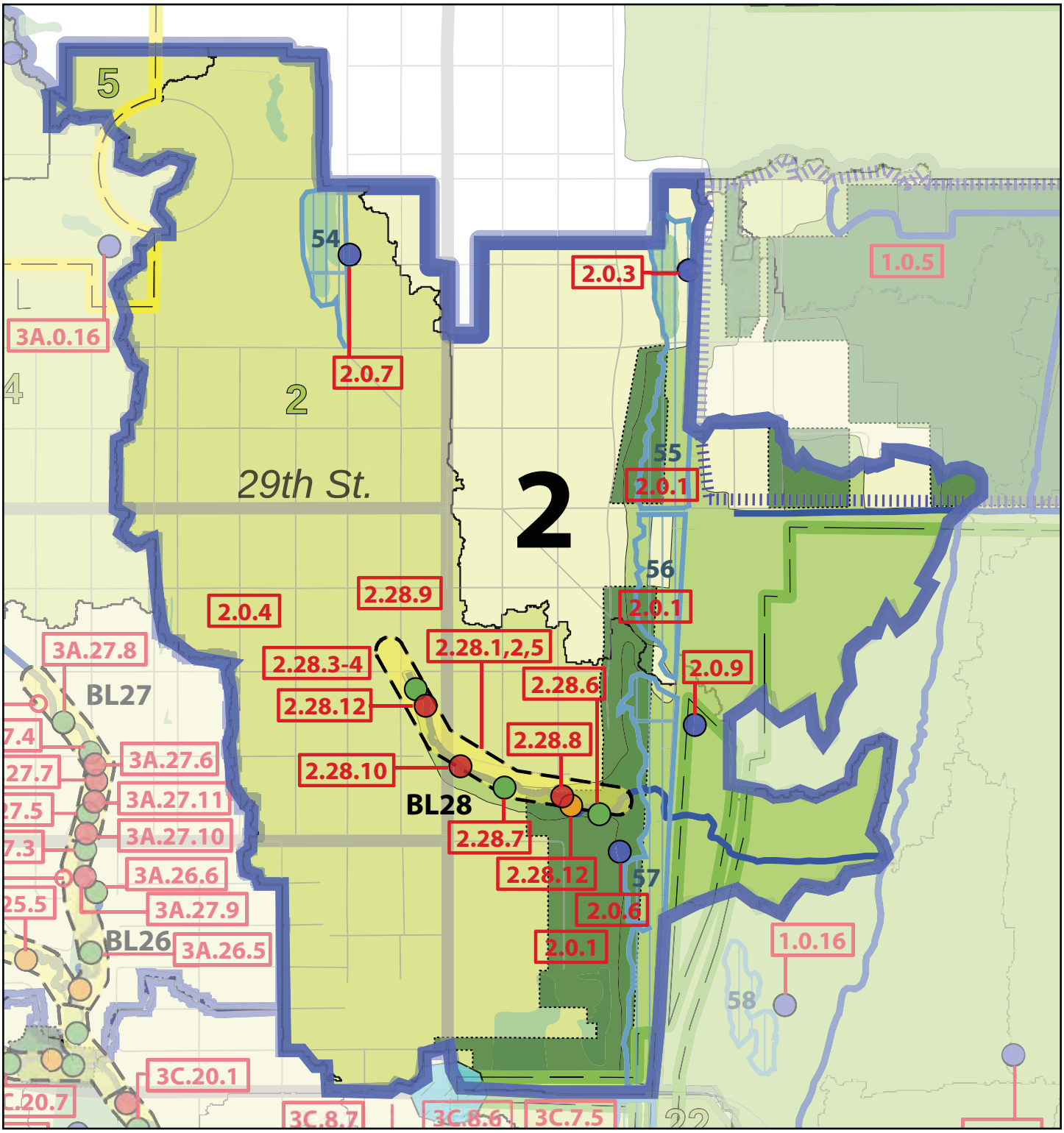


FIGURE 5.2 SUBWATERSHED MANAGEMENT UNIT 1



Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins
- Stream Reach
- Critical Stream Reach
- Action Recommendations
- Subwatershed Management Unit
- FPAI Site

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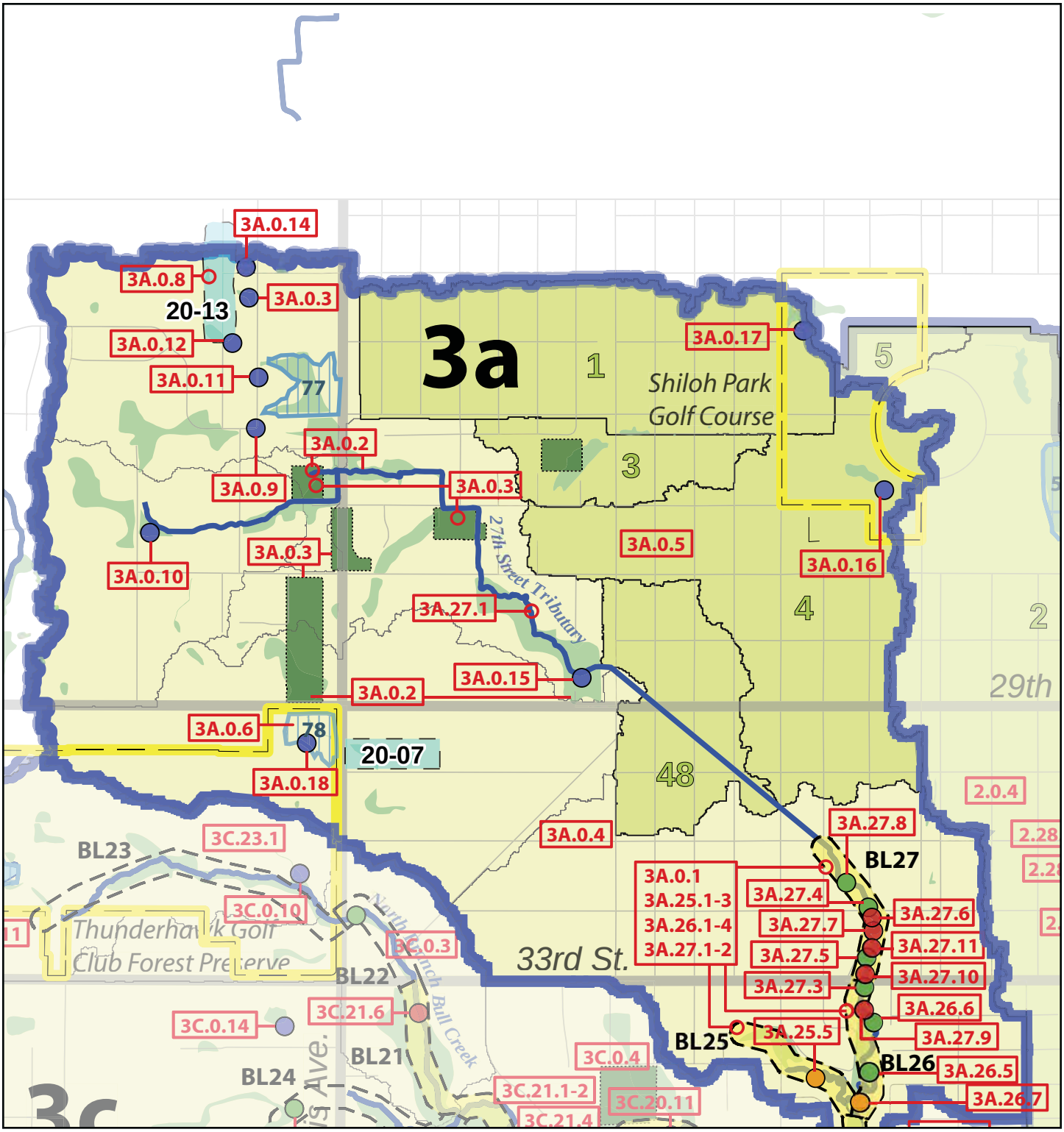
Lake County Stormwater Management Commission
September, 2007

DATA SOURCES:
Lake County Stormwater Management
Lake County Department of Information And Technology, GIS & Mapping Division

FIGURE 5.3 SUBWATERSHED MANAGEMENT UNIT 2



Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins
- Stream Reach
- Critical Stream Reach
- Action Recommendations
- Subwatershed Management Unit
- FPAI Site

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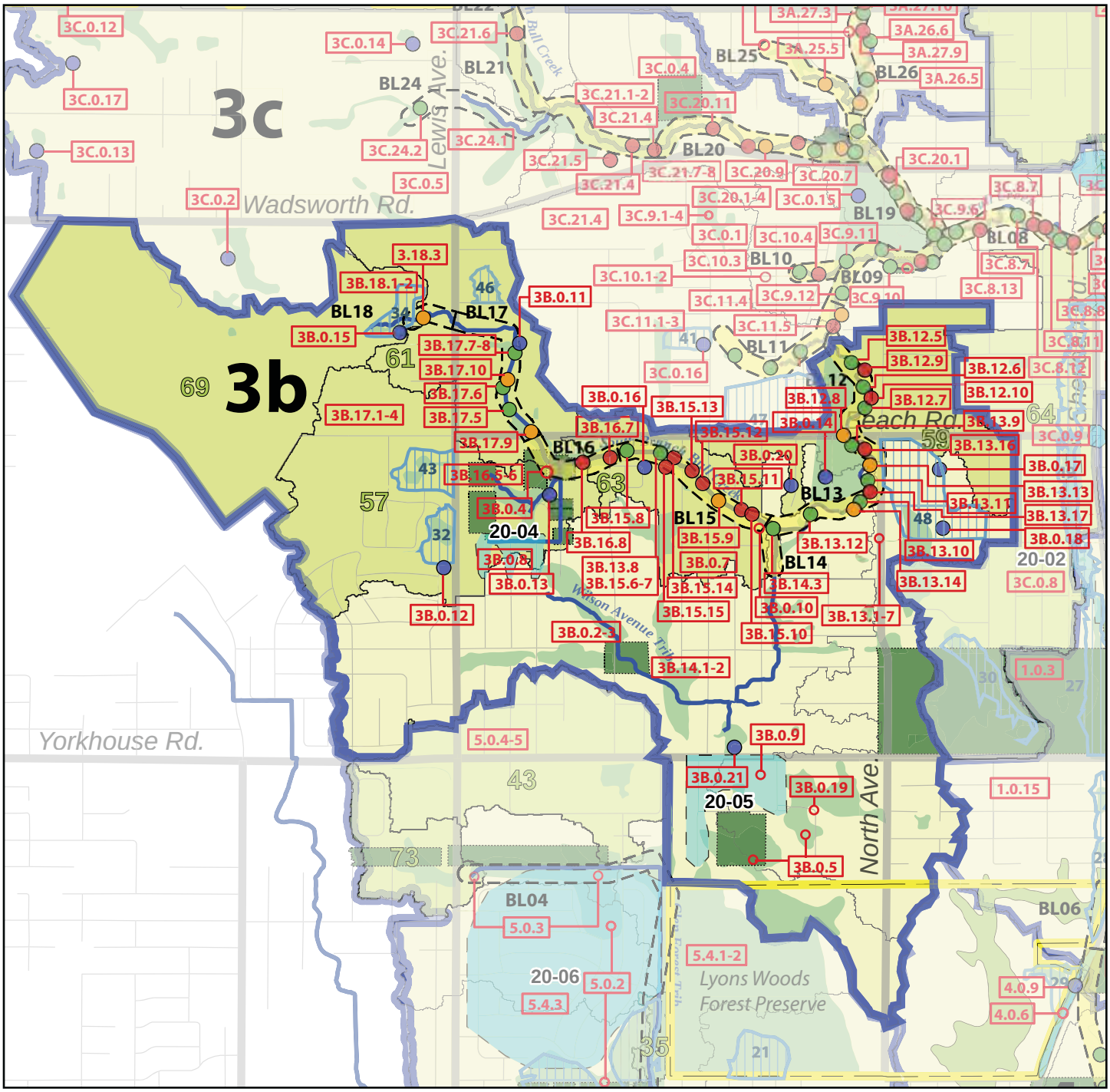
Lake County Stormwater Management Commission
September, 2007

DATA SOURCES:
Lake County Stormwater Management
Lake County Department of Information And Technology, GIS & Mapping Division

FIGURE 5.4 SUBWATERSHED MANAGEMENT UNIT 3A



Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins
- Stream Reach
- Critical Stream Reach
- Action Recommendations
- Subwatershed Management Unit
- FPAI Site

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September, 2007

DATA SOURCES:
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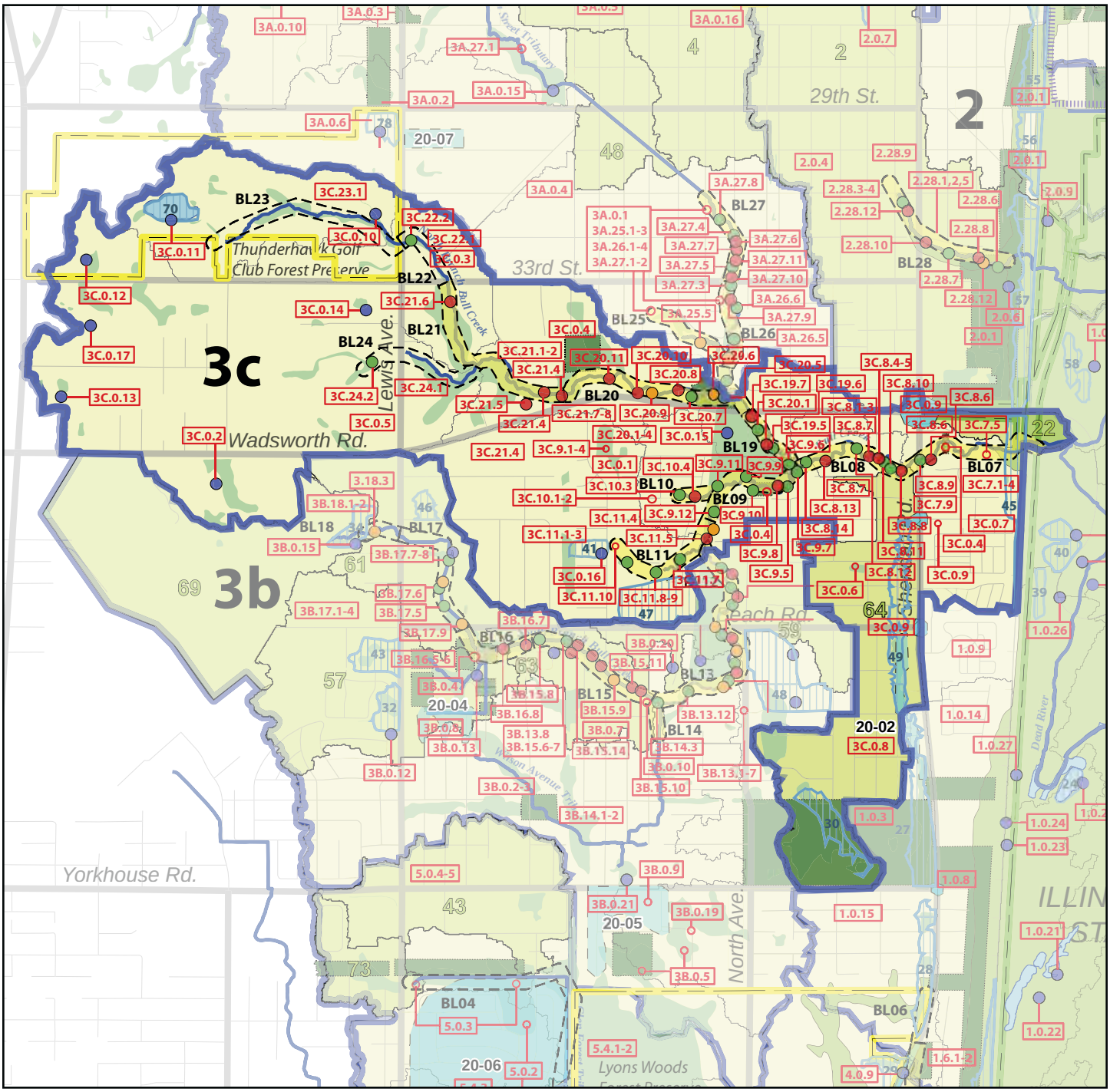
FIGURE 5.5 SUBWATERSHED MANAGEMENT UNIT 3B



Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins
- Stream Reach
- Critical Stream Reach
- Action Recommendations
- Subwatershed Management Unit
- FPAI Site

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September, 2007

DATA SOURCES:
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Lake County Department of Information And Technology, GIS & Mapping Division

FIGURE 5.6 SUBWATERSHED MANAGEMENT UNIT 3C

Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
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- Critical Stream Reach
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DATA SOURCES:
Lake County Stormwater Management
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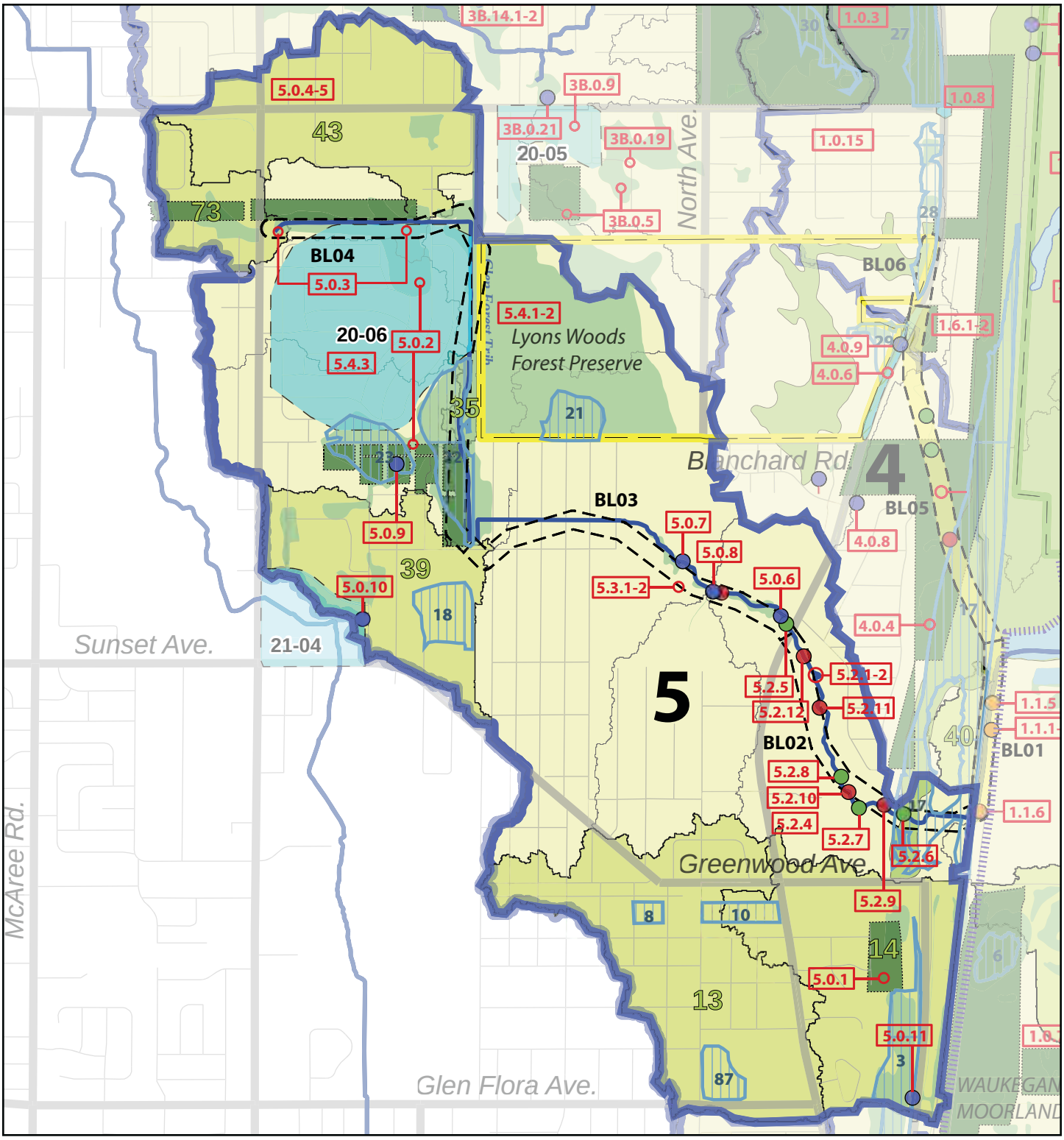
FIGURE 5.7 SUBWATERSHED MANAGEMENT UNIT 4



Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region
- Regional Storage
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins
- Stream Reach
- Critical Stream Reach
- Action Recommendations
- Subwatershed Management Unit
- FPAI Site

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Lake County Stormwater Management Commission
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DATA SOURCES:
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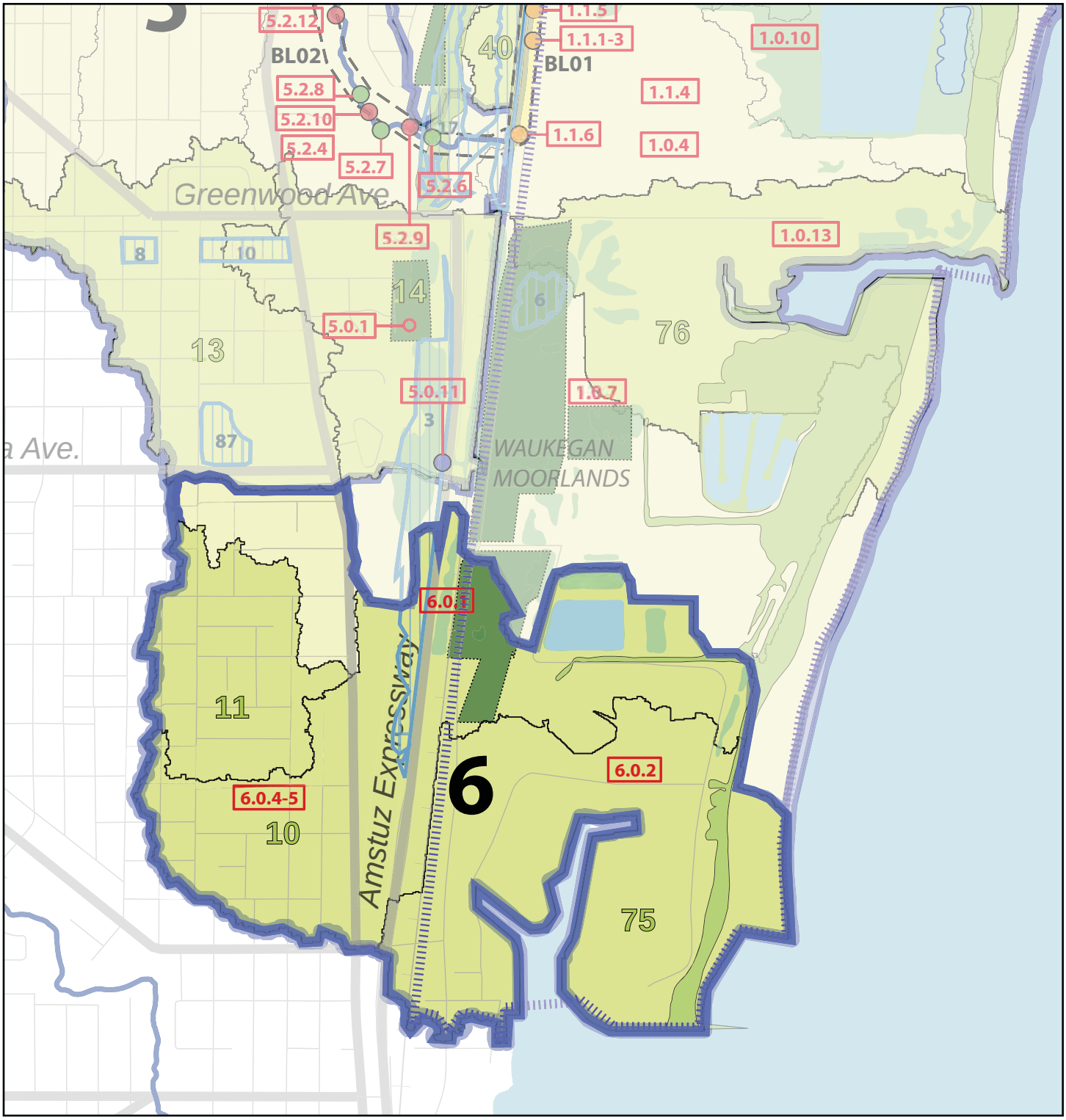
FIGURE 5.8 SUBWATERSHED MANAGEMENT UNIT 5



Legend

- Forest Preserve
- State Park
- Wetlands
- ADID Wetlands
- Critical Region (10)
- Regional Storage (52)
- Detention Basins
- Hydraulic Structures
- Instream Problem Areas
- Point Discharges
- Watershed Boundary
- SMU Boundary
- Priority Green Infrastructure Areas
- Subbasin Boundary
- Critical Subbasins (152)
- Stream Reach
- Critical Stream Reach (KC1)
- Action Recommendations (1.0.1)
- Subwatershed Management Unit (2)
- FPAI Site (20-07)

This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
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September, 2007

DATA SOURCES:
Lake County Stormwater Management
Lake County Department of Information And Technology, GIS & Mapping Division

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FIGURE 5.9 SUBWATERSHED MANAGEMENT UNIT 6

5.4 INFORMATION AND EDUCATION PLAN

A watershed-based plan must include a strategy to inform and educate the public and stakeholders about watershed issues and to encourage them to take positive action, to support watershed plan implementation, to improve private land management, to become involved in watershed stewardship activities, and to change behavior that may be impacting watershed resources. Because many watershed problems result from individual actions and the solutions are often voluntary practices, effective public involvement and participation promote the adoption of management practices, help activate the implementation of the watershed-based plan, and encourage changes in behavior that will help improve watershed resources. 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 and other resources helps provide the motivation and basis for changing behavior.

There are a limited number of known education programs occurring within or near the watershed area, though there does appear to be a number of individuals and organizations actively involved in environmental issues, such as the Illinois Dunesland Preservation Society, the Waukegan Harbor Citizens Advisory Group, and volunteers involved with restoration and management in Illinois Beach State Park. These groups, whether through a dedicated education initiative or general public outreach and participation in the community, are engaged in an education and information campaign. A few programs, as reported by watershed stakeholders, include the following:

- The Waukegan Harbor Citizens Advisory Group is involved with educating local residents about issues related to the Waukegan Harbor Area of Concern. The group conducts meetings and tours in support of this goal.
- A new summer environmental day camp for area 5th grade students is currently in development for Bowen Park in Waukegan. This program will focus on life, earth, and watershed science and will use the nearby ravine as a living laboratory to connect children with nature.
- Within Bowman Park, the Chicago Botanic Garden and the United States Forest Service are initiating a program to train volunteers to help monitor amphibians within the park boundary.
- At Zion Benton Township High School, Larry Anglada teaches an environmental curriculum to students that includes water resources and aquatic biology.
- Area churches are taking on an environmental education role with technical support from Chicago Wilderness.

It is clear from the limited programs focused on environmental education that additional efforts are needed. This section of the Action Plan includes an identification of the target audiences and partner organizations, a brief description of evaluating the information and education plan, and specific action recommendations for conducting the information and educationi campaign, which are presented in Table XX. A general overall strategy for information, education, and public involvement to address watershed topics and issues is included in Appendix I, along with a list of resources for conducting the education campaign.

Watershed organizations that may be tasked with coordinating and guiding actions within the Dead River watershed should consider developing a separate education committee to help build and implement a more detailed information and education campaign.

5.4.1 TARGET AUDIENCES

To define the audience for educational outreach, contacts should be made with individuals, organizations, and decision-makers within the watershed community to determine their level of understanding of watershed issues and needs for further education and outreach. 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 as well as their motivations.

The primary target audiences for this plan are (1) residents and other landowners, (2) land and resource managers and organizations, (3) government officials and agencies, and (4) developers and contractors. More specifically, potential target audiences include the following, abbreviations are

keyed to the education tables:

1. Residents, other landowners, and visitors
   - Riparian residents and landowners (RR)
   - Non-riparian residents and landowners (NR)
   - Homeowner associations (HOA)
   - General public and visitors (GP)
   - Businesses and institutions (BI)

2. Land and resource managers and organizations
   - Land and resource managers, including farmers, golf course superintendents, facility managers, and site stewards (LM)
   - Organizations, committees, land trusts, professional associations, agencies, and special interest groups interested in the future and management of watershed resources (OG)

3. Government officials and agencies
   - Local governments, including municipalities, townships, counties, state, health departments, park districts, forest preserve districts, port authorities, and transportation departments that manage land within the watershed (LG)
   - Schools (S)

4. Developers and contractors
   - Developers and homebuilders (DH)
   - Consultants and contractors (architects, engineers, planners, landscapers, lawn care) working in the watershed (CC)

The various target audiences will need to hear different messages or the same message in different ways (and with different emphasis) through a variety of delivery mechanisms, as determined by this plan and through the initial contact with target audiences mentioned above. A number of strategies for crafting and delivering messages for watershed information and education are provided below. Single issue messages tend to be simple and effective, though messages can also be crafted to address multiple issues such as the link between hydrology and stream health.

5.4.2 PARTNER ORGANIZATIONS

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

Beach Park Drainage District (BPDD)
Chicago Metropolitan Agency for Planning (CMAP)
Corporate and Business Landowners (CBL)
Developers & Homebuilders (DH)
Federal / Illinois Emergency Management Agency (FEMA/ IEMA)
Golf Courses (GC)
Illinois Department of Natural Resources (IDNR) (includes Winthrop Harbor)
IDNR Coastal Management Program (CMP)
Illinois / Lake County Departments of Transportation (DOT)
Illinois Environmental Protection Agency (IEPA)
Lake County Forest Preserve District (LCFPD)
Lake County Health Department (LCHD)
Lake County Planning, Building, and Development (PBD)
Lake County Stormwater Management Commission (SMC)
Lake Michigan Watershed Ecosystem Partnership (LMWEP)
Municipalities (all departments) (M)
National Audubon Society (NAS)
Natural Resources Conservation Service (NRCS)
Soil and Water Conservation Districts (SWCD)
Parks and Recreation Districts and Departments (PD)
Private Residential Landowners and Homeowners Associations (HOA)
North Shore Sanitary District (NSSD)
Townships (T)
Taskforce on Waukegan Neighborhoods (TOWN)
U.S. Army Corps of Engineers (USACE)
U.S. Department of Agriculture (USDA)
U.S. Environmental Protection Agency (USEPA)
U.S. Fish and Wildlife Service (USFWS)
Waukegan Harbor Citizens Advisory Group (WHCAG)

5.4.3 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 information and education 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 the Dead River 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.

5.4.4 INFORMATION AND EDUCATION STRATEGY FOR DEAD RIVER WATERSHED

The Information and Education Strategy tables on the next pages outline a general approach for providing education and outreach to watershed stakeholders. The table is organized by major Issues and Goals (dark green rows), and by topic area within each of the Issue and Goal categories. 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 landowners and residents. The table includes the following information and a key to the table is included at the end.

- Issue and Goal: the table is organized around major watershed issues and goals.
- Topic: a number of educational topics are recommended for each issue and goal.
- Target Audiences: indicates the primary audiences who need to hear the message or receive the information delivered. See the table footnote for explanations and acronyms.
- Messages: suggests a number of messages to be disseminated to address the topic, issue, and goal.
- Delivery Mechanism / Format: suggests the means by which the message should be distributed.
- Anticipated Behavioral Changes / Outcomes: indicates the desired outcome that will result when a message is properly distributed to the target audience.
- Evaluation Indicators: suggests means by which progress in implementing the Information and Education Strategy can be measured.
- Lead + Partners: recommends the primary parties that should be responsible for crafting and delivering the messages. See the table footnote for explanations and acronyms.
- Schedule: indicates the time frame for implementing the recommendation. See the table footnote for explanations and acronyms.
- Priority: indicates the relative importance of getting that particular message delivered. See the table footnote for explanations and acronyms.
- Status: this column is intentionally blank so that progress can be monitored within the table.

Table 5.16 Information and Education Plan

ISSUE:	Limited public understanding about watershed resources and the impact of human activities.								
GOAL:	Educate the public about general watershed issues.								
Topic	Target Audiences	Messages	Delivery Mechanism / Format	Anticipated Behavioral Changes / Outcome	Evaluation Indicators	Partners	Schedule	Priority	Status
General watershed awareness	GP A	• You live in a watershed, the area of land where all water drains to a single body of water, in this case, Lake Michigan. • Rain falling on your property picks up pollutants found there and carries them to the stream and Lake Michigan. You can manage your property to reduce these pollutants and improve water resources. • Help us keep your/our stream clean! YOUR actions impact the stream. • Everyone can contribute to solutions, no matter how small the action.	• Messages in community newsletters. • Simple public interest radio and newspaper advertisements. • Additional signage at stream crossings. • Post paper watershed maps in community buildings, government buildings, schools, and libraries.	• Landowners, residents, and the general public participate in watershed activities and events. • The general public requests additional information, maps, materials, etc.	• Number of participants in watershed events and activities. • Number of requests for additional information, maps, materials, etc	SMC M NRCS LCSWCD LCFPD LCHD AGL CMP TOWN LMWEP PD	Short to Long term	Medium	

Table 5.16 Information and Education Plan (continued)

ISSUE:	Stream restoration and management are needed to improve water quality and restore habitat.								
GOAL:	Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.								
Topic	Target Audiences	Messages – organize these messages by target audience	Delivery Mechanism / Format	Anticipated Behavioral Changes / Outcome	Evaluation Indicators	Partners	Schedule	Priority	Status
Stream restoration	RR HOA BI	• Improving the natural habitat features of the stream channel, stabilizing streambanks, and restoring the riparian buffer can bring fish and other native species back. • Eroding streambanks contribute silt and sediment to the stream, impairing water quality, degrading aquatic habitat, and threaten property and infrastructure.	• Distribute stream management and restoration guidebooks and other print materials. • Hold riparian landowner training workshops. • Provide stream restoration stewardship and volunteer opportunities. • Simple public interest messages on radio.	• Riparian landowners replace hardscape armoring with bioengineering practices • Riparian landowners actively restore stream habitat features.	• Number of riparian landowners reached / attending workshops. • Number of stream restoration and stabilization projects. • Participation in volunteer stream restoration events. • Requests for assistance or funding for restoration projects. • Number of reaches in the High or Moderate streambank erosion category.	SMC M BPDD NRCS LCSWCD LCFPD LCHD GC IDNR IEPA LMWEP	Short to Long term	High	
	LM LG CC	• Bioengineering practices, which use deep-rooted plants and other "soft" solutions to stabilize eroding streambanks, are more effective than rip rap, concrete, and other "hardscape" solutions, and are less detrimental to the stream channel and habitat. • Hardscape solutions are strongest when installed and get weaker over time, while bioengineering practices are weakest when installed and get stronger over time.	• Distribute technical stream restoration and stabilization manuals. • Hold technical restoration training workshops. • Install stream restoration / stabilization demonstration projects. • Provide list of funding and technical assistance sources.	• Land managers and local governments stabilize streambanks with bioengineering practices	• Number of streambank stabilization projects. • Number of reaches in the High or Moderate streambank erosion category.	SMC M BPDD NRCS LCSWCD LCFPD LCHD GC IDNR IEPA LMWEP	Short to Long term	High	
Stream management	RR HOA BI LM CC	• You can improve water quality, stabilize streambanks, reduce erosion, and provide wildlife habitat by maintaining a minimum 30' native riparian buffer along the stream. • Invasive and exotic plants can crowd out native plant communities and should be removed and replaced with deep-rooted, native riparian plant species. • Save time and money: don't mow to the edge of the creek. • Beautify your property: plant native plants and wildflowers along the stream. • Landowners are responsible for maintaining the stream on his/her property. You can improve water quality, reduce erosion, and improve the appearance of the stream by keeping garbage, debris, and yard waste away from the stream and its banks. • Rooftop and footing drains that discharge water from your property to the stream cause streambank erosion. Instead, direct this water into rain gardens or rain barrels. • Removing creek obstructions and log jams can help reduce erosion and prevent local flooding problems.	• Distribute stream management guidelines and other print materials. • Hold riparian landowner training workshops on riparian zone management. • Publish articles in community newsletters. • Provide stream management volunteer opportunities. • Install informational signage at stream crossings. • Simple public interest messages on radio. • Website.	• Riparian landowners actively manage stream and riparian zone and establish native buffers. • Riparian landowners stop dumping branches and other yard waste in and along the stream. • Landowners reduce activities that worsen streambank erosion such as rooftop drains, mowing to the edge of the stream, and dumping yard waste.	• Number of riparian landowners reached through workshops. • Number of stream management volunteers. • Linear feet of riparian buffer actively managed. • Requests for assistance or funding for restoration projects.	SMC M BPDD NRCS LCSWCD LCFPD LCHD GC IDNR IEPA LMWEP	Short to Long term	High	

Table 5.16 Information and Education Plan (continued)

ISSUE:	Stormwater runoff contributes to impaired water quality, eroding streambanks, and flooding.								
GOAL:	Improve stormwater management to enhance water quality and reduce erosion and flood damage.								
Topic	Target Audiences	Messages – organize these messages by target audience	Delivery Mechanism / Format	Anticipated Behavioral Changes / Outcome	Evaluation Indicators	Partners	Schedule	Priority	Status
Stormwater management	RR NR HOA BI LM	• You can help reduce ravine and streambank erosion and improve water quality by reducing the amount of stormwater leaving your property and entering the stream or storm sewer. • You can install stormwater BMPs to filter and infiltrate stormwater runoff. • Minimize the impact of installed drains (e.g., flexible corrugated plastic pipes), on your property by directing them into a rain garden or other on-site infiltration BMP.	• Distribute stormwater management how-to materials such as rain garden guides. • Hold property owner training presentations and workshops on stormwater management.	• Landowners voluntarily act to reduce the rate and volume of stormwater being discharged to ravines and/or stream channels. • Landowners stabilize erosion around infrastructure on their property, and report infrastructure problems to the proper authorities.	• Number of landowners and land managers reached. • Number of drain retrofit projects. • Number of on-site infiltration projects for roof and site runoff.	SMC M BPDD HOA LCPBD IEPA LMWEP TOWN	Short to Long term	High	
	LG LM BI HOA	• You can maintain the conveyance capacity of the stream, reduce erosion, and improve water and habitat quality by repairing and maintaining failing, impaired, or obstructed stormwater outfalls, culverts, and channels. • You can retrofit detention basins and drainage swales to help improve water quality and infiltrate water into the ground.	• Meet with landowners, municipalities, and others who manage these stormwater features. • Hold training presentations and workshops on stormwater infrastructure management.	• Stormwater infrastructure managers and municipalities monitor, maintain, and repair the conveyance system and structures on a regular basis. • Stormwater infrastructure managers and municipalities actively manage and retrofit detention basins and swales with deep rooted vegetation and other measures to help improve water quality.	• Number of swale and detention basin retrofit projects. • Number of new detention basins and swales using BMPs.	SMC M BPDD HOA LCPBD IEPA LMWEP TOWN	Short to Long term	High	

Table 5.16 Information and Education Plan (continued)

ISSUE:	The watershed experiences flood risk and flood damage.								
GOAL:	Reduce flood damage and prevent increased flooding to protect public and private property and investments.								
Topic	Target Audiences	Messages	Delivery Mechanism	Anticipated Behavioral Changes / Outcome	Evaluation Measure	Partners	Schedule	Priority	Status
Floodproofing and flood risk awareness	RR NR HOA BI	• Landowners in and near the floodplain should be aware of flood risk and the importance of flood insurance. • Landowners can protect their property and mitigate flood losses and/or flood damage through buyouts and flood proofing techniques. • Landowners can call on a variety of local and county agencies for flood response assistance. • Excess water has to go somewhere: your basement or the floodplain? • Flooding is expensive.	• Distribute print information to landowners with property in or near floodplain or flood problem areas. • Hold workshops for landowners on floodproofing and flood awareness. • Website	• Floodplain insurance held by all who need it. • At risk structures are flood-proofed.	• Number of flood prone property owners reached. • Number of structures insured, flood proofed, or removed from the floodplain or flood prone areas.	FEMA LCPBD IEMA M BPDD SMC	Medium term	Medium	
	DH LG	• Avoid developing within the floodplain or floodprone areas, which exposes property and infrastructure to flood damage risk. • Development of the watershed has resulted in an increase in runoff volume and the expansion of the floodplain, thereby exposing a greater area to risk of flood damage. • Protect the natural drainage system as green infrastructure to prevent flooding.	• Hold training sessions for municipalities and the development community on the importance of preserving the natural drainage system and the risks and costs associated with developing within the floodplain or floodprone areas.	• Creation of an incentive program to preserve existing floodplain as open space in perpetuity. • Floodplains are preserved by local ordinances.	• Number of floodplain preservation ordinances and/or incentive programs. • Acres of floodplain and flood prone areas preserved.	FEMA LCPBD IEMA M BPDD SMC	Medium term	Medium	
Runoff rate and volume control	RR NR HOA BI LM DH LG	• Watershed problems associated with excessive stormwater runoff rate and volume can be addressed by using conservation development practices and stormwater BMPs.	• Hold training workshops and presentations on stormwater BMPs, low impact (LID), and conservation development design. • Install stormwater BMP demonstration projects. • Provide model stormwater BMP standards and ordinances.	• Municipalities require stormwater runoff volume and rate control BMPs in new development. • Increase in voluntary retrofits of developed areas to reduce runoff rate and volume.	• Number of participants in workshops and presentations. • Number of requests for BMP information / assistance. • Number of Section 319 or WMB funding requests for BMPs. • Number of developments using stormwater management BMPs or LID techniques.	SMC LCPBD M BPDD LCSWCD	Short term	Medium	
Sanitary system problems	RR NR BI HOA	• Poor sanitary system design, stormwater infiltration into sanitary sewers, and cross connections between the two have led to sewer backups into buildings. • Building owners should install one-way flow valves in sewer drains, which prevent backups, until the larger infrastructure problems can be solved. • Landowners inspect their sanitary sewer lines and correct any I&I problems on their property.	• Distribute print information to property owners in areas where sanitary sewer backups occur.	• Building owners install one-way valves in sewer drains.	• Number of property owners reached. • Number of system / drain protection projects.	NSSD LCPBD M BPDD	Short term	Medium	
	LG	• Local governments and the North Shore Sanitary District inspect sanitary sewer lines and interceptors and correct any I&I problems within their systems.	• Presentations to municipal and agency officials regarding the impact of cross connections and techniques for fixing problems.	• Local governments and other responsible parties identify, plan, and correct infiltration, inflow, cross connections, and poor designs that have resulted in backups.	• Number of infrastructure remediation projects completed.	NSSD LCPBD M BPDD	Long term	Medium	

Table 5.16 Information and Education Plan (continued)

ISSUE:	A complete and interconnected green infrastructure network is important for protecting watershed resources and natural hydrology.								
GOAL:	Protect, restore, and enhance a green infrastructure network of terrestrial and aquatic resources including streams, riparian corridors, wetlands, floodplains, ravines, depressional areas, and upland resources.								
Topic	Target Audiences	Messages	Delivery Mechanism	Anticipated Behavioral Changes / Outcome	Evaluation Measure	Partners	Schedule	Priority	Status
Green infrastructure planning and implementation	RR NR GP LM LG	• An interconnected system of open spaces, natural areas, wetlands, floodplains, streams, and stream buffers can help maintain the hydrologic and biologic health of the watershed. • A preserved green infrastructure system is essential for preserving and restoring the health of Lake Michigan. • Protected green infrastructure can increase property values for nearby landowners. • Preserving natural drainage and storage areas, floodplains, wetlands, and riparian corridors helps to prevent flashy stream systems that cause erosion, absorbs excess stormwater, and reduces the risk of flooding.	• Provide watershed tours to exhibit green infrastructure elements. • Presentations on green infrastructure at community and board meetings. • Host land preservation workshops for landowners. • Distribute electronic and paper maps that show the green infrastructure system coverage.	• Voluntary landowner preservation and restoration of green infrastructure elements through integration into private and public development, permanent conservation easements, and/or integration into land management plans.	• Number of attendees at watershed tours and events. • Number of residents and others reached at community meetings. • Number of acres of green infrastructure protected.	M SMC LCPBD LCFPD PD CMAP LMWEP IDNR BPDD BCN CW OLP	Long term	High	
	LM LG OG	• Everyone needs to do their part and collaborate on preserving green infrastructure important to the health of the watershed. Local governments, park districts, and the forest preserve district are essential partners in the effort to protect green infrastructure elements.	• Presentations on green infrastructure at board meetings. • Provide conservation design / Low Impact Development standards to local governments and the development community. • Distribute electronic and paper maps that show the green infrastructure system coverage. • Communities convey the message to landowners & developers during the development review & permitting processes.	• Local governments adopt and incorporate the Green Infrastructure Plan into their Comprehensive Plans. • Long term preservation of corridors through easements and acquisition. • Communities include green infrastructure preservation in their capital and public works budgets. • Communities develop incentives for developers & landowners to preserve green infrastructure during site design & development.	• Number of local governments adopting the Green Infrastructure Plan. • Number of communities adopting conservation design / Low Impact Development standards. • Number of local government officials and staff reached at community meetings. • Number of acres of green infrastructure protected.	M SMC LCPBD LCFPD PD CMAP LMWEP IDNR BPDD BCN CW OLP	Long term	High	

Table 5.16 Information and Education Plan (continued)

ISSUE:	The watershed contains unique natural resources in need of preservation, restoration and management.								
GOAL:	Preserve, restore, and enhance terrestrial and aquatic natural resources.								
Topic	Target Audiences	Messages	Delivery Mechanism / Format	Anticipated Behavioral Changes / Outcome	Evaluation Indicators	Partners	Schedule	Priority	Status
Natural area / wetland management & restoration	GP LM LG S	• The ecological health of the unique system of wetlands, dunes, and panes found in Illinois Beach State Park and Spring Bluff Forest Preserve, some of which are found nowhere else on earth, depends on the interest and participation of watershed residents and stakeholders in the restoration and management of these systems. • Every landowner and land manager can contribute to the ecological and biological quality of the watershed by planting native species, restoring small or large areas of land to native habitat, and restoring the stream corridor and riparian buffer. • The watershed contains some of the last remaining undeveloped Lake Michigan lakeshore in Illinois, which supports a host of species including the migratory routes of numerous bird species. The lakeshore deserves continued preservation and improved management to restore this unique resource.	• Develop electronic media and printed advertisements. • Provide natural area tours to exhibit the unique resources. • Host natural area restoration and stewardship outings. • Install demonstration restoration projects. • Deliver presentations at community meetings, garden clubs, and libraries. • Distribute a watershed ecology report card.	• Increased awareness of unique watershed resources and actions to improve them. • Increased volunteer involvement in restoration and management activities, both by landowners on private property and by the public in publicly held natural areas.	• Number of participants in watershed tours and presentations. • Number of volunteers participating in restoration events in IBSP, forest preserves, and parks.	SMC LCFPD IDNR CMP LMWEP PD BCN CW OLP DPS NAS USFWS LCPBD	Short to Long term	Medium to Low	
	RR HOA LM LG	• Watershed ravines support unique and valuable ecosystems and provide important watershed functions that are being been degraded by encroaching development, stormwater discharge, inappropriate management of edges and slopes, and dumping of yard waste and other debris. • Landowners should set development back from ravine edges by a 50 foot, native buffer and restore a healthy layer of ground vegetation within ravines to help stabilize ravine slopes, reduce erosion, and protect property and infrastructure.	• Host ravine restoration and stewardship outings. • Install demonstration ravine restoration projects. • Distribute ravine management guidelines and directly contact ravine-side landowners and residents about appropriate practices for these sensitive resources.	• Ravine-side landowners voluntarily take appropriate management actions such as removing roof and footing drains from the ravines, installing and managing stabilizing ground vegetation, and avoiding land use activities that hasten ravine erosion.	• Number of participants in ravine restoration events. • Number of ravine-side landowners and land managers contacted about proper ravine management. • Number of in-ravine plastic pipe discharge points removed or remediated and removed from Action Plan.	SMC LCFPD IDNR LMWEP PD NRCS SWCD CW OLP LCPBD M	Short to Long term	High	

Table 5.16 Information and Education Plan (continued)

ISSUE:	Land use and human activity throughout the watershed are degrading water quality in the stream and Lake Michigan.								
GOAL:	Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.								
Topic	Target Audiences	Messages	Delivery Mechanism / Format	Anticipated Behavioral Changes / Outcome	Evaluation Indicators	Partners	Schedule	Priority	Status
Yard and landscape management	RR NR HOA BI LM LG CC	• Better turf and landscape management practices, which contribute organic matter, nutrients, pet waste, fertilizers, and pesticides to the stream, can improve water quality, reduce landscape maintenance costs, and increase profitability. • Using phosphorous-free fertilizers minimizes nutrient loading to the stream. • Pick up animal waste before it can be washed into the stream. • Lawn chemicals are killing our streams and rivers. • Excessive application of chemicals and fertilizers wastes money. • Yard waste smothers beneficial vegetation along the stream.	• Distribute yard and landscape management guidelines and other print materials. • Hold workshops for landowners, land managers, and landscape contractors. • Install demonstration natural landscaping projects. • Produce advertisements, public service announcements, and cable access spots. • Post billboards and posters. • Hold presentations at community and HOA meetings.	• Landowners reduce fertilizer and pesticide application. • Landowners dispose of yard waste properly through mulching or bagging. • Landowners properly dispose of pet waste. • Landscape companies adopt environmentally-friendly management practices.	• Number of people attending workshops and presentations. • Number of demonstration natural landscaping projects. • Number of landscape companies adopting environmentally-friendly practices. • Number of public reached through media, billboards, and advertisements (i.e., circulation).	M IEPA LCHD BPDD GC LCSWCD LMWEP PRL TOWN	Short term	High	
Golf course and agricultural land management	LM LG	• Smarter agricultural and golf course management practices can improve water quality and save money. • Agricultural operations should plant cover crops and use conservation tillage. • Organic agricultural growing operations improve water quality by reducing the input of most detrimental chemicals. • Stream and pond buffers with deep rooted vegetation can reduce migration of pollutants to the stream and reduce streambank erosion. • Managing goose populations can reduce contribution of animal waste to the stream.	• Distribute NRCS / SWCD and golf course management guidelines and other print materials, and directly contact agricultural and golf course land owners / managers regarding management practices. • Work with Audubon International and strive for Audubon certification on golf courses, using Thunderhawk Golf Course as a model. .	• Voluntary installation of stormwater BMPs such as filter strips. • Reduction in the amount of fertilizers and pesticides used. • Onsite water resources are buffered with natural vegetation.	• Number of agricultural and golf course operations / acres using conservation and water quality improvement practices. • Number of Audubon certified courses. • Length and width of stream buffer on agricultural lands and golf courses.	NRCS LCSWCD LCFPD PD AI GC	Medium term	Medium	
Urban pollutants / stormwater BMPs	RR NR HOA BI LM LG CC OG S	• Pollutants such as automotive chemicals, fertilizers, and pet waste collect on urban surfaces and rainwater runoff washes them into the stream, your drinking water, and your swimming beaches. • Filtration and infiltration practices installed on your property can help remove runoff pollutants before they enter the stream, watershed wetlands, and Lake Michigan. • Natural vegetation and BMPs can be installed virtually anywhere to help clean urban pollutants form our streams, wetlands, and Lake Michigan.	• Distribute BMP guidelines to residents, landowners, local governments, consultants, contractors, developers, and homebuilders. • Conduct training workshops and deliver presentations at community and professional association meetings. • Articles in community newsletters. • Install and publicize BMP demonstration projects.	• New development and redevelopment incorporates stormwater BMPs. • Local governments will adopt and enforce stormwater BMP guidelines and standards to reduce runoff and improve water quality. • Landowners and developers voluntarily retrofit existing development with stormwater BMPs. • Watershed residents reduce the release of urban pollutants into the landscape.	• Number of communities adopting and enforcing BMP standards and guidelines. • Number of participants in educational workshops and meetings. • Number of new developments using stormwater BMPs. • Number of BMP retrofit projects.	M SMC IEPA LCHD LMWEP	Short term	Medium	

Table 5.16 Information and Education Plan (continued)

ISSUE:	Land use and human activity throughout the watershed are degrading water quality in the stream and Lake Michigan. (continued)								
GOAL:	Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.								
Road, parking lot, and runway management	HOA BI LG WA DOTs	• Runoff from roads, parking lots, and runways impairs water quality by carrying pollutants, including metals and automotive fluids, to the stream. • Installing permeable paving practices instead of conventional concrete or asphalt can improve water quality. • High chlorides are considered a pollutant of concern in the stream. Chloride levels are increasing in recent years as a consequence of road salt applications. • Improved highway and parking lot maintenance, regular sweeping, and lower salt application, can improve water quality.	• Directly contact departments of transportation and public works departments through one-on-one contact, presentations, and workshops. • Distribute print materials to public works departments.	• Improved highway and parking lot maintenance practices (e.g., use of alternative seal coating products, use of alternative deicing products or procedures).	• Number of transportation and public works departments reached through contact, workshops and presentations. • Number of public works and highway departments adopting environmentally-friendly practices.	DOT IEPA M	Medium term	L	
Construction site erosion	DH LG CC	• Erosion from construction sites (and other sources) impairs aquatic life habitat in the stream, Illinois Beach State Park, and Lake Michigan. • Appropriate and cost-effective soil erosion and sediment control (SESC) measures can reduce the sediment input to the stream. • If you see a problem development site, call your local engineer.	• Provide direct outreach, workshops, and presentations to municipalities regarding erosion control practices, standards, and enforcement. • Distribute print materials to developers and homebuilders working in the watershed. • Implement Certified Erosion Control Specialist programs	• Improved soil erosion and sediment control measures that reduce the flow of sediment to streams, lakes, and wetlands. • Municipalities enforce and regularly inspect SESC practices.	• Number of municipalities reached and number of participants in workshops and presentations.	M LCPBD NRCS LCSWCD IEPA	Short term	Medium	
Waste and dumping	RR NR HOA BI LM LG CC S	• Dumping of inappropriate substances into the stream or storm sewer seriously impairs water quality. • Burning of leaves in ditches or stream corridors contributes pollution to the stream. • If you see someone dumping garbage or other waste call your municipality. • Don't dump in the drain; it flows to Lake Michigan.	• Hold watershed events such as stream clean ups and storm drain stenciling. • Distribute print advertising and door hangers. • Publish informational pieces in village newsletters.	• Reduced dumping into the stream corridor or storm sewer system. • Less debris and garbage within the stream corridor. • Volunteer participation in stream clean up and stenciling events. • Residents properly dispose of household chemicals and fluids in collection centers	• Number of participants in watershed events. • Number of reports of debris dumping. .	M	Short term	H	

Table 5.16 Information and Education Plan (continued)

ISSUE:	Development within the watershed will further degrade watershed resources.								
GOAL:	Future watershed development uses conservation and Low Impact Development practices.								
Topic	Target Audiences	Messages	Delivery Mechanism / Format	Anticipated Behavioral Changes / Outcome	Evaluation Indicators	Partners	Schedule	Priority	Status
Low Impact Development	HOA DH LG CC	• Local government and developer commitment to better development approaches, such as Low Impact Development, is important to maintaining the integrity of watershed resources.	• Distribute guidelines and model ordinances to local governments and developers working in the watershed. • Conduct training workshops and deliver presentations at community meetings and professional association meetings.	• New development uses Low Impact Development practices that protect on- and off-site water resources. • Local governments adopt and enforce Low Impact Development standards and guidelines. • Developers incorporate conservation design principles into site and stormwater design.	• Number of municipalities adopting and enforcing conservation design standards and guidelines. • Number of participants in workshops and meetings. • Number of new developments using LID practices.	SMC LCPBD CMAP LMWEP	Medium term	Medium	

Audiences		Lead & Partner Organizations			
A	All audiences	AGL	Alliance for the Great Lakes	LCSWCD	Lake County Soil and Water Conservation District
BI	Businesses and institutions	AI	Audubon International	LCPWD	Lake County Public Water District
CC	Consultants and contractors	BPDD	Beach Park Drainage District	LMWEP	Lake Michigan Watershed Ecosystem Partnership
DH	Developers and homebuilders	BCN	Bird Conservation Network	M	Municipalities (all departments)
DOT	Departments of Transportation	CMAP	Chicago Metropolitan Agency for Planning	NAS	National Audubon Society
GP	General public and visitors	CW	Chicago Wilderness	NOAA	National Oceanographic and Atmospheric Administration
HOA	Homeowners associations	CBL	Corporate and Business Landowners	OLP	Open Lands Project
LG	Local governments	DH	Developers and Homebuilders	PD	Parks and Recreation Departments
LM	Land and resource managers	DPS	Dunesland Preservation Society	PRL	Private Residential Landowners and Homeowners Associations
NR	non-riparian residents and landowners	FEMA	Federal / Illinois Emergency Management Agency	NSSD	North Shore Sanitary District
OG	Organizations, committees, and special interests	GC	Golf Courses	TOWN	Taskforce on Waukegan Neighborhoods
RR	Riparian residents and landowners	IDNR	Illinois Department of Natural Resources	T	Townships
S	Schools	CMP	IDNR Coastal Management Program	USACE	U.S. Army Corps of Engineers
WA	Waukegan Airport	DOT	Illinois / Lake County Departments of Transportation	USDA	U.S. Department of Agriculture
		IEPA	Illinois Environmental Protection Agency	NRCS	USDA Natural Resources Conservation Service
Abbreviations		IISG	Illinois-Indiana Sea Grant	USEPA	U.S. Environmental Protection Agency
BMP	Best Management Practice	LCFPD	Lake County Forest Preserve District	USFWS	U.S. Fish and Wildlife Service
WPC	Watershed Planning Committee	LCHD	Lake County Health Department	WHCAG	Waukegan Harbor Citizens Advisory Group
LID	Low Impact Development	LCPBD	Lake County Planning, Building, and Development	WPA	Waukegan Port Authority
WMB	Watershed Management Board	SMC	Lake County Stormwater Management Commission	YCC	Youth Conservation Corps
HOA	Homeowners Association				
Schedule					
Short	0-5 years				
Meduim	5-10 years				
Long	10+ years				

6

plan implementation and evaluation

6 - plan implementation and evaluation

This chapter identifies a strategy for moving from planning to implementation of the action plan recommendations. How readily this plan is used and implemented by watershed stakeholders is one indicator of its success. Improvement in watershed resources is another indicator. Successful plan implementation will require significant cooperation and coordination among watershed stakeholders to secure project funding and to efficiently and effectively move the action plan from paper to the watershed.

This chapter also relates some more technical details about the expected results of putting action recommendations in place and the cost of plan implementation. It also presents a plan for monitoring and evaluating plan implementation as a way to determine progress towards watershed goals and objectives.

6.1 PLAN IMPLEMENTATION STRATEGY

The Dead River watershed includes many stakeholders (see Table 6.1) that will have to coordinate efforts to implement many of the projects recommended in the action plan. Since no single municipality, district, resident, business, landowner, or organization has the financial or technical resources to accomplish the plan goals and objectives alone, working together will be essential to achieve meaningful results. Combining and coordinating resources, funding, effort, and leadership will be the most efficient and effective means of creating real improvement of watershed resources.

One important step in plan implementation will be the establishment of a committee or organization to step forward as a project leader to help organize and coordinate plan implementation. Responsibilities of this organization would also include administration, coordination of stakeholders to support individual watershed projects, and working with municipalities and other stakeholders to implement recommended policies and programs.

Throughout the watershed planning process, the Watershed Planning Committee has provided valuable input to the plan regarding watershed issues, resources, and priorities. This Planning Committee is encouraged to function as the stakeholder forum for the watershed until a separate organization or committe can be created. The Planning Committee can continue to hold regular meetings, organize watershed field trips, host educational workshops and forums, and bring watershed stakeholders and multiple units of government together to discuss watershed issues and opportunities. The Planning Committee may consider whether a formal staff position is needed to support the efforts of the Committee and to solicit volunteers for the position.

The Planning Committee, or an established watershed organization, is encouraged to work to generate additional stakeholder interest and involvement with watershed plan implementation and stewardship activities. As projects are initiated, and as the positive environmental, aesthetic, and community benefits come to light, projects and participation are expected to increase over time. There are tangible benefits to stakeholder participation in watershed activities, from positive media attention to improved quality of life for community residents. Increased involvement also can yield significant local, state, and federal funding opportunities to help share the cost of project implementation.

The watershed action plan contains a number of programmatic and site specific recommendations and an identification of the party responsible for leading the implementation of those recommendations. Some actions, such as the repair or stabilization of a municipal stormwater discharge point, can be added to municipal or drainage district capital improvement and maintenance plans, budgets, and schedules. This is a fairly quick and easy approach to implementing recommendations within the purview of specific jurisdictions.

In other cases, however, the action recommendation will require the involvement of multiple stakeholders for implementation, such as residents, a municipality, and a county, state, or federal agency to provide financial and technical support. Some actions require cross-jurisdictional coordination for issues, such as streambank stabilization, that span multiple jurisdictions or properties. The establishment of a green infrastructure corridor along the stream channel, or the preservation and restoration of

a large wetland complex are examples of projects that may require inter-jurisdictional cooperation and may require a longer time frame for implementation.

Other actions will require the cooperation of individual or groups of landowners, whether they are residents, homeowners associations, businesses, or institutions. These actions will often need a leader, or a single champion for the project, that can organize resources and keep the project moving forward. This champion may be the watershed organization, or a single entity such as a landowner or the municipality.

Actions that involve preservation of areas of land or water may also require the involvement of a local land trust, such as the Lake County Land Trust, or other conservation organization. These groups can often provide technical or financial assistance for preservation efforts.

In some cases, actions recommend the adoption of new policies, plans, or standards that modify the form, intensity, or type of development or redevelopment in the watershed in a way that better protects watershed resources. These actions will require some effort on the part of municipalities to understand how plans and policies can be modified and to discuss and adopt new, or modify existing, policies, plans and standards. The first step in this effort is to understand how current development practices impact watershed resources and how they can be improved, followed by discussion and debate about possible modifications, and finally adopting policies and standards that have will have the desired outcome.

Clearly there is much to be done and there are many parties to coordinate. However, a dedicated and determined effort will benefit all watershed stakeholders and future generations of residents and visitors.

6.2 IMPAIRMENT REDUCTION TARGETS AND PROJECTIONS

In order to meet the requirements for a watershed-based plan, the plan must pay particular attention to water quality pollutants and impairments and measures for reducing the impairment. The high priority water quality pollutants for the Dead River Watershed include low dissolved oxygen, Total Suspended Solids / sedimentation, nutrients (phosphorous), aquatic life toxicity (total dissolved solids, chlorides, and salinity), and bacterial contamination (fecal coliform). Additional impairments addressed by the plan include degraded watershed aquatic habitat, loss and degradation of wetlands, natural area invasion by exotic species, impacted or lack of stream buffers and riparian zones, and flood flows and damages. These are the most important impairments needing to be addressed, for the reasons provided below.

Low dissolved oxygen is problematic because it creates aquatic habitat conditions that only some fish and aquatic organisms can tolerate, causing the diversity of species to be reduced, which is an indicator of an impaired system. Restoring dissolved oxygen levels to levels that are consistently above 5.0 mg/L (the Illinois standard) will help recreate high quality aquatic habitat conditions.

Total Suspended Solids / sedimentation impair watershed resources when they settle out in streambeds, wetlands, and natural areas making them uninhabitable by some sensitive plant and animal species. The primary impact of high suspended solids concentrations in streams occurs when these solids settle in depositional areas of the stream system and cover the more desirable gravel substrates. Excessive levels of particulate material also create difficult conditions for gill breathing fish and some of their food sources, including macroinvertebrate organisms. In Illinois Beach State Park, sediment is obstructing flow and settling out in the park and degrading the quality of habitat. Reducing the flow of sediment into the stream channel, wetlands, and natural areas will help to repair these degraded systems by preventing further sedimentation and beginning the process of natural recovery.

Nutrient loads (phosphorous) cause algae blooms that impair the habitat quality of water resources and block light from reaching desirable aquatic plants. When the algae dies, the decomposition process can deplete dissolved

Table 6.1 Implementation Partners

Acronym	Responsible Party	General Responsibility
BPDD	Beach Park Drainage District	Drainage system management and maintenance.
CMAP	Chicago Metropolitan Agency for Planning	Technical and planning assistance, training, and funding assistance.
CBL	Corporate and Business Landowners	Grounds management and maintenance.
DH	Developers & Homebuilders	Land development, stormwater management system design and construction.
FEMA	Federal Emergency Management Agency	National Flood Insurance Program, floodplain mapping and enforcement, and mitigation funding.
GC	Golf Courses	Grounds management and maintenance.
IDNR	Illinois Department of Natural Resources	Natural area preservation and management, research, technical and financial assistance.
CMP	IDNR Coastal Management Program	Preserve and manage Lake Michigan coastal resources (if established).
IDOT	Illinois Department of Transportation	Road and highway planning, construction, and maintenance.
IEMA	Illinois Emergency Management Agency	Flood and disaster planning, emergency response, and hazard mitigation.
IEPA	Illinois Environmental Protection Agency	Water resource monitoring, pollution regulation and control, project funding.
LC	Lake County	Land use planning for unincorporated areas, natural resources, drainage system management.
LCFPD	Lake County Forest Preserve District	Manage and maintain green infrastructure, natural areas, and open space.
LCHD	Lake County Health Department	Monitor, manage, and provide technical support for water resources.
LCSMC	Lake County Stormwater Management Commission	Technical and financial assistance for flooding, watershed planning, and water quality.
LMEP	Lake Michigan Ecosystem Partnership	Watershed advocacy and education, technical and financial assistance.
LMGLO	Lake Michigan / Great Lakes Organizations	Great Lakes and Lake Michigan water resource management, education, and outreach.
M	Municipalities (all departments)	Land use and development, technical and financial support, and drainage system management.
NGRREC	National Great Rivers Research & Education Center	Stream, lake, wetland, and coastal data collection, watershed education and outreach.
NRCS / SWCD	Natural Resources Conservation Service / Soil and Water Conservation Districts	Provide natural resource management technical and financial assistance.
PD	Parks and Recreation Districts	Management and maintenance of parks and open space.
PRL / RL	Private Residential / Riparian Landowners	Land management and maintenance including stream channels and riparian corridors.
NSSD	North Shore Sanitary District	Maintain sanitary sewer system infrastructure, stream monitoring.
T	Townships	Road maintenance and support for watershed improvement projects.
USACE	U.S. Army Corps of Engineers	Wetland protection and regulation, wetland restoration funding.
USDA	U.S. Department of Agriculture	Farmland and natural resoruce technical and financial assistance.
USEPA	U.S. Environmental Protection Agency	Lake Michigan and Great Lakes management and restoration.
USFWS	U.S. Fish and Wildlife Service	Threatened and endangered species, technical and funding assistance for habitat restoration.
CAG	Waukegan Harbor Citizens Advisory Group	Organize and coordinate activities related to Waukegan Harbor contamination and cleanup.
WPC	Watershed Planning Committee	Coordinate watershed plan implementation, education and outreach.

oxygen levels in the water, impairing the habitat quality for aquatic wildlife. Reducing the flow of phosphorous to watershed water resources can help to restore high quality aquatic habitat conditions necessary for a healthy diversity of species.

Total Dissolved Solids (TDS) include salt (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. Chlorides are not removed by best management practices, does not decompose or readily change form, and can cause spikes in the water column, typically detected as increased conductivity, making the water uninhabitable by certain aquatic plants and animals. Reducing chloride loading to the stream will help maintain a consitent quality of water that supports healthy aquatic habitat.

Lake Michigan beaches high fecal contamination / pathogens that causes beach closures due to the potential threat to human health that pathogens present. Reducing this contamination will reduce beach closures and help protect human health.

Watershed habitat has been degraded and altered due to a number of causes. The lack of aquatic habitat characteristics, including pools and riffles and healthy substrates, means that aquatic species do not have sufficient cover and sources of food. Other habitat alterations that degrade conditions for aquatic organisms include streambank erosion and barriers to the movement of fish upstream and downstream, such as debris buildup or inconsistent connections to Lake Michigan. Alterations to watershed hydrology, creating flashy conditions, also impairs habitat because low flow conditions can mean that there is not enough water for aquatic species to live, and that dissolved oxygen levels fall below healthy levels due to the lack of flow and aeration. Restoring natural watershed hydrology, habitat characteristics, and streambank stability are important for recreating habitat conditions that support a healthy diversity of aquatic organisms.

Watershed wetlands have been drained, filled, and degraded, which impairs their ability to absorb and filter stormwater, to improve water quality, and to support wildlife that depend on high quality wetlands. Restoring the remaining wetlands and recreating some former wetlands, is important to replace water storage and retention areas and to improve water quality by restoring their water filtering capacity.

Watershed wetlands and natural areas have been invaded by exotic and invasive species, which crowd out native species and degrade habitat necessary to support threatened and endangered species. Removal and control of exotic and invasive species, including the reintroduction of natural management mechanisms such as prescribed fire, is important to restore the quality and function of watershed wetlands and natural areas.

Natural stream buffers and riparian zones have been removed, converted to turf grass or other uses, or otherwise degraded to a state that does not help filter runoff and improve water quality, stabilize streambanks, nor support a healthy stream system habitat.

Increased flood flows and flood damages are the result of increased rate and volume of stormwater runoff, the loss of natural drainage and water retention areas such as wetlands and depressional storage, and development within or adjacent to the floodplain. Restoring watershed hydrology, reducint the rate and volume of stormwater runoff, and restoration of depressional and wetland storage can help reduce the risk of flooding of structures in the future.

For these impairments, the intent of the action plan recommendations is to reduce the impairment to an acceptable level. The ‘acceptable level’ for some pollutants is set by the Illinois Pollution Control Board and Illinois Environmental Protection Agency. However, Illinois standards only exist for one of these impairments, dissolved oxygen, which is set at a concentration of 5.0 mg/L for most conditions. For other impairments, reduction targets are set according to professional opinion.

Setting impairment reduction targets and estimating the improvement expected by implementing plan recommendations are important for assessing the effectiveness of watershed plan recommendations for determining whether watershed impairments are being addressed. Targets and reduction estimates also satisfy one of the nine required watershed-based plan elements established by the US Environmental Protection Agency.

USEPA watershed-based plan element #2: water quality improvement expected from implementing plan recommendations (also see Appendix K).

Table 6.2 Three Point Scale for Estimating the Ability of a Best Management Practice to Meet a Reduction Target

Rank	Description of Potential Effectiveness	Range of Effectiveness
3	Fully achieves target	67-100%
2	Partially achieves target	34-66%
1	Minimially achieves target	0-33%

Table 6.3 Watershed Impairment Reduction Targets and Projections

Impairment	Cause	Degree / Basis of Impairment	Reduction Target	Reduction Projection	Is the target being met?
Water Quality	Total suspended solids / sedimentation	3,208,000 lb/yr of TSS loading (based on non-point source pollution loading model)	75%	7,040,928 lb/yr reduction in TSS loading	Yes
Water Quality	Low dissolved oxygen	8% of dissolved oxygen samples below 5.0 mg/L	50%	30-90% reduction in samples below 5.0 mg/L	Yes
Water Quality	Nutrients (phosphorous)	Observed and reported algae blooms	50%	112,300 lb/yr phosphorous	Unknown
Water Quality	Aquatic life toxicity (salinity / chlorides / total dissolved solids)	188 mg/L median chloride concentrations in water quality samples	25%	Estimate unavailable	Unknown
Water Quality	Fecal coliform (Lake Michigan beaches)	72 beach closures per year on average	50%	0-33% reduction in fecal coliform load	No
Habitat degradation and alteration	Lack of habitat characteristics	39% of stream reaches with fair or poor habitat conditions	25%	0-100% reduction in # of reaches with fair or poor instream habitat	Yes
Habitat degradation and alteration	Hydrologic disturbance / flow alterations / creek obstructions	Velocity variability of 0.0 - 4.06 f/s and flow variability of 0.2 - 688 cfs (2006-2007 data)	50%	0-66% reduction in flow variability	Yes
Habitat degradation and alteration	Draining, filling, and degradation of wetlands	1077 wetland acres needing restoration	90%	66-100% of wetlands restored	Yes
Habitat degradation and alteration	Exotic and invasive species	Observed and reported	25%	0-100%	Yes
Habitat degradation and alteration	Loss / reduction / degradation of natural buffer	43% of stream reaches with fair or poor riparian habitat	75%	0-100% reduction in # of reaches with fair or poor riparian habitat	Yes
Habitat degradation and alteration	Streamside alterations	43% of stream reaches with fair or poor riparian habitat	75%	0-66% reduction in # of reaches with fair or poor riparian habitat	No
Increased flood flows	Increased rate and volume of runoff	Velocity variability of 0.0 - 4.06 f/s and flow variability of 0.2 - 688 cfs (2006-2007 data)	75%	0-66% reduction in flow variability	No
Increased flood flows	Loss / drainage of depressional storage	Loss of 754 acres (70%) of wetlands	90%	0-100% wetlands restored / depressional areas preserved	Yes
Flood damages	Past encroachments on floodplain	292 structures in the floodplain	100%	0-66% of structures protected from flood damage	No

6.2.1 IMPAIRMENT REDUCTION TARGETS

Impairment Reduction Targets are indicated in two ways and are based on professional opinion of feasibility. First, Impairment Reduction Targets (shown in Table 6.3) indicate the potential reduction of the indicated impairment based on full (100%) implementation of the recommended action. For example, if all of the recommended actions intended to address sediment / Total Suspended Solids were to be fully implemented, then 75% of the sediment / Total Suspended Solids impairment, or problem, can reasonably be expected to be addressed. In other words, even under the best conditions, the entire sediment / Total Suspended Solids problem could not be addressed because there will always be some erosion and runoff of sediment from the urban landscape into the stream. Nonetheless, a 75% reduction in Total Suspended Solids / sediment loading would be a successful achievement for watershed improvement.

The second way that impairment reduction targets are indicated is displayed in the table included in Appendix K. Area Improvement Targets indicate the area that can reasonably be expected to be addressed by each of the recommended actions. For example, many of the wetland restoration recommendations have an Area Improvement Target of 75%, indicating that 75% of the wetland can reasonably be expected to be restored to a healthy condition. For wetlands, an improvement of 100% is considered unattainable given the hydrologic and stormwater issues of the watershed.

6.2.2 IMPAIRMENT REDUCTION PROJECTIONS

Impairment Reduction Projections are best estimates and/ or ranges of impairment reduction that can be achieved for recommended actions for the quantities (e.g., acres, linear feet of stream) indicated in Appendix K. Impairment reduction estimates, whether indicated as quantities, as ranges of percentages, or as an estimated ability to meet reduction targets, are based on a variety of studies examining the potential effectiveness of different actions and best management practices. Tables of results from the various studies are also included in Appendix K.

As shown in Table 6.3, impairment reduction projections are expected to meet or exceed eight of the 14 impairment reduction targets. Four of the impairment reduction targets are not expected to be adequately addressed by the recommendations. And, due to the lack of quantitative data, it is unknown whether the remaining two of the impairments will meet their reduction targets. Though the reduction targets may be difficult to meet for a number of the impairments, any and all reductions in impairment will improve watershed resources. In other words, every small effort and accomplishment helps.

6.3 PLAN IMPLEMENTATION COST ESTIMATE AND SCHEDULE

Implementation of this plan will require the development of partnerships with local, state, and federal organizations for implementation, technical assistance, and funding. These efforts require the investment of a significant amount of time and resources and, especially, funding. Table 6.4 summarizes the estimated amount of funding required for initial and ongoing implementation of the practices recommended in the action plan. Initial costs indicate cost for installation and/ or establishment; annual costs indicate cost for ongoing management and maintenance.

There are numerous sources of funds available to help support projects or provide cost-share to match other sources of funds. A list of numerous local, regional and state funding sources, and the types of projects funded under the various programs, is provided in Appendix L of the plan. Most of the programs require a local match of funds or in-kind services. Although these funding sources can provide a good 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.

Table 6.5 presents a summary of the plan implementation schedule. The number of short, medium, and long term actions are shown to give watershed plan implementors an idea of how many actions are recommended to be implemented in each of these time frames.

More detailed plan implementation cost and scheduling can be found in Appendix H Expanded Site Specific Action Plan and Appendix J Plan Implementation Cost Estimate. Potential fundiing sources for implementing plan recommendations are found in Appendix L.

USEPA watershed-based plan elements #4 and #6: technical and financial assistance needed to implement this plan, and plan implementation schedule (also see Appendices G, H and J).

Table 6.4 Plan Implementation Cost Estimate

SMU	Initial Cost	Ongoing Cost
1	$21,718,055	$3,455,321
2	$3,040,925	$167,575
3a	$4,142,400	$294,465
3b	$9,657,725	$708,730
3c	$9,515,812	$622,253
4	$3,659,800	$586,062
5	$4,567,025	$482,812
6	$275,575	$56,513
Total	$56,577,317	$6,373,732

Table 6.5 Plan Implementation Schedule Summary

Implementation Term	Number of Actions
Short	150
Short to Medium	103
Medium	9
Medium to Long	45
Short to Long	0
Long	18

6.4 PLAN MONITORING AND EVALUATION

6.4.1 MONITORING PLAN IMPLEMENTATION

Continued monitoring and analysis is critical for providing feedback on the progress of implementation of this Watershed-based Plan. The implementation and effectiveness of the watershed plan and recommendations, and an assessment of whether plan goals are being achieved, can be measured through a process called '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 6.6.

This monitoring strategy 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 basis or every three years. Progress on overall plan implementation should be reviewed using the milestones and indicators every 5 years and the plan should be updated as needed.

The following monitoring plan includes a monitoring baseline, frequency of monitoring, short, medium, and long term milestones, responsible party, and mode of collection. There are also empty columns for implementers to track the number of actions taken, location of implementation, and percentage complete. The empty cells of the table (number of actions, and location of implementation) are to be filled in by the parties responsible for monitoring as identified in the table. *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. *Percent complete* is a measure of progress toward the goal itself, where 100% would indicate the complete achievement of a goal.

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 (National Great Rivers Research & Education Center). 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.

6.4.2 EVALUATING PLAN PERFORMANCE

Watershed issues, opportunities, and conditions will change over time. This watershed plan should be evaluated and updated every five years to account for these changes. At each evaluation and update, completed projects can be removed from the plan and new projects should be added.

In addition to this 5-year update, plan implementation should be monitored annually by the Watershed Planning Committee or, if established, the watershed organization.

At the time of the annual evaluation, the committee should assess the list of priorities and identify the top priority actions for the following year.

As projects are implemented, they should be recorded using Table 6.6, which tracks the implementation of actions against the watershed plan goals and objectives as a means of monitoring watershed plan implementation.

6.4.3 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. Quality monitoring guidance and information needed to produce a QAPP can be found at www.epa.gov/quality.

Table 6.6 Monitoring Plan

Issue	Issue 1: Stream Restoration and Management	Issue 1: Stream Restoration and Management	Issue 1: Stream Restoration and Management	Issue 1: Stream Restoration and Management
Goal	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.
Objective	1. Remediate detrimental stream channel conditions such as armoring, channelization, siltation, and lack of habitat characteristics with in-stream and channel-specific restoration enhancements such as remeandering, regrading, bioengineering approaches to stabilization, and habitat structures (pools and riffles, boulders, root wads, etc.)	2. Remove or retrofit problem impoundments, dams, and weirs to support fish passage and migration and natural baseflow.	3. Stabilize all moderately and severely eroded streambanks using BMPs.	4. Reduce the erosive capacity of storm sewer outfalls, drain tiles, and sump pump, roof, and footing drains being discharged into the stream channel through on-site infiltration practices and outfall retrofit and stabilization projects.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration	Water Quality
Indicators	Number / linear feet of reaches with detrimental channel conditions that have been addressed by restoration efforts.	Number of fish found in upstream reaches; seasonally consistent baseflow.	Linear feet of streambanks with moderate or severe erosion that have been stabilized.	Number of problem point discharges that have been repaired or remediated.
Frequency of Monitoring	Every 3 years	Annual; daily (using LCHD sondes)	Every 3 years	Every 3 years
Baseline (2007)	0 lf / 0 reaches out of 69,200 lf / 27 reaches needing restoration	Baseline needs to be established by fish sampling in upstream reaches and identifying a current baseflow.	0 linear feet out of 44,600 lf total with moderate or severe erosion	0 point discharges out of 49 total point discharges needing attention
Short Term Milestones (2008-2013) (1-5 years)	10% restored (7000lf / 3 reaches)	10% increase in fish count; 10% greater stability in baseflow over previous 5 year period	10% (4500lf) of streambanks addressed	10% (5) of point discharges addressed
Mid Term Milestones (2013-2018) (5-10 years)	25% restored (17,300lf / 6 reaches)	25% increase in fish count; 10% greater stability in baseflow over previous 5 year period	25% (11,000lf) of streambanks addressed	25% (12) of point discharges addressed
Long Term Milestones (2018+) (10+ years)	100% restored (69,200 lf / 27 reaches)	100% increase in fish count; 10% greater stability in baseflow over previous 5 year period	100% (44,600lf) of streambanks addressed	100% (49) of point discharges addressed
Party Responsible for Monitoring	Municipality / Drainage District, LCSMC/ Watershed Planning Committee	IDNR, LCHD	Municipality / Drainage District, LCSMC/ Watershed Planning Committee	Municipality / Drainage District, LCSMC/ Watershed Planning Committee
Priority				
Mode of Collection	Visual / stream survey; homeowner / landowner contact and anecdotal reporting	Physical sampling using accepted protocols, e.g., IDNR Riverwatch program; streamflow monitoring data	Visual / stream survey; homeowner / landowner contact and anecdotal reporting	Visual / stream survey; homeowner / landowner contact and anecdotal reporting
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 1: Stream Restoration and Management	Issue 1: Stream Restoration and Management	Issue 1: Stream Restoration and Management	Issue 1: Stream Restoration and Management
Goal	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.
Objective	5. Expand and restore a native riparian buffer to protect the stream corridor from impacts of adjacent land uses and to support wildlife habitat.	6. Protect steep slopes and stream corridors with minimum setback requirements for land disturbance activities including new development, structures, and redevelopment of previously developed land.	7. Reduce sedimentation and channelization of stream reaches within Illinois Beach State Park to enhance instream habitat quality and support Lake Michigan aquatic species.	8. Beginning with downstream reaches, develop a stream restoration plan for each reach that suffers moderate to severe stream bank erosion
Impairments Addressed	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration
Indicators	Linear feet / acres of riparian buffer undergoing restoration efforts; average buffer width and condition.zv	Number of municipalities adopting setback requirements.	Improved in-stream habitat quality as reflected by IBI and MBI scores.	Number of reaches with moderate or severe erosion with restoration plans.
Frequency of Monitoring	Every 3 years	Every 3 years	Every 3 years	Every 3 years
Baseline (2007)	0 lf of riparian buffer out of 69,900 lf total stream length	Baseline needs to be established by surveying the three municipalities	Baseline needs to be established through biological survey	0 reaches / 18 reaches needing plans
Short Term Milestones (2008-2013) (1-5 years)	10% (7000 lf) of riparian buffer restored	1 municipality	Baseline biological indices established	10% (2) of reaches
Mid Term Milestones (2013-2018) (5-10 years)	25% (17,500lf) of riparian buffer restored	3 municipalities	Improvement trend established	25% (5) reaches
Long Term Milestones (2018+) (10+ years)	100% (69,900lf) of riparian buffer restored	3 municipalities	Improvement trend continued	100% (18) reaches
Party Responsible for Monitoring	Landowners, Municipalities	Municipalities, LCSMC	IDNR	Municipality / Drainage District, LCSMC/ Watershed Planning Committee
Priority				
Mode of Collection	Visual / stream survey; homeowner / landowner contact and anecdotal reporting	Contact municipal officials and staff and review policies and regulations	Physical sampling using accepted protocols, e.g., IDNR Riverwatch program	Internal audit / recordkeeping
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 1: Stream Restoration and Management	Issue 1: Stream Restoration and Management	Issue 1: Stream Restoration and Management
Goal	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.	Goal A: Restore and manage the stream system to protect and enhance stream and riparian health, function, and conveyance as part of a watershed green infrastructure system.
Objective	9. Develop a stream management and maintenance plan.	10. Develop a program with authority and funding to implement the stream management and maintenance plan.	11. Clear, repair, or replace blocked, damaged, eroding, and failing culverts, outfall pipes, discharge channels, and other stormwater infrastructure to maintain conveyance and reduce erosion and other impacts of an impaired or blocked stormwater system.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration	Water Quality; Flood Damages
Indicators	Development of stream maintenance plan that includes a schedule, proposed funding source, and implementation partner.	Number of stream reaches being addressed by a management and maintenance program.	Number of structures (culverts, outfalls, and headwalls) cleared, repaired, and replaced; number of blockages / debris jams removed
Frequency of Monitoring	Every 3 years	Every 3 years	Every 3 years
Baseline (2007)	No plan exists	No program exists	0 structures addressed out of 60 total; 0 debris obstructions cleared out of 28 total
Short Term Milestones (2008-2013) (1-5 years)	Plan underway	Program under development	10% (6) of structures; 10% (3) of debris obstructions addressed
Mid Term Milestones (2013-2018) (5-10 years)	Plan complete	Program in place	25% (15) of structures; 25% (7) of debris obstructions addressed
Long Term Milestones (2018+) (10+ years)	Plan complete	Program in place	100% (60) of structures; 100% (28) of debris obstructions addressed
Party Responsible for Monitoring	Municipality / Drainage District, LCSMC/ Watershed Planning Committee	Municipality / Drainage District, LCSMC/ Watershed Planning Committee	Municipality / Drainage District, LCSMC/ Watershed Planning Committee
Priority			
Mode of Collection	Internal audit / recordkeeping; contact public officials and staff	Internal audit / recordkeeping; contact public officials and staff; homeowner / landowner contact and anecdotal reporting	Visual / stream survey; homeowner / landowner contact and anecdotal reporting; internal audit / recordkeeping
Number of Actions			
Location of Implementation			
Percent Complete			

Table 6.6 Monitoring Plan (continued)

Issue	Issue 2: Flood Risk & Flood Damage	Issue 2: Flood Risk & Flood Damage	Issue 2: Flood Risk & Flood Damage	Issue 2: Flood Risk & Flood Damage
Goal	Goal B: Reduce flood damage and prevent increased flooding to protect public health & safety, and public and private property and infrastructure investments.	Goal B: Reduce flood damage and prevent increased flooding to protect public health & safety, and public and private property and infrastructure investments.	Goal B: Reduce flood damage and prevent increased flooding to protect public health & safety, and public and private property and infrastructure investments.	Goal B: Reduce flood damage and prevent increased flooding to protect public health & safety, and public and private property and infrastructure investments.
Objective	1. Maintain riparian and depressional floodplain and wetlands as open and undeveloped to maximize flood storage and conveyance.	2. Mitigate flood damages through floodproofing of at-risk structures.	3. Mitigate sanitary sewer backup flood damages through remediation / correction of infiltration and cross connections with sanitary sewer system.	4. Mitigate local drainage capacity flood damage by providing additional flood storage and or maintaining / improving local drainage system.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Flood Damages	Flood Damages	Increased Flood Flows; Flood Damages
Indicators	Number of new structures in the floodplain &/or number of floodplain or wetlands permits issued.	Number of flood damage reports; # of structures removed or floodproofed.	Number of flood damage reports; removal of FPA from inventory.	Number of flood damage reports; removal of FPA from inventory.
Frequency of Monitoring	Annual	Annual	Annual	Annual
Baseline (2007)	Baseline # of floodplain or wetland permits needs established	Baseline # of flood damage reports needs established; unknown # (10-year), 270 (100-year), and 682 (500-year) at-risk structures	1 FPAI site (20-06)	6 FPAI sites exist (20-13, 20-07, 20-02, 20-04, 20-05, 21-04)
Short Term Milestones (2008-2013) (1-5 years)	0 new structures and 10% fewer permits	10% fewer flood damage reports; 10% of structures removed or floodproofed.	1 FPAI site (20-06) removed from inventory; 0 additional FPAI sites	2 FPA sites removed from inventory
Mid Term Milestones (2013-2018) (5-10 years)	0 new structures and 50% fewer permits	50% fewer flood damage reports; 10% of structures removed or floodproofed.	0 additional FPAI sites	4 FPA site removed from inventory
Long Term Milestones (2018+) (10+ years)	0 new structures and 0 permits	75% fewer flood damage reports; 10% of structures removed or floodproofed.	0 additional FPAI sites	6 FPA sites removed from inventory
Party Responsible for Monitoring	LCSMC, Municipality	LCSMC, Municipality	LCSMC, Municipality, NSSD	LCSMC, Municipality / Drainage District
Priority				
Mode of Collection	Contact municipal officials and staff; internal audit / recordkeeping; review public land records; damage reporting	Damage reporting; homeowner / landowner contact and anecdotal reporting	Contact municipal officials and staff; damage reporting; homeowner / landowner contact and anecdotal reporting; agency contact	Contact municipal officials and staff; damage reporting; homeowner / landowner contact and anecdotal reporting; agency contact
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 3: Natural Resources and Habitat	Issue 3: Natural Resources and Habitat	Issue 3: Natural Resources and Habitat	Issue 3: Natural Resources and Habitat
Goal	Goal C: Protect, restore, and enhance a green infrastructure network of terrestrial and aquatic resources including streams, riparian corridors, wetlands, and upland resources.	Goal C: Protect, restore, and enhance a green infrastructure network of terrestrial and aquatic resources including streams, riparian corridors, wetlands, and upland resources.	Goal C: Protect, restore, and enhance a green infrastructure network of terrestrial and aquatic resources including streams, riparian corridors, wetlands, and upland resources.	Goal C: Protect, restore, and enhance a green infrastructure network of terrestrial and aquatic resources including streams, riparian corridors, wetlands, and upland resources.
Objective	1. Adopt and prioritize Green Infrastructure Plan elements and recommendations in local land use plans, policies, and maps to establish the community vision, direction, and intent.	2. Implement the Green Infrastructure Plan to guide prioritization, preservation, restoration, and management of important core and connecting green infrastructure elements and buffers.	3. Improve ecological and biological quality of aquatic and terrestrial natural resources by improving habitat characteristics, stabilizing watershed hydrology, improving water quality, and reducing coverage of exotic and invasive species.	4. Reduce shoreline / beach erosion in Illinois Beach State Park to protect rare community types and habitat for resident and migratory species.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows	Water Quality; Habitat Degradation and Alteration	Habitat Degradation and Alteration
Indicators	Number of municipalities adopting Green Infrastructure Plan elements into local land use plans, policies, and maps.	Acres of Category 1 or 2 Green Infrastructure parcels / linear feet of stream channel and buffer protected.	Biological survey data (MBI, IBI, and FQI scores).	Linear feet of shoreline lost or gained.
Frequency of Monitoring	Annual	Every 3 years	Annual	Annual
Baseline (2007)	0 municipalities	0 acres of prioritized parcels preserved.	Baseline needs to be established through biological survey	Baseline shoreline location to be established by IBSP / IDNR.
Short Term Milestones (2008-2013) (1-5 years)	1 municipality	10% of prioritized acres preserved	Baseline biological indices established	Less than 50% of historically eroding shoreline currently exhibiting erosion.
Mid Term Milestones (2013-2018) (5-10 years)	3 municipalities	25% of prioritized acres preserved	Improvement trend established	Less than 25% of historically eroding shoreline currently exhibiting erosion.
Long Term Milestones (2018+) (10+ years)	3 municipalities	100% of prioritized acres preserved	Improvement trend continued	Less than 10% of historically eroding shoreline currently exhibiting erosion.
Party Responsible for Monitoring	Municipality	Municipality, LCFPD, IDNR	LCFPD, IDNR	IDNR
Priority				
Mode of Collection	Contact municipal officials and staff; internal audit / recordkeeping	Contact municipal officials and staff; internal audit / recordkeeping; review public land records	Physical sampling using accepted protocols, e.g., IDNR Riverwatch program; wetland / natural area survey and monitoring	Embedded stakes to monitor Lateral Recession Rate; landowner / resource manager contact and anecdotal reporting;
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 3: Natural Resources and Habitat	Issue 3: Natural Resources and Habitat	Issue 4: Watershed Education and Communication	Issue 4: Watershed Education and Communication
Goal	Goal C: Protect, restore, and enhance a green infrastructure network of terrestrial and aquatic resources including streams, riparian corridors, wetlands, and upland resources.	Goal C: Protect, restore, and enhance a green infrastructure network of terrestrial and aquatic resources including streams, riparian corridors, wetlands, and upland resources.	Goal D: Watershed residents, students, and communities have adequate knowledge, skills, resources, assistance, and stewardship opportunities to implement the watershed plan.	Goal D: Watershed residents, students, and communities have adequate knowledge, skills, resources, assistance, and stewardship opportunities to implement the watershed plan.
Objective	5. Reduce the potential for contamination of Illinois Beach State Park, the Dead River, and Lake Michigan from the impacts of adjacent industrial land uses.	6. Remove barriers to fish and other species migration by restoring and enhancing hydrologic connections of streams to Lake Michigan.	1. Increase watershed stewardship (management, monitoring, and restoration) opportunities and participation by residents.	2. Increase public awareness and understanding of watershed issues by distributing watershed-related messages through public relations, outreach, and media vehicles.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration	Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages
Indicators	Sampling data, studies, and reports showing presence of contamination.	Number of hydrologic connections restored and maintained; number of fish found in upstream reaches.	Number of watershed stewardship opportunities and participants; number of stream reaches covered by a stewardship group.	Number of placements and mentions in local and regional media.
Frequency of Monitoring	Every 5 years	Annual	Annual	Annual
Baseline (2007)	Contaminated material exists on IBSP property	0 hydrologic connections restored out of X; baseline needs to be established by fish sampling in upstream reaches.	Baseline # of stewardship opportunities and participants needs established; 0 stream reaches covered by stewardship group	Baseline # of mentions needs to be established.
Short Term Milestones (2008-2013) (1-5 years)	On average, 25% less contaminated material exsits, by weight	1 hydrologic connection restored; 10% increase in fish count	3 stewardship opportunities and 50 participants per year; 10% (3) of reaches covered	5 mentions per year
Mid Term Milestones (2013-2018) (5-10 years)	On average, 50% less contaminated material exsits, by weight	2 hydrologic connections restored; 25% increase in fish count	6 stewardship opportunities and 100 participants per year; 25% (7) reaches covered	10 mentions per year
Long Term Milestones (2018+) (10+ years)	On average, 75% less contaminated material exsits, by weight	100% of hydrologic connections restored; 100% increase in fish count	10 stewardship opportunities and 150 participants per year; 75% (21) reaches covered	20 mentions per year
Party Responsible for Monitoring	IDNR, USEPA / IEPA, Watershed Planning Committee	IDNR	LCSMC / Watershed Planning Committee, IDNR	LCSMC / Watershed Planning Committee
Priority				
Mode of Collection	Physical sampling using accepted protocols; landowner / resource manager contact and anecdotal reporting; agency contact	Visual / stream survey; landowner / resource manager contact and anecdotal repoting;	Watershed event reports; review volunteer and monitoring databases; internal audit recordkeeping	Internal audit / recordkeeping; news clipping service
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 4: Watershed Education and Communication	Issue 4: Watershed Education and Communication	Issue 5: Water Quality	Issue 5: Water Quality
Goal	Goal D: Watershed residents, students, and communities have adequate knowledge, skills, resources, assistance, and stewardship opportunities to implement the watershed plan.	Goal D: Watershed residents, students, and communities have adequate knowledge, skills, resources, assistance, and stewardship opportunities to implement the watershed plan.	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.
Objective	3. Provide technical assistance to watershed communities, the development community, and stakeholders to help them implement watershed plan recommendations.	4. Increase technical knowledge and understanding of alternative development approaches by distributing conservation-oriented / Low Impact Development (LID) land use planning and development guidelines and practices information to public entities.	1. All watershed streams and lakes meet or exceed state water quality standards.	2. Reduce non-point source pollution loading from existing and new development by controlling inputs at the source / on site using BMPs.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Water Quality	Water Quality
Indicators	Number of brochures, information packets, and other educational materials distributed; number of participants in technical workshops.	Number of local government officials and staff participating in LID workshops; number of permits / acres of conservation development approved as compared to conventional development.	Water quality monitoring data (Phosphorous < 0.05 mg/L; Dissolved oxygen > 5.0 mg/L; Index of Biotic Integrity (IBI) > 30; Macroinvertebrate Biotic Index (MBI) < 6.0; Trophic State Index < 70 (Sand Pond))	Water quality monitoring data (DO, phosphorous, TSS); acres / linear feet of BMPs installed.
Frequency of Monitoring	Annual	Annual	Annual	Annual
Baseline (2007)	0 educational materials currently distributed; baseline # needed for participants in technical workshops	0 local government officials and staff participating in LID workshops; 0 permits / acres of conservation development approved	P (no baseline); DO=7.58 (two-year mean); baseline needs to be established for biological indices	P (no baseline); DO=7.58 (two-year mean); Turbidity (as proxy for TSS)=14.3 NTU; 0 acres / lf of BMPs installed
Short Term Milestones (2008-2013) (1-5 years)	500 educational material packets distributed per year; 10 participants in technical workshops per year	5 local government participants in LID workshops per year; 1 permit / 10 acres of conservation development approved	P=0.5 mg/L or less; DO=8.0 (two-year mean); baseline biological indices established	P=0.5 mg/L or less; DO=8.0 (two-year mean); Turbidity (as proxy for TSS)=12.9 NTU (10% improvement); 5 acres / 1000 lf of BMPs installed
Mid Term Milestones (2013-2018) (5-10 years)	1000 educational material packets distributed per year; 25 participants in technical workshops per year	15 local government participants in LID workshops per year; 3 permits / 50 acres of conservation development approved	P=0.25 mg/L or less; DO=8.25 (two-year mean); improvement trend established for biological indices	P=0.25 mg/L or less; DO=8.25 (two-year mean); Turbidity (as proxy for TSS)=10.7 NTU (25% improvement); 10 acres / 5000 lf of BMPs installed
Long Term Milestones (2018+) (10+ years)	2000 educational material packets distributed per year; 50 participants in technical workshops per year	25 local government participants in LID workshops per year; 5 permits / 100 acres of conservation development approved	P=0.1 mg/L or less; DO=8.5 (two-year mean); improvement trend established for biological indices	P=0.1 mg/L or less; DO=8.5 (two-year mean); Turbidity (as proxy for TSS)=1.4 NTU (90% improvement); 20 acres / 10,000 lf of BMPs installed
Party Responsible for Monitoring	LCSMC / Watershed Planning Committee	LCSMC / Watershed Planning Committee, Municipality	LCHD, IEPA	Municipality, LCSMC
Priority				
Mode of Collection	Watershed workshop / event reports; internal audit / recordkeeping	Watershed workshop / event reports; contact municipal officials and staff; review policies and regulations; review public land records; internal audit / recordkeeping	Physical / chemical sampling and / or lab analysis using accepted protocols, e.g., IDNR Riverwatch program	Physical / chemical sampling and / or lab analysis using accepted protocols, e.g., IDNR Riverwatch program; homeowner / landowner contact and anecdotal reporting; contact municipal officials and staff
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 5: Water Quality	Issue 5: Water Quality	Issue 5: Water Quality	Issue 5: Water Quality
Goal	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.
Objective	3. Prevent erosion from construction sites to reduce total suspended solids.	4. Prevent erosion and flow of agricultural and golf course chemicals (fertilizers and pesticides) from farmland, golf courses, parks and yards into streams and wetlands by reducing / controlling inputs at the source using BMPs.	5. Prevent dumping of inappropriate substances (e.g., yard waste, garbage, household or automotive fluids, etc.) within the stream channel, riparian corridor, and stormsewer network.	6. Reduce fecal coliform contamination on Lake Michigan beaches / nearshore waters by controlling gull populations and other contributing sources.
Impairments Addressed	Water Quality	Water Quality	Water Quality; Habitat Degradation and Alteration	Water Quality
Indicators	Water quality monitoring data (TSS); construction site inspection reports showing violations of SESC standards.	Water quality monitoring data (DO, phosphorous); acres / linear feet of BMPs installed.	Illicit Discharge Detection and Elimination reports.	Number of beach closures.
Frequency of Monitoring	Annual	Annual	Annual	Annual
Baseline (2007)	Turbidity (as proxy for TSS)=14.3 NTU; 0 construction site inspection reports	P (no baseline); DO=7.58 (two-year mean); Turbidity (as proxy for TSS)=14.3 NTU; 0 acres / lf of BMPs installed	Baseline needs to be established	72 total beach closures per year (5 year average 2002-2006)
Short Term Milestones (2008-2013) (1-5 years)	Turbidity (as proxy for TSS)=12.9 NTU (10% improvement); 5 or fewer construction site inspection reports per year showing violations	P=0.5 mg/L or less; DO=8.0 (two-year mean); Turbidity (as proxy for TSS)=12.9 NTU (10% improvement); 5 acres / 1000 lf of BMPs installed	5 or fewer IDDE reports	60 total beach closures per year (5 year average)
Mid Term Milestones (2013-2018) (5-10 years)	Turbidity (as proxy for TSS)=10.7 NTU (25% improvement); 3 or fewer construction site inspection reports per year showing violations	P=0.25 mg/L or less; DO=8.25 (two-year mean); Turbidity (as proxy for TSS)=10.7 NTU (25% improvement); 10 acres / 5000 lf of BMPs installed	3 or fewer IDDE reports	45 total beach closures per year (5 year average)
Long Term Milestones (2018+) (10+ years)	Turbidity (as proxy for TSS)=1.4 NTU (90% improvement); 0 construction site inspection reports per year showing violations	P=0.1 mg/L or less; DO=8.5 (two-year mean); Turbidity (as proxy for TSS)=1.4 NTU (90% improvement); 20 acres / 10,000 lf of BMPs installed	0 IDDE reports	25 total beach closures per year (5 year average)
Party Responsible for Monitoring	Municipality, LCSMC	Landowner, Municipality	?	LCHD, IEPA
Priority				
Mode of Collection	Physical / chemical sampling and / or lab analysis using accepted protocols, e.g., IDNR Riverwatch program; municipal and agency contact / reports; internal audit / recordkeeping	Physical / chemical sampling and / or lab analysis using accepted protocols, e.g., IDNR Riverwatch program; homeowner / landowner contact and anecdotal reporting; contact municipal officials and staff	Contact municipal officials and staff; internal audit recordkeeping	Agency contact / recordkeeping
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 5: Water Quality	Issue 5: Water Quality	Issue 5: Water Quality	Issue 5: Water Quality
Goal	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.	Goal E: Improve water quality in streams, lakes, and wetlands by reducing the impacts of land use and development, land management, and modified hydrology.
Objective	7. Restore natural hydrology and baseflow to address low dissolved oxygen, water temperature, and streambank erosion impacts.	8. Develop and implement a watershed monitoring program to collect and monitor water quality and biological data on a regular basis.	9. Retrofit existing stormwater management structures such as detention ponds and roadside swales to improve water quality.	10. Reduce or modify the use / application of road salt and other chemicals for snow and ice management to reduce the impact of chlorides and toxic substances on water quality
Impairments Addressed	Water Quality; Habitat Degradation and Alteration	Water Quality; Habitat Degradation and Alteration	Water Quality	Water Quality
Indicators	Water quality monitoring data (flow, temperature, and DO).	Established monitoring program; record of monitored data.	Number / acres of retrofitted detention basins; linear feet of improved roadside swale.	Water quality monitoring data (specific conductivity)
Frequency of Monitoring	Annual	Every 3 years	Every 3 years	Annual
Baseline (2007)	DO=7.58 (two-year mean); baseflow baseline needs to be established; 14.96°C (two-year mean)	No data exists for biological measures; hydrologic and water quality data has been collected consistently (spring through fall) for 2006-07; 0 watershed plan recommendations implemented.	35 detention basins needing attention; 1,043,400 lf of swale targeted for improvement	0.93 mS/cm (two-year mean)
Short Term Milestones (2008-2013) (1-5 years)	DO=8.0 (two-year mean); 10% greater stability in baseflow over previous 5 year period; 14.0°C (two-year mean)	4 years of consistently collected biological, hydrologic, and water quality data; 10 watershed recommendations implemented	5 detention basins addressed; 25,000 lf of swale improved	0.8 mS/cm (10% improvement)
Mid Term Milestones (2013-2018) (5-10 years)	DO=8.25 (two-year mean); 10% greater stability in baseflow over previous 5 year period; 13.5°C (two-year mean)	8 years of consistently collected biological, hydrologic, and water quality data; 25 watershed recommendations implemented	10 detention basins addressed; 50,000 lf of swale improved	0.7 mS/cm (25% improvement)
Long Term Milestones (2018+) (10+ years)	DO=8.5 (two-year mean); 10% greater stability in baseflow over previous 5 year period; 13°C (two-year mean)	20 years of consistently collected biological, hydrologic, and water quality data; 50 watershed recommendations implemented	20 detention basins addressed; 100,000 lf of swale improved	0.1 mS/cm (90% improvement)
Party Responsible for Monitoring	LCHD, IEPA	LCSMC / Watershed Planning Committee	Municipality / Drainage District, LCSMC	LCHD, IEPA
Priority				
Mode of Collection	Physical / chemical sampling and / or lab analysis using accepted protocols, e.g., IDNR Riverwatch program; streamflow monitoring data	Physical / chemical sampling and / or lab analysis using accepted protocols, e.g., IDNR Riverwatch program	Contact municipal officials and staff; internal audit recordkeeping; homeowner / landowner contact	Physical / chemical sampling and / or lab analysis using accepted protocols
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 6: Watershed Coordination	Issue 6: Watershed Coordination	Issue 6: Watershed Coordination	Issue 6: Watershed Coordination
Goal	Goal F: Improve coordination, research, and decision-making between public, private, and non-profit entities to help achieve watershed plan goals and objectives.	Goal F: Improve coordination, research, and decision-making between public, private, and non-profit entities to help achieve watershed plan goals and objectives.	Goal F: Improve coordination, research, and decision-making between public, private, and non-profit entities to help achieve watershed plan goals and objectives.	Goal F: Improve coordination, research, and decision-making between public, private, and non-profit entities to help achieve watershed plan goals and objectives.
Objective	1. Pursue cross-jurisdictional cost-sharing arrangements for projects with multi-jurisdictional benefits and impact.	2. Establish a watershed organization or council with funding and support to guide watershed plan implementation and provide assistance to watershed stakeholders.	3. Adopt, strengthen, and enforce ordinances and guidelines intended to protect watershed resources.	4. Understand and minimize detrimental impact of local land use decisions on watershed resources.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages
Indicators	Number of projects funded by multiple jurisdictions.	Establishment of lead organization with budget and executive committee; number of projects undertaken under the auspices of the watershed organization.	Number of communities adopting, strengthening, and enforcing protective ordinances and guidelines.	Number of communities using LID and conservation-oriented approaches to development.
Frequency of Monitoring	Every 3 years	Annual	Every 3 years	Every 3 years
Baseline (2007)	Baseline average # of multi-jurisdictional projects needs to be established	No organization exists; 0 projects	Baseline is current set of municipal ordinances and guidelines	0 municipalities using LID approaches to development
Short Term Milestones (2008-2013) (1-5 years)	2 multi-jurisdictional projects per year	Organization established; 3 projects undertaken	1 municipality has strengthened guidelines	1 municipality using LID approaches to development
Mid Term Milestones (2013-2018) (5-10 years)	5 multi-jurisdictional projects per year	Organization established; 10 projects undertaken	3 municipalities have strengthened guidelines	3 municipalities using LID approaches to development
Long Term Milestones (2018+) (10+ years)	10 multi-jurisdictional projects per year	Organization established; 25 projects undertaken	3 municipalities have strengthened guidelines	3 municipalities using LID approaches to development
Party Responsible for Monitoring	Municipality, LCSMC/ Watershed Planning Committee	LCSMC/ Watershed Planning Committee	Municipality, LCSMC/ Watershed Planning Committee	Municipality, LCSMC/ Watershed Planning Committee
Priority				
Mode of Collection	Contact municipal officials and staff; internal audit / recordkeeping; agency contact	Internal audit / recordkeeping	Contact municipal officials and staff; review policies and regulations; internal audit / recordkeeping	Contact municipal officials and staff; review policies and regulations; internal audit / recordkeeping
Number of Actions				
Location of Implementation				
Percent Complete				

Table 6.6 Monitoring Plan (continued)

Issue	Issue 6: Watershed Coordination	Issue 6: Watershed Coordination	Issue 6: Watershed Coordination
Goal	Goal F: Improve coordination, research, and decision-making between public, private, and non-profit entities to help achieve watershed plan goals and objectives.	Goal F: Improve coordination, research, and decision-making between public, private, and non-profit entities to help achieve watershed plan goals and objectives.	Goal F: Improve coordination, research, and decision-making between public, private, and non-profit entities to help achieve watershed plan goals and objectives.
Objective	5. Help communities and stakeholders secure project funding by disseminating information to communities and stakeholders on funding sources and mechanisms for implementing watershed projects.	6. Incorporate watershed improvement elements into local government ongoing management, maintenance, and infrastructure projects (i.e. streets, the manmade drainage system etc.)	7. Understand and track watershed conditions by monitoring watershed resources and trends (hydrologic, biologic, and water quality) and implementation of plan recommendations.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages
Indicators	Number of communities receiving funding for watershed improvement projects; funding amount secured; number of projects installed / undertaken.	Number of communities adding watershed improvement practices and functions to ongoing activities, plans, and budgets.	Watershed monitoring data; years of data collected; number of recommendations implemented.
Frequency of Monitoring	Annual	Every 3 years	Annual
Baseline (2007)	Baseline assumed to be 0 municipality; 0 funding secured; and 0 projects	Baseline assumed to be 0 municipalities	No data exists for biological measures; hydrologic and water quality data has been collected consistently (spring through fall) for 2006-07; 0 watershed plan recommendations implemented.
Short Term Milestones (2008-2013) (1-5 years)	1 municipality; $50,000 secured; 5 projects installed	1 municipality	4 years of consistently collected biological, hydrologic, and water quality data; 10 watershed recommendations implemented
Mid Term Milestones (2013-2018) (5-10 years)	3 municipalities; $100,000 secured; 10 projects installed	3 municipalities	8 years of consistently collected biological, hydrologic, and water quality data; 25 watershed recommendations implemented
Long Term Milestones (2018+) (10+ years)	3 municipalities; $150,000 secured; 15 projects installed	3 municipalities	20 years of consistently collected biological, hydrologic, and water quality data; 50 watershed recommendations implemented
Party Responsible for Monitoring	Municipality, LCSMC/ Watershed Planning Committee	Municipality, LCSMC/ Watershed Planning Committee	LCSMC/ Watershed Planning Committee
Priority			
Mode of Collection	Contact municipal officials and staff; internal audit / recordkeeping; agency contact	Contact municipal officials and staff; review plans, policies and regulations; internal audit / recordkeeping	Review volunteer and monitoring databases; internal audit / recordkeeping
Number of Actions			
Location of Implementation			
Percent Complete			

Table 6.6 Monitoring Plan (continued)

Issue	Issue 7: Watershed Hydrology	Issue 7: Watershed Hydrology	Issue 7: Watershed Hydrology	Issue 7: Watershed Hydrology
Goal	Goal G: Restore and enhance watershed hydrology and stabilize the stream systems by reducing surface runoff.	Goal G: Restore and enhance watershed hydrology and stabilize the stream systems by reducing surface runoff.	Goal G: Restore and enhance watershed hydrology and stabilize the stream systems by reducing surface runoff.	Goal G: Restore and enhance watershed hydrology and stabilize the stream systems by reducing surface runoff.
Objective	1. Reduce/minimize the rate and volume of runoff from the developed and developing landscape by installing urban BMPs.	2. Protect, restore and enhance overland flow paths.	3. All new development incorporates conservation design and LID practices to minimize changes / maintain pre-development hydrology and minimize impervious cover.	4. Restore natural hydrologic regime to watershed wetlands, Illinois Beach State Park, Spring Bluff Nature Preserve, Lyons Woods Forest Preserve, and other natural areas.
Impairments Addressed	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Increased Flood Flows	Water Quality; Habitat Degradation and Alteration; Increased Flood Flows; Flood Damages	Water Quality; Habitat Degradation and Alteration
Indicators	Average difference between maximum and minimum flow rate; peak flow data / hydrographs showing reduction in peak flows for the 1-year event; change in rainfall event attenuation time; reduction in stream flow for a given rainfall event.	Change in rainfall event attenuation time.	Number of stormwater management plans demonstrating maintenance of pre-development hydrology as compared to number of development applications; percentage of impervious cover in watershed.	Natural area management and monitoring reports and FQI scores.
Frequency of Monitoring	Annual	Annual	Annual	Every 3 years
Baseline (2007)	203 cfs	Baseline needs to be established.	0 stormwater plans demonstrate maintenance of pre-development hydrology; XX% watershed imperviousness.	Baseline FQI for each natural area needs establishment.
Short Term Milestones (2008-2013) (1-5 years)	182.7 cfs (10% decrease)	10% increase in rainfall event attenuation time.	100% of stormwater plans demonstrate maintenance of pre-development hydrology; no increase in watershed imperviousness.	Increase by 1 point in FQI score
Mid Term Milestones (2013-2018) (5-10 years)	152.3 cfs (25% decrease)	25% increase in rainfall event attenuation time.	100% of stormwater plans demonstrate maintenance of pre-development hydrology; 5% reduction in watershed imperviousness.	Increase by 1.5 points in FQI score
Long Term Milestones (2018+) (10+ years)	20.3 cfs (90% decrease)	90% increase in rainfall event attenuation time.	100% of stormwater plans demonstrate maintenance of pre-development hydrology; 10% reduction in watershed imperviousness.	Increase by 2 points in FQI score
Party Responsible for Monitoring	Municipality, LCSMC/ Watershed Planning Committee	Municipality	Municipality, LCSMC/ Watershed Planning Committee	LCFPD, IDNR, Muncipalities
Priority				
Mode of Collection	Streamflow monitoring data	Streamflow monitoring data	Contact municipal officials and staff; internal audit / recordkeeping; review plans, policies, and regulations	Landowner / resource manager contact; wetland / natural areas survey and monitoring
Number of Actions				
Location of Implementation				
Percent Complete				

7

watershed resources

7 watershed resources

Watershed resources include public agencies and private organizations that provide funding and technical assistance to watershed stakeholders seeking to improve watershed resources. These organizations are often willing to cooperate on projects for restoration, environmental education, and other types of projects. Some assistance is provided after an application process selects appropriate and eligible projects, and applicants are often better positioned to be awarded assistance for projects that involve multiple partners, that leverage other funding, and that achieve multiple environmental or community benefits. Almost any land or water conservation project ultimately requires the support of those who live nearby if it is to be successful over the long run. Local neighborhood associations, homeowner associations, and similar groups interested in open space, preventing sprawl or protecting wildlife habitat and scenic vistas, make the best partners for specific projects.

The programs described in the following pages do not include all possible partners and/or sources of available assistance. Rather, they are programs deemed most promising for restoration projects included in the Action Plan. Many watershed stakeholders will perform regulatory roles in implementation of the Watershed Plan, and as such, are excellent starting points for securing assistance.

7.1 WHO TO CALL

The following list provides information on who to contact for a particular watershed related issue or concern.

Municipalities: Beach Park, 847-746-1770; Waukegan, 847-599-2500; Winthrop Harbor, 847-872-3846; Zion, 847-746-4000.
Usually have staff or budget through public works to handle common problems; have authority to enter lands to remove blockages even outside own boundaries. Call when issues relate to: Lot and Neighborhood level drainage concerns; Emergency response: sandbags, evacuation procedures; Construction site soil erosion and sediment control problems in incorporated areas..

Townships: Benton Township Highway Department, 847-746-2070; Waukegan Township Highway Department, 847-662-7280; Zion Township (No Highway Department), 847-872-2811
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. Call when issues relate to: Drainage concerns are within the right-of-way of a township road.

Beach Park Drainage District, 847-623-6661
Provides information, technical assistance; field staff may be available for site visits in cases of severe drainage, soil erosion. Call when issues relate to: Problem associated with drainage ditches and streams within a drainage district.

Lake County Stormwater Management Commission, 847-918-5260, www.co.lake.il.us/smc
The Lake County SMC relies on other governmental units to respond to smaller scale problems; has field staff to investigate drainage complaints and construction-related water quality concerns in non-certified communities; funding available for repair or maintenance of drainage facilities and drainage problems; flood insurance, flood safety, floodplain management and flood hazard maps; compiles drainage data for watershed planning and should be notified by Certified Communities of major problems. Call when issues relate to: Neighborhood, watershed or regional scale problems; Interjurisdictional issues; Involves a violation of the Lake County Watershed Development Ordinance [related to new development and in non-certified communities].

Lake County Planning, Building, & Development Department, Engineering and Environmental Services Division (E&ES), 847-377-2600
The Lake County PB&D has field staff to inspect and respond to drainage and water quality 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. Call when issues relate to: Construction site soil erosion and sediment control problems in Unincorporated Lake County; Complaint is on a parcel located in an unincorporated area; Drainage

complaints, erosion control, Site Development Permits; Individual, neighborhood, watershed scale problems; Involves a violation of the Lake County Unified Development Ordinance (related to older or new development).

Lake County Forest Preserve District (LCFPD), 847-367-6640
Handles issues related to Lyon's Woods Forest Preserve, Spring Bluff Forest Preserve, Thunderhawk Golf Course Forest Preserve; Lake County Forest Preserve properties and programs; Technical assistance for vegetative issues in natural areas; Volunteer opportunities.

Lake County Health Department Lakes Management Unit, 847-377-8020
Provides technical and educational services and expertise essential to the management and protection of Lake County surface waters to maintain or improve water quality, promote healthy and safe lake conditions, and protect and improve ecological diversity. Call when issues relate to: Lake Michigan beaches.

Lake County Division of Transportation (LCDOT), 847-362-3950
Maintains all bridges, culverts and ditches within the ROW of county highway signs signified by blue and gold route markers saying Lake County. Call when issues relate to: Bridges, culverts, and ditches located within the right-of-way of county roads.

Lake County Emergency Management Agency (LCEMA), 847-377-7100
Primarily responsible for emergency services in a disaster; works closely with local EMA coordinators during a disaster/flood event. Refer requests for sandbags and evacuation procedures to local municipality or to township; does not distribute insurance claims. Call when issues relate to: Municipal EMA coordinators and township officials coordinate request for sandbags and evacuation procedures.

Lake County Soil and Water Conservation District (SWCD), 847-223-1056
Agricultural, urban, and water body-related technical guidance; Provides technical assistance, education, and information on cost-share programs; field staff may make site visits to evaluate complex problems, can prepare Natural Resource Inventories for a property; Will do a certified wetland determination on farm land; Conservation planning on private lands; Provides residents with native plants and fish in an annual sale event. Call when issues relate to: Technical assistance on soil erosion and natural resource issues; Educational assistance in the form of workshops, presentations, brochures, pamphlets, and handouts; Federal and state available cost-share programs; Erosion concerns in agricultural and urban areas.

Illinois Environmental Protection Agency, 217-782-0610 or 847-294-4000
Enforce stormwater pollution prevention plan on development sites greater than 1 acre in size; address contaminant spills, point source discharges, etc. Call when issues relate to: Water pollution problems.

Illinois Department of Natural Resources (IDNR), Illinois Beach State Park, 847-662-4811, Region 2 Headquarters, 847-608-3100
Call when issues relate to: State natural areas; Wildlife and fisheries; Regulatory requirements.

Illinois Dunesland Preservation Society, 312-332-3377
Co-founder of Illinois Beach State Park now deals with stewardship and contamination-related issues. Call when issues relate to: Illinois Beach State Park contamination and clean up.

Lake County Land Conservancy, 847-356-6001
Protects and manages natural and open lands in Lake County. Call when issues relate to: open space preservation and conservation easements.

Liberty Prairie Conservancy, 847-548-5989
Preserves open space and restores natural areas in Lake County. Call when issues relate to: open space preservation and conservation easements.

North Shore Sanitary District, 847-623-6060
Manages sanitary sewer lines and pumping stations which collect and convey wastewater from local sewer systems

to wastewater treatment plants. Call when issues relate to: sanitary sewer system problems such as back ups, exposed sewer lines, and overflows / discharges into watershed streams and wetlands.

Waukegan Harbor Citizens Advisory Group, WaukeganHarborCAG@email.com
Represents the community and assumes a leadership role in developing a remedial action plan for contamination issues in and around the Waukegan Harbor Area of Concern. Call when issues relate to: Waukegan Harbor and surrounding industrial land use area.

Alliance for the Great Lakes, 312-939-0838
Works to conserve and restore the world's largest freshwater resource through policy, education and local efforts aimed at preserving the Great Lakes. Program areas include water quality, water conservation, habitat, land use, clean energy, and education and outreach. Call when issues relate to: Lake Michigan.

U.S. Army Corps of Engineers, 312-353-6400
Requires consultation for activities within most wetlands and may refer some questions to LCSMC. Call when issues relate to: Wetlands.

Waukegan Harbor Citizens Advisory Group (CAG)
Box 297, Waukegan, IL 60079, WaukeganHarborCAG@email.com.
Works on issues related to the Waukegan Harbor Area of Concern and surrounding areas.

Alliance for the Great Lakes, 312-939-0838
Works on a variet of Great Lakes issues including water quality, water conservation, habitat recovery, land use, clean energy, and education and outreach.

7.2 FUNDING AND TECHNICAL ASSISTANCE

The list of potential funding and technical assistance sources is compiled from a variety of sources and is accurate as of 2007. Funding and program availability are contingent upon federal, state, and local budgets and appropriations for the budget year in which funding is being sought. Contact the program representative for updates or changes to program details.

U.S. Environmental Protection Agency (USEPA) issues federal environmental regulations, enforces federal environmental law, and manages a number of grant programs.

- Clean Water Act Section 319 Grants provide funding for implementing corrective and preventative best management practices on a watershed scale, for the demonstration of innovative BMPs on a sub-watershed scale, and the development of information and education non point source pollution control programs. Administered by Illinois EPA.

Eligibility: State and local governments, nonprofits, individuals, businesses.
Assistance: Federal cost share at 60 percent maximum.
Website:http://www.epa.state.il.us/water/financial-assistance/non-point.html.
Contact: Illinois EPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois, 62794-9276. Phone: 217-782-3397.

- Clean Water State Revolving Loan Funds (SRF), initially designed for wastewater treatment plant upgrades, supports watershed and non-point source control measures. These can include projects such as agricultural and urban runoff control, wet weather flow control including stormwater and sewer overflows, buffers, wetland protection, habitat restoration, and community-based comprehensive watershed management. Currently IEPA targets SRF funding to point source pollution control, i.e., upgrading wastewater infrastructure, but there has been discussion of setting aside some SRF funds for non-point source control programs.

Eligibility: State and local governments, nonprofits, individuals, businesses.
Assistance: Funds projects at 100 percent at a national

average interest rate of 2.2 percent, subject to change.
Website: http://www.epa.gov/owmitnet/cwfinance/cwsrf/.
Contact: Illinois EPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois, 62794-9276. Phone: 217-782-3397.

- Five Star Restoration Challenge Grants bring together citizen groups, corporations, youth groups and students, landowners, and government agencies to undertake projects that restore streambanks and wetlands. Projects must include a strong wetland or riparian restoration component, and should also include education, outreach, and community stewardship. Jointly administered by the National Fish and Wildlife Foundation, the National Association of Counties, and the Wildlife Habitat Council, and mainly funded by USEPA.
Eligibility: Requires at least five or more partnering organizations.
Assistance: $5,000 to $20,000 with a 1 to 1 match requirement.
Website: http://www.nfwf.org/programs/5star-rfp.htm http://www.epa.gov/owow/wetlands/restore/5star/.
Contact: USEPA Wetlands Division, Room 6105 (4502 T), 1200 Pennsylvania Avenue, NW, Washington, DC. Email: price.myra@epa.gov.

- Water Quality Cooperative Agreements assist public or nonprofit organizations in developing, implementing, and demonstrating innovative that reduce wastewater related pollution. Primarily meant to fund exemplary projects, e.g., new BMPs, that increase and transfer knowledge. Not to be used for land acquisition and development.
Eligibility: States, public agencies, and nonprofit organizations.
Assistance: $10,000 to $500,000 with no local match requirement, although match offers are considered during evaluation.
Website: http://www.epa.gov/owm/wqca/2004.htm
Contact: USEPA Region 5, 77 W. Jackson Blvd. Chicago, IL 60604. Phone: 312-353-4378.

- Wetland Program Development Grants support strengthening state comprehensive wetland programs, developing a comprehensive wetland monitoring and assessment program, improving the effectiveness of compensatory mitigation, and refining the protection of vulnerable wetlands and aquatic resources.
Eligibility: States, local governments, public agencies, and interstate agencies.
Assistance: $50,000 to $420,000 grants with 25 percent local match requirement.
Website: http://www.epa.gov/owow/wetlands/grantguidelines/.
Contact: US EPA Region 5, 77 West Jackson Blvd., Chicago, IL, 60604. Phone: 312-886-0241 Email: garra.catherine@epa.gov.

- Assessment and Watershed Protection Program Grants help to develop innovative approaches to watershed protection, make a contribution to the body of restoration and management techniques, and transfer knowledge. Application of established techniques may be funded if doing so would contribute to the general understanding of an environmental problem.
Eligibility: States, local governments, public agencies, nonprofit organizations, individuals.
Assistance: $5,000 to $80,000 with no local match requirement, although match offers are considered during evaluation as 10 percent of the ranking.
Website: http://www.epa.gov/owow/funding.html.
Contact: USEPA Office of Wetlands, Oceans, and Watersheds, 1200 Pennsylvania Avenue, N.W., Washington, D.C. 20460. Phone: 202-566-1211, 202-566-1206.

- Targeted Watersheds Grants Program (formerly Watershed Initiative) funds projects that demonstrate innovative approaches to watershed restoration with an emphasis on inter-organizational collaboration, market-based techniques, and demonstrable environmental improvement. Does not support activities directly required under the Clean Water Act.
Eligibility: Any public entity, but must be nominated by the state.
Assistance: $600,000 to $900,000 with 25 percent local match required.
Website: http://www.epa.gov/owow/watershed/initiative/.
Contact: USEPA Region 5, 77 W. Jackson Blvd. Chicago, IL 60604. Phone: 312-886-7742. Email: thomas.paul@epa.gov.

- State Wetlands Protection Grants support development of new wetland protection, management, and restoration programs or refine existing programs. Grants can finance monitoring, assessment, and river corridor restoration.
Eligibility: State governments, local governments, and special districts.
Assistance: Federal–local cost share at 75 percent federal funding.
Website: http://www.epa.gov/region5/business/fs-swpg.htm.
Contact: USEPA Region 5, Water Division, 77 W. Jackson Blvd. Chicago, IL 60604. Phone: 312-886-0241.

- The Illinois Clean Lakes Program grant program supports lake owners' interest and commitment to long-term, comprehensive lake management. Detailed diagnostic/ feasibility studies scientifically document the causes, sources and magnitude of lake impairment (Phase I). Data generated from these monitoring studies are used to recommend lake protection/ restoration practices for future implementation (Phase II).
Eligibility: Lake owners, local units of government, private not-for-profit (501C3) groups.
Assistance: up to $75,000 for Phase 1, 40% match required; up to $300,000 for Phase II study costs with 50 percent local match required. Available for publicly-owned lakes larger than 6 acres with public access.
Website: http://www.epa.state.il.us/water/conservation-2000/iclp.html.
Contact: IEPA Bureau of Water – Surface Water Section, Des Plaines Monitoring and Assessment Unit, 9511 West Harrison, Des Plaines, IL 60016. Phone: 847-294-4000. Contact Wally Matsunaga.

- The Lake Education Assistance Program (LEAP) supports educational programs on inland lakes and lake watersheds.
Eligibility: local governments, educational organizations, and private not-for-profit groups.
Assistance: Maximum funding of $500 is reimbursed after completion.
Website: http://www.epa.state.il.us/water/financial-assistance/index.html.
Contact: 217-782-3362.

- The Volunteer Lake Management Program (VLMP), administered by the Illinois EPA, serves as an educational program for Illinois citizens to learn about lake ecosystems and utilizes the time and talents of citizen volunteers to gather fundamental information on inland lakes.
Eligibility: Lake owners.
Assistance: technical assistance only.
Website: http://www.epa.state.il.us/water/conservation-2000/vlmp.html.
Contact: Holly Hudson, Chicago Metropolitan Agency for Planning, 233 South Wacker, Suite 800, Sears Tower, Chicago, IL 60606. email: hlhudson@cmap.org.

- The USEPA Guidebook for Financial Tools is used for identifying conservation funding source options
Eligibility: anyone can access the guidebook.
Assistance: informational only.
Website: http://www.epa.gov/efinpage or http://cfpub.epa.gov/fedfund/
Contact: see website.

- USEPA Catalog of Funding Sources for Watershed Protection is useful for identifying programs that will protect both urban and rural watersheds
Eligibility: anyone can access the guidebook.
Assistance: informational only.
Website: http://www.epa.gov/owow/funding.html, http://www.epa.gov/owow/watershed/ or http://cfpub.epa.gov/fedfund/.
Contact: see websites.

- The Brownfields Assessment, Revolving Loan Fund, and Cleanup Grants are for the re-use and remediation of brownfield sites throughout Illinois.
Eligibility: local governments, private not-for-profit (501C3) groups, and others.
Assistance: $2 to $3 million annually. Cleanup grants require 25% cost-share, grants range from under $15,000 to over $50,000.
Website: http://www.epa.gov/brownfields/
Contact: Call 312-886-7576 or 301-589-5318.

- The Environmental Education Grants Program funds environmental education activities such as curricula design

or dissemination, designing or demonstrating educational field methods for the public, and training educators.
Eligibility: Educational organizations, private not-for-profit groups, and local governments.
Assistance: Minimum of 25% matching funds or in-kind services required. Awards of $25,000 or less are granted by regional offices.
Website: http://www.epa.gov/enviroed/grants.html
Contact: Call 312-353-5282 or visit the website for most current information and deadlines.

- The Environmental Justice Grant Programs include community-based approaches for environmental protection.
Eligibility: Educational organizations, private not-for-profit groups.
Assistance: No match is required. Up to $15,000 per non-superfund site, other project grants variable up to $100,000.
Website: http://www.epa.gov.
Contact: Call 312-886-5993 or 1-800-962-6215.

- Smart Growth Technical Assistance Opportunities assist local communities develop in an environmentally-friendly, sustainable manner.
Eligibility: Local governments, private not-for-profit groups, and others.
Assistance: In-kind contributions with assistance preferred.
Website: http:/www.epa.gov/smartgrowth/techasst.htm/.
Contact: Call 202-566-2853.

- The Priority Lake and Watershed Implementation Program provides funding to implement protection/ restoration practices that improve water quality.
Eligibility: Local governments, private not-for-profit groups. Priority given to publicly-owned and accessed lakes.
Assistance: Funding up to 100%, projects range up to $40,000.
Website: http://www.epa.state.il.us/water/financial-assistance/.
Contact: 217-782-3362.

- The Streambank Cleanup and Lakeshore Enhancement (SCALE) program provides up top $3,500 in funds for the implementation of a streambank or lakeshore clean up event; specifically for litter collection and disposal.
Eligibility: Applicant selection based on event proximity to Illinois EPA designated priority waters, number of participants, and size of clean up area.
Assistance: Funding up to $3,500.
Website: www.epa.state.il.us/water/watershed/scale.html.
Contact: 217-782-3362.

- The Community Based Environmental Protection program funds projects that use community-based approaches for environmental protection for energy, land use, brownfields, open space and wetlands.
Eligibility: open.
Assistance: 20% match required.
Website: www.epa.gov/ecocommunity/
Contact: 800-621-8431

U.S. Army Corps of Engineers (USACE) Civil Works programs involve the planning, design, construction management, operation and maintenance of water resource management and restoration projects to meet flood and storm damage reduction, navigation, environmental restoration, hydropower, recreation and other water related goals.

- Flood Hazard Mitigation and Riverine Ecosystem Restoration Program ("Challenge 21") focuses on non-structural, sustainable approach to flood protection, including watershed-based planning, wetland conservation, relocation of buildings out of the floodplain, riparian corridor restoration, and pre-disaster mitigation planning. Funding has not yet been authorized.
Eligibility: Local governments; study area must be within a floodplain.
Assistance: Federal cost share at 50 percent for studies and 65 percent for project implementation. Maximum federal allocation is $30 million.
Website: Information is available at http://www.saw.usace.army.mil/floodplain/ Challenge%2021.htm.
Contact: For information, contact USACE (Headquarters) Planning Division, 20 Massachusetts Avenue NW, Washington, DC 20314. Phone: 202-761-4750.

- Continuing Authorities Program allows the Corps to respond quickly to water resources problems. Some of the legislative authorities of the program include Aquatic Ecosystem Restoration (Section 206), Environmental Dredging (Section 312), and Environmental Restoration

(Section 1135). See website for full listing.
Eligibility: Local public entities are eligible for studies, planning engineering, construction, and administration.
Assistance: Federal–local cost share percentages vary depending on the program. Up to $5 million federal assistance provided.
Website: The USACE Vicksburg District provides an overview of the Continuing Authorities Program at http://www.mvk.usace.army.mil/Offices/pp/Projects/ Small_Projects_Program/basics.htm.
Contact: USACE Chicago District, 111 N. Canal St, Suite 600, Chicago, IL 60606. Phone: 312-846-5498.

- The Project Modifications for Improvement of the Environment (Section 1135) program gives the Corps authority to review water resource projects constructed by the Corps and determine the need for modifications to improve the quality of the environment. The objective is to restore ecosystem structure, function and dynamic processes to a less-degraded, more natural condition.

Eligibility: feasibility studies, planning, engineering, construction and supervision.
Assistance: Federal cost-share of up to $5 million available. 25% non-federal cost share required.
Contact: Planning Division Chief, Chicago District Corps, 312-846-5330.

- The Small Flood Control Projects (Section 205) program gives the Corps authority to develop and construct small flood control projects.

Eligibility: feasibility studies, planning, engineering, construction, supervision and administration.
- Assistance: Federal cost-share of up to $5 million available. 50% non-federal cost-share required for feasibility study. 35% non-federal cost-share required for project costs.

Contact: Planning Division Chief, Chicago District Corps, 312-846-5330.

Federal Emergency Management Agency (FEMA) manages a number of programs that assist communities in disaster planning and hazard mitigation.

- Flood Mitigation Assistance (FMA) helps states and communities identify and implement measures to reduce the risk of flood damage to structures insured under the National Flood Insurance Program (NFIP). Awards planning grants to assist development of Flood Mitigation Plans and project grants for projects that reduce flood losses, such as elevation, relocation, demolition, acquisition of insured structures and property, flood proofing, and minor structural projects that reduce the risk of flood to insured structures.

Eligibility: State agencies, NFIP communities, qualified local organizations, Tribal governments.
Assistance: Federal cost share maximum of 75 percent.
Website: http://www.fema.gov/fima/fma.shtm
Contact: FEMA Region 5, 536 South Clark St., Chicago, IL 60605. Phone: 312-408-5500.

- Hazard Mitigation Grant Program (HMGP) implements long-term hazard mitigation measures following a major disaster declaration and, in Illinois, for post-disaster floodplain building buy-outs, elevation, relocation, retrofit, and demolition on public and private land.

Eligibility: State and local governments, qualified non-profit organizations, Tribal governments.
Assistance: Federal cost share maximum of 75 percent.
Website: http://www.fema.gov/fima/hmgp/
Contact: Mr. Ron Davis, Illinois Emergency Management Agency, 110 East Adams Street, Springfield, IL 62701-1109. Phone: 217-782-8719. E-mail: RDavis@iema.state.il.us.

- Pre-Disaster Mitigation Program (formerly Project Impact) implements the pre-disaster mitigation program for states and communities to reduce risk to the population, the costs and disruption caused by severe property damage and the cost to all taxpayers of Federal disaster relief efforts. Eligible projects include: acquisition, relocation, elevation, and strengthening of structures, development of standards to protect structures from disaster damage, and drainage improvement projects.

Eligibility: State and local governments, universities, Tribal governments.
Assistance: Federal cost share maximum of 75 percent with a $3 million cap.
Website: http://www.fema.gov/fima/pdm.shtm.
Contact: FEMA Region 5, 536 South Clark St., Chicago, IL 60605. Phone: 312-408-5500.

- National Flood Insurance, Increased Cost of Compliance Program provides flood insurance policyholders with flood damaged homes and businesses in high-risk areas, also known as Special Flood Hazard Areas, with assistance to help pay the costs to bring their home or business into compliance with their community's floodplain ordinance, including building elevation, relocation, demolition, or floodproofing.
Eligibility: flood insurance policy holders.
Assistance: Federal assistance up to $30,000.
Website: http://www.fema.gov/nfip/icc.shtm.
Contact: FEMA Region 5, 536 South Clark St., Chicago, IL 60605. Phone: 800-427-4661.

US Department of Agriculture, Natural Resource Conservation Service (NRCS), the successor agency to the Soil Conservation Service, partners with state conservationist offices and provides funding and technical assistance to landowners to promote soil and water conservation.

- Environmental Quality Incentives Program (EQIP) provides incentive payments and cost-shares to implement conservation practices.
Eligibility: Non-federal landowners engaged in farming or ranching.
Assistance: Federal share maximum of 75 percent, $450,000 aggregate cap on EQIP contracts. Beginning farmers and ranchers, as well as limited resource producers, may qualify for a 90 percent cost-share.
Website: http://www.nrcs.usda.gov/programs/eqip/.
Contact: 500 C Street, SW Washington, D.C. 20472. Phone: (202) 566-1600.

- Conservation Reserve Program (CRP) offers annual rental payments, incentive payments for certain activities, and cost-share assistance to remove highly erodable cropland or sensitive acres from crop production. Program encourages farmers to plant long-term resource conserving vegetative covers to improve soil, water, and wildlife resources. Eligible practices include riparian buffers along streams, ditches, lakes, wetlands, and ponds, grass or contour filter strips, and windbreaks. Funds also may be used to retire agricultural floodplain land. Program is administered by the Farm Service Agency.
Eligibility: Non-federal landowners engaged in farming or ranching.
Assistance: Farmers receive compensation, based on agricultural rent, for retiring sensitive land over a multiyear contract.
Website: http://www.fsa.usda.gov/dafp/cepd/crp.htm.
Contact: USDA Farm Service Agency, 1400 Independence Ave, SW Washington, DC 20250-0506 Phone: 800-457-3642.

- Emergency Watershed Protection Program (EWP) provides assistance to reduce hazards to life and property in watersheds from erosion and flooding due to severe natural events. May be used to establish vegetative cover, open restricted channels, repair diversions and levees, and purchase floodplain easements on flooded land in non-urban areas.
Eligibility: Public and private landowners with a project sponsor, i.e., a state or local government or special government district. Applications must be submitted within 60 days of disaster or 10 days in an emergency.
Assistance: Up to 75 percent federal cost-share for projects.
Website: http://www.nrcs.usda.gov/programs/ewp/.
Contact: USDA, NRCS, Financial Assistance Programs Division, 14th and Independence Ave., SW, Room 6103A-S, Washington, DC 20250. Phone: 202-690-0793.

- Soil and Water Conservation Assistance program provides cost share and incentive payments to farmers and ranchers to voluntarily address threats to soil, water, and related natural resources, including grazing land, wetlands, and wildlife habitat. Requires a conservation plan and certification of eligible conservation practices by state conservationist.
Eligibility: Farmers and ranchers who own or control land.
Assistance: 5 to 10 year contracts with NRCS, 75 percent federal cost share, $50,000 maximum benefit.
Website: http://www.nrcs.usda.gov/programs/swca/.
Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1873.

- Watershed Protection and Flood Prevention Program (PL 83-566) includes the Watershed Surveys and Planning program as well as the Watershed Operations program. The latter provides funding for installing conservation practices in small watersheds for flood prevention, erosion and sediment control, water quality, habitat enhancement, wetland creation and restoration.

Eligibility: Sponsorship by a state/local government or special government district, watershed less than 250,000 acres.
Assistance: Project grants.
Website: http://www.nrcs.usda.gov/programs/watershed/index.html#Watershed_ops.
Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-8770.

- Wetlands Reserve Program provides funds to purchase permanent or 30-year easements and restoration agreement, or assist in a cost-share agreement with landowners, to restore wetlands and floodplain habitat on private land.

Eligibility: Individual landowners who have owned land for at least one year. Eligible lands must be restorable, contribute significantly to wetland functions and values, and be suitable for wildlife habitat
Assistance: Permanent easement purchased by USDA with 100 percent of restoration funded by federal government; thirty year easement purchased by USDA with 75 percent of restoration funded federally; or restoration cost-share only with USDA contributing 75 percent of cost.
Website: http://www.nrcs.usda.gov/programs/wrp/.
Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1062.

- Wildlife Habitat Incentives Program (WHIP) provides funding and technical assistance for private landowners to develop and improve fish and wildlife habitat.

Eligibility: Private lands and some federal, state, and local government lands.
Assistance: Cost-share agreements up to 75% depending on landowner commitment, increased assistance for agreements longer than 15 years.
Website: http://www.nrcs.usda.gov/programs/farmbill/index.html
Contact: USDA NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1062.

- The Streambank Stabilization Restoration Program, administered by the Soil and Water Conservation District, goals are to develop and demonstrate vegetative, stone structure and other low-cost bio-engineering techniques for stabilizing streambanks and to encourage the adoption of low-cost streambank stabilization practices by making available financial incentives, technical assistance and educational information to landowners with critically eroding streambanks.

Eligibility: All landowners and project sites (rural and urban) in each Illinois county.
Assistance: check with the Lake County SWCD for details.
Website: http://www.lakeswcd.org/.
Contact: Lake County Soil and Water Conservation District, 100 N Atkinson Rd, Suite 102A, Grayslake, IL 60030 Phone: 847-223-1056. Email: lcswcd@sbcglobal.net.

- The Conservation Security Program (CSP) promotes the conservation of soil, water, air, energy, plant and animal life located on working lands.

Eligibility: Individuals, organizations, and others. Contact administrator for details.
Assistance: check with the county-based USDA Service Centers for application deadlines and most current information. In-kind services or operations are required.
Website: http://www.nrcs.usda.gov/programs/farmbill/index.html.
Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1062.

- The Farm and Ranch Lands Protection Program (FRPP) is intended to permanently preserve prime farmland or protect lands with historical and archeological resources.

Eligibility: local units of government, private not-for-profit (501C3) groups, educational institutions, and others.
Assistance: matching and in-kind match required. Check website for details.
Website: http://www.nrcs.usda.gov/programs/farmbill/index.

Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1062.

- The Illinois Conservation Reserve Enhancement Program (CREP) program provides incentive payments and technical assistance to farm owners who plant grasses and trees, restore wetlands to reduce top soil loss, improve water quality, and enhance wildlife habitat in the Illinois River basin.

Contact: 217-785-8774.

United States Department of Agriculture, Forest Service (USDA-FS) manages programs that promote forestry and natural enhancement of urban areas through urban forestry programs.

- Urban and Community Forest Challenge Cost-Share Grant Program helps establish and support urban and community forests and forestry activities.

Eligibility: local governments, educational organizations, individuals, and others.
Assistance: Non-federal match of 50% required
Website: http://www.fs.fed.us/ucf/.
Contact: USDA, Forest Service 1400 Independence Ave., SW, Washington, D.C., 20250-0003. Phone (202) 205-8333.

United States Department of Energy (USDOE) compiles and distributes a list of monthly funding opportunities relating to energy and the environment. Go to http://www.eere.energy.gov/ and click on financial opportunities.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS) manages programs to protect wildlife and habitat by means such as issuing rules for hunters and anglers, administering the Endangered Species Act, and awarding grants for environmental restoration.

- Coastal Program provides grants for habitat restoration and other purposes.

Eligibility: Individuals, state and local governments, universities, non-profit organizations.
Assistance: Project grants at 50 percent local match. Award typically varies between $5,000 and $50,000.
Website: http://www.fws.gov/cep/cepcode.html.
Contact: USFWS, Branch of Habitat Restoration, Room 400, 4401 N. Fairfax Blvd., Arlington VA 2220 Phone: (703) 358-2201 USFWS Region 3 Office, 2651 Coolidge Rd, East Lansing, MI 48823. Phone: (517) 351-8470.

- Challenge Cost Share Program provides grants for conservation practices, ecosystem protection, and enhancement of wildlife and plant habitat.

Eligibility: Individuals, businesses, federal, state, and local governments, universities, and non-profit organizations.
Assistance: Grants at 50 percent local match. Average award is about $7,800.
Website: See Catalog of Federal Domestic Assistance (15.642), http://www.cfda.gov.
Contact: USFWS National Wildlife Refuge System, 4401 N. Fairfax Drive, Suite 670, Arlington, VA 22203. Phone: 703-358-1744.

- Private Stewardship Program provides cost share funding for conservation practices by private landowners or community groups that benefit threatened, endangered, and at-risk species.

Eligibility: Individuals, businesses, private nonprofit organizations, local or county governments. Cooperating private landowners must be identified in proposals.
Assistance: Project grants at 10 percent local match. Average award about $70,000.
Website: http://endangered.fws.gov/grants/private_stewardship/index.html.
Contact: USFWS Region 3, One Federal Drive, Fort Snelling, MN 55111-4056. Phone: 612-713-5343.

- Partners for Fish and Wildlife Programs assists private landowners in restoring habitat in accordance with USFWS goals, including, for example, restoration of wetland hydrology, use of prescribed burns, and planting with native vegetation. Wetlands are the primary focus of the program in Illinois. Landowners enter into at least a 10 year agreement to refrain from returning the land to its former use or otherwise nullifying the restoration. Eligible projects include restoration or enhancement of transient waterfowl habitat, improve water quality, flood protection, and groundwater recharge.

Eligibility: Non-state and non-federal landowners.
Assistance: Project grants at 50 percent local cost-share with matching or in-kind services preferred, but not required.
Website: http://www.fws.gov/partners/.
Contact: USFWS, Branch of Habitat Restoration, Room 400, 4401 N. Fairfax Blvd., Arlington VA 2220 Phone: (703) 358-2201 USFWS Region 3 Office, 2651 Coolidge Rd, East Lansing, MI 48823. Phone: (517) 351-8470.

- Northeastern Illinois Wetlands Conservation Account is intended for restoration, enhancement, and/or replacement of wetland functions and values which have been degraded or destroyed as a result of activities conducted in violation of the Clean Water Act or the Rivers and Harbors Act. Also funds activities that promote understanding, appreciation, and stewardship of wetlands.
Eligibility: Governmental agencies, non-profit conservation organizations, and private home owner associations.
Assistance: Project grants up to $150,000. Matching funds preferred but not required.
Website: http://www.fws.gov/midwest/chicago/neiwca2004rfp.htm.
Contact: USFS Chicago Illinois Field Office, 1250 South Grove Ave., Suite 103, Barrington, Illinois 60010. Phone: 847-381-2253.

- North American Wetlands Conservation Act
Eligibility: Eligible on-the-ground projects include acquisition, restoration, creation and/or enhancement of wetlands and wetland-associated uplands. Partnerships are encouraged. Conservation easements are required.
Assistance: Requires 1:1 non-federal match, maximum grant amount is $50,000.
Contact: Contact Small Grants Coordinator, N. American Waterfowl & Wetlands Office, USFWS, at 703-358-1784.

- Flexible Funds provides relatively small amounts of funds from up to five separate programs to good projects on private lands to restore fish and/or protect wildlife habitat.
Eligibility: Governmental agencies, non-profit conservation organizations, and private home owner associations.
Assistance: A 1:1 match is preferred.
Contact: Steve Kufrin at 612-713-5447

National Park Service (NPS) manages the nation's system of national parks, historic sites, etc. and serves as a conduit for some recreation-related conservation funding.

- Land and Water Conservation Fund (LWCF) provides funds to states and localities for park and recreational land planning, acquisition, and development. Public access must be granted in perpetuity. Funds are awarded through the Illinois Department of Natural Resources, which also manages a similar program, using state funding, called the Open Space Lands Acquisition and Development (OSLAD) Program. Points are generally awarded for applications that place natural resources in protection.
Eligibility: Local government agencies with authority to develop land for parks.
Assistance: Up to $750,000 for acquisition projects, with 50 percent match required.
Website: http://dnr.state.il.us/ocd/newoslad1.htm.
Contact: Illinois DNR, One Natural Resources Way, Springfield, IL 62702. Phone: 217-782-6302.

- Challenge Cost-Share Program (CCSP) provides matching funds for a variety of projects relating to conservation, natural area enhancement, and recreation, but tends to fund projects on or near lands managed by the National Park Service.
Eligibility: State and local governments, private nonprofit organizations.
Assistance: Up to $30,000 with 50 percent match.
Website: http://www.nps.gov/ncrc/programs/ccsp/index.htm.
Contact: National Center for Recreation and Conservation, NPS, 1849 C Street NW (Org. Code 2220), Washington, DC 20240. Phone: 202-354-6912.

- The Rivers and Trails Program provides technical assistance to help local communities achieve conservation objectives. It provides no direct funding.
Contact: Contact Mark Weaver at 414-297-3617.

National Oceanic and Atmospheric Administration (NOAA)
NOAA guides the conservation and management of coastal resources through a variety of mechanisms, including collaboration with the coastal resource management programs of states and US territories.

- Coastal Zone Management Program (CZMP) assists states in implementing Coastal Zone Management programs approved by NOAA. Generally supports large and small projects by local governments and non-profit organizations through the Coastal Zone Enhancement Grants Program (Section 309, Coastal Zone Management Act). Funding for watershed projects in Illinois is expected in upcoming years, following program adoption and establishment by the State of Illinois.

- Coastal Services Center Cooperative Agreements provide technical assistance and project grants through a range of programs and partnering arrangements, all focused on protecting and improving coastal environments.
Eligibility: Varies by program, but includes state and local governments, universities, non-profit corporations, and others.
Assistance: Project grants and cooperative agreements.
Website: http://www.csc.noaa.gov/funding/.
Contact: 2234 South Hobson Avenue, Charleston, SC 29405-2413. Phone: 843-740-1200.

U.S. Department of Transportation (DOT) regulates the federally mandated metropolitan planning process and administers federal transportation funding.

- Transportation Enhancement Program (TEA-21) funds projects that may include, among others, control technologies to prevent polluted highway runoff from reaching surface water bodies, scenic easements, pedestrian and bicycle trails, and wetland mitigation efforts including mitigation banking, wetland preservation and restoration, wetland planning, and natural habitats. Projects must relate to surface transportation and fall into one of twelve eligible categories. Funding is disbursed through State of Illinois.
Eligibility: Local government units with taxing authority.
Assistance: 80 percent federal share of project costs in general, 50 percent for acquisition. Awards up to $2 million.
Website: http://www.fhwa.dot.gov/environment/te/overview.htm (Federal), http://www.dot.il.gov/ opp/itep.html (Illinois).
Contact: Illinois DOT, 2300 S. Dirksen Pkwy., Springfield, IL 62764. Phone: 217-782-7820.

Illinois Department of Natural Resources (IDNR)

- Conservation 2000 supports nine conservation programs across three state agencies and provides financial and technical support to groups (ecosystem partners) which seek to maintain and enhance ecological and economic conditions in key watersheds of Illinois.
Eligibility: Varies by program. Eligible projects include habitat protection or improvement, technical assistance, and education. Funds may be applied for through the Lake Michigan Ecosystem Partnership.
Assistance: Project grants, varies by program.
Website: http://dnr.state.il.us/orep/c2000/.
Contact: IDNR Region 2, 2050 W. Stearns Road, Bartlett, IL 60103. Phone: 847-608-3100.

- Urban Flood Control Assistance involves initial study process and determination of appropriate flood control solutions. Funding depends on General Assembly appropriations for tributary studies and project feasibility investigations, focused on structural flood control solutions.
Eligibility: Local sponsorship, positive net benefit formally shown by benefit-cost analysis, membership in good standing in National Flood Insurance Program.
Assistance: Varies with appropriation.
Website: http://dnr.state.il.us/owr/OWR_programs.htm.
Contact: IDNR Office of Water Resources, One Natural Resources Way, 2nd Floor, Springfield, Illinois 62702-1271. Phone: (217) 782-4637.

- Small Projects Fund provides direct assistance to rural and small urban communities statewide to reduce stormwater related flood damages by alleviating localized, significant drainage and flood problems.
Eligibility: Local government sponsorship, membership in good standing in National Flood Insurance Program.

Assistance: Maximum of $100,000 per locality.
Website: http://dnr.state.il.us/owr/OWR_programs.htm.
Contact: IDNR Office of Water Resources, One Natural Resources Way, 2nd Floor, Springfield, Illinois 62702-1271. Phone: (217) 782-4637.

- The **Open Space Lands Acquisition and Development (OSLAD) Program** is a state-financed grant program that provides funding assistance to local government agencies for acquisition and/or development of land for public parks and open space. The federal Land & Water Conservation Fund program (known as both LWCF and LAWCON) is a similar program with similar objectives.
Eligibility: Local governments having statutory authority to acquire and develop land for public park purposes.
Assistance: Under both programs, funding assistance up to 50% of approved project costs can be obtained. Grant awards up to $750,000 are available for acquisition projects, while development/renovation projects are limited to a $400,000 grant maximum.
Website: http://dnr.state.il.us/ocd/newoslad1.htm.
Contact: IDNR Office of Office of Architecture, Engineering and Grants, One Natural Resources Way, 2nd Floor, Springfield, Illinois 62702-1271. Phone: 217/782-6302.

- The **Division of Wildlife or Resource Protection and Stewardship Trees, Shrubs and Seedlings at No Cost** program is intended to encourage landowners to reforest land, increase wildlife, and control erosion.
Eligibility: varies.
Assistance: Seedlings provided at no charge. Shipping costs paid by grantee.
Contact: IDNR 217-785-8774.

- The **Forestry Assistance Grant Programs** are intended to create or enhance landowner or local forestry programs.
Eligibility: Local governments, individuals, and others.
Assistance: 50% cost share grants and reimbursement up to $5,000.
Website: http://dnr.state.il.us/conservation/forestry/.
Contact: 217-782-2361.

- **Schoolyard Habitat Action Grants** support enhancement of wildlife habitat, with emphasis on youth involvement and education.
Eligibility: Educational organizations and others. Project must involve a trained Project WILD educator or facilitator.
Assistance: Maximum funding to $600.
Website: http://dnr.state.il.us/lands/education/CLASSRM/grants.htm.
Contact: 217-524-4126.

- **Illinois Biodiversity Field Trip Grants & Free Educational Materials** supports field trips for students to visit natural areas, natural history museums, and other natural resource related activities. Conservation education materials, including lesson plans, can be used separately.
Eligibility: Educational organizations and others.
Assistance: funding for field trips up to $500 per class, per project.
Website: http://dnr.state.il.us/lands/education/CLASSRM/grants.htm.
Contact: 217-524-4126.

- The **Urban and Community Forestry Grant Program** goal is to create or enhance local forestry programs in communities with a local forestry ordinance.
Assistance: 50% match required.
Contact: IDNR Regional Administration at 815-625-2968.

- The **Division of Wildlife Resources Special Funds Application (Habitat, Furbearer, and Pheasant Funds)** provides assistance for habitat improvement or land acquisition/protection projects funded by Habitat Fund, Furbearer Fund or Pheasant Fund. Projects must preserve, protect, acquire or manage wildlife for future generations – by benefiting wildlife either directly or indirectly.
Eligibility: Habitat, research, or education projects are considered.
Assistance: Cost-share not required, but preferred.
Website: http://dnr.state.il.us/lands/education/CLASSRM/grants.htm.
Contact: Office of Resource Conservation – Special Funds 217-782-2602.

- The **Illinois Migratory Waterfowl Stamp Fund** provides for the acquisition of public lands and/or the

development of habitat to attract and support waterfowl. Eligible projects must directly or indirectly benefit waterfowl hunting in Illinois.
Eligibility: Projects involving education or research are not eligible.
Assistance: Cost-share not required, but preferred.
Contact: specialfunds@dnrmail.state.il.us for information.

- Illinois Wildlife Preservation Fund

Eligibility: projects include those that deal with habitat enhancement, endangered and threatened species.
Assistance: Match preferred but not required.
Contact: Contact IDNR at 217-785-8774.

- The Private Land Wildlife Habitat Management Fund is a technical assistance program for private landowners that provide plans, field equipment, plant materials, and labor to develop, implement and maintain wildlife habitat management practices that require specialized training, equipment or resources which would otherwise be unavailable to landowners.

Eligibility: Eligible land is privately owned and is at least 0.25 acre in urban areas and 1 acre in rural areas.
Contact: IDNR at 217-782-6384.

- The Illinois Bicycle Path Grant Program provides financial assistance to eligible government agencies for the acquisition, construction and rehabilitation of public non-motorized bicycle paths.

Eligibility: Habitat, research, or education projects are considered.
Assistance: 50% match required.
Contact: IDNR at 217-782-7481

- The Illinois Trails Grant Program provides funding to acquire, develop, and maintain trails for public recreational uses.

Assistance: 50% match required.
Contact: IDNR at 217-782-7481

- The Recreation Trails Program provides financial assistance to federal, state and local government agencies and not-for-profit organizations for the acquisition, development, rehabilitation, and maintenance of public motorized and non-motorized recreational trails.

Assistance: Minimum 20% non-federal match.
Contact: IDNR at 217-782-7481

- The Office of Water Resources Small Projects Fund provides assistance to rural and smaller urban communities to reduce stormwater related damages by alleviating local significant drainage and flood problems. The Office of Water Resources Division of Planning does initial surveys and makes recommendations for flood control or acquisition projects for local flood problem areas. If a project is warranted, the Division coordinates planning and funding and provides project design.

Assistance: Can contribute up to $75,000 financial assistance on small projects.
Contact: IDNR Office of Water Resources (IDNR-OWR) at 217-782-4637

- The Land and Water Conservation Fund (LWCF) is a state-financed grant program that provides funding assistance to local government agencies for acquisition and/or development of land for public parks and open space. It is similar to OSLAD.

Contact: www.dnr.state.il.us/ocd/newoslad1.htm.

- The Open Land Trust Fund Grant (OLT) makes grants available to local governments to acquire land from willing sellers for open space and resource based outdoor recreation.

Contact: IDNR at 217-782-7481 or www.dnr.state.il.us/ocd/newolt2.htm.

- The Illinois Nature Preserves Commission Programs (INPC) assists private and public landowners in protecting high quality natural areas and habitats of endangered and threatened species in perpetuity, through voluntary dedication or registration of such lands into the Illinois Nature Preserves System. The Commission promotes the preservation of these significant lands and provides leadership in their stewardship, management and protection.

Contact: http://dnr.state.il.us/INPC/programs/programstest.htm.

Illinois Department of Agriculture (IDA)

- Streambank Stabilization & Restoration Program (SSRP) is designed to support naturalized stream bank stabilization practices in rural and urban communities.
Eligibility: All organizations and individuals.
Assistance: 25% match required.
Website: http://www.agr.state.il.us.
Contact: 217-782-6297, or contact your local Soil & Water Conservation District that services your county.

- Sustainable Agriculture Grant (Conservation 2000) Program supports projects include those that carry out research, education, and on-farm demonstration projects that support sustainable agriculture, protect the environment, and maintain profitability.
Eligibility: Individuals, all organizations, local governments.
Assistance: Grants awarded up to $10,000 per individual; $50,000 per unit of government, or other eligible organization.
Website: http://www.agr.state.il.us.
Contact: 217-782-6297 or contact the local Soil & Water Conservation District that services your county.

Illinois State Geological Service (ISGS)

- Created in 1905, the ISGS provides scientific information to government, business, and the public. Research and service programs encompass geologic mapping, water and mineral resources, environmental and engineering geology, geochemistry, and education. Geological mapping and other forms of technical assistance and advice are available from ISGS on topics such as: preliminary environmental assessments of chosen sites; locating and protecting groundwater resources; locating and conserving mineral and energy resources, including limestone, sand and gravel, oil and gas or coal; avoiding geological hazards such as landslides or abandoned underground mines; protecting existing wetlands and developing new ones, and understanding the relationships between geology and natural and man-made habitats. Depending on the level of assistance needed, cost reimbursement may be required. Contact www.isgs.uiuc.edu/isgsroot/isgshome.html.

Illinois State Board of Education (ISBE)

- Useful website to search for educational grants at http://www.isbe.state.il.us/grants/default.htm.

State of Illinois Tax Incentives for Conservation are available for organizations and individuals. See http://dnr.state.il.us/OREP/C2000/Incentives.htm for details.

- Real Property Conservation Rights Act (765 ILCS 120/1 et seq.): if land is qualified by having a conservation easement, it may be assessed at 8 1/3 fair market value.

- Illinois Natural Areas Preservation Act (525 ILCS 30/1 et.seq)/17 Ill Adm. Code: if land is qualified by being designated as an Illinois Nature Preserve, it may be assessed at $1/year in perpetuity.

- Preferential Assessment of Farmland (Property Tax Code, Sec. 1-60 (Definitions.) Sec. 10-110 et seq.: if qualified, assessments are based on Cropland as 33 1/3% of the agricultural economic value; Permanent Pasture as 1/3 of its value of cropland; other farmland at 1/6 of its value as cropland; and wasteland without a contributory value to farmland at zero.

- Open Space Assessment (Illinois Property Tax Code Sections 10-155): a lower use evaluation is used for land in open space; 10 acre minimum area.

- Preferential Assessment of Common Areas (Illinois Property Tax Code Sections 10-35): Purpose is to encourage open space in residential developments; if qualifying, assessment is reduced to $1/year.

- Other tax incentives may also apply. Contact IDNR regarding the Real Property Conservation Rights Act and the Illinois Natural Areas Preservation Act at 217-785-8774. Contact your local township or county assessor to determine eligibility under other incentives.

Chicago Metropolitan Agency for Planning

- Provides technical assistance for lake monitoring and protection, watershed protection, stream stabilization, stormwater management planning, hydrologic modeling, and

greenway planning. Also prepares Geographic Information System (GIS) mapping and analysis and offers GIS training. Develops model ordinances and manuals of best practices for stream and wetland protection, soil erosion and sediment control, stormwater drainage and detention. Contact www.nipc.cog.il.us/.

Lake County

- Lake County SMC Watershed Management Board Fund

Eligibility: Watershed Management Board members in good standing with the National Flood Insurance Program and comply with SMC policies.
Assistance: Cost-share at least 50% with funds or in-kind services or a combination of both. Approximately $100,000 to $150,000 is available each year for planning, engineering analysis, alternate solution evaluation, design, capital construction, maintenance and repairs projects.
Website: http://www.co.lake.il.us/smc/projects/wmb/.
Contact: Lake County Stormwater Management Commission, 333 Peterson Road, Libertyville, Illinois, 60048. For information on Des Plaines River and North Branch of the Chicago River WMBs, call Tony Wolff, 847.918.5264 or email twolff@co.lake.il.us. For information on Fox River and Lake Michigan WMBs, call Rasto Vrazda, 847.918.7696 or email rvrazda@co.lake.il.us.

- Lake County Soil and Water Conservation District Technical Assistance

Provides site-specific natural resource information for parcels undergoing annexation, subdivision, zoning change, variance, conditional use, or special use permit (NRI reports) and technical site assessments and recommendations for natural resource management. Prepares Geographic Information System (GIS) mapping and provide aerial photographs. Conducts soil borings to determine the suitability of septic systems, practicality of basements, etc. Contact http://www.lakeswcd.org/.

Other Sources of Assistance and Funding

Project funding sources that could potentially qualify as federal/state matching funds may come from a variety of local government, private, or community trusts or foundations that support initiatives reflecting organizational policies. Eligibility criteria are as varied as the donors. Most of these sources require a Not-For-Profit (501c3,*c4, etc.) corporate status.

- The Illinois Clean Energy Foundation supports projects that enhance natural areas, increase renewable energy, or improve energy efficiency.

Eligibility: private not-for-profit organizations, educational organizations, local governments.
Assistance: call for details, which change year to year.
Website: http://www.illinoiscleanenergy.org.
Contact: Illinois Clean Energy Foundation, 312-372-5191.

- Habitat Restoration Funds for Northeastern Illinois River Watersheds supports wetland restoration and aquatic wildlife habitat projects.

Eligibility: individuals, all organizations, educational organizations, local governments.
Assistance: 25% cost share.
Website: http://www.lakeswcd.org.
Contact: Lake County SWCD, 100 N. Atkinson Road, Suite 102-A, Grayslake, IL 60030-7805.
Phone: 847-223-1056. E-Mail: lcswcd@sbcglobal.net.

- The Great Lakes Basin Program for Soil Erosion and Sediment Control supports projects that protect Great Lakes Water Quality, such as by controlling erosion and sedimentation,

Eligibility: Educational organizations, local governments, and not-for-profit organizations in Lake, Cook, and Will Counties.
Assistance: Grant amounts awarded for small-scale ($30,000) and large-scale ($100,000) projects.
Website: http://www.glc.org/basin/.
Contact: Great Lakes Commission, Eisenhower Corporate Park, 2805 S. Industrial Hwy, Suite 100, Ann Arbor, MI 48104-6791. Phone: 734-971-9135.

- The National Fish and Wildlife Foundation General Matching, Challenge Grants, and Special Grant Programs support habitat restoration and protection on private lands.

Eligibility: varies. Priority areas are: wetland conservation, conservation education, fisheries, neotropical migratory bird

conservation, conservation policy, and wildlife and habitat.
Assistance: Sample grant sizes in Illinois range from $3,000 to over $100,000. Requires minimum 1:1 non-federal match.
Website: http://www.nfwf.org.
Contact: 202-857-0166.

- The National Fish and Wildlife Foundation Wildlife Links Program funds cutting edge research, management and education projects that will help golf courses become an important part of the conservation landscape. Areas of interest include: management and design techniques for increasing biodiversity on golf courses; management guidelines for specific species; research to determine habitat characteristics that serve as corridors or barriers on golf courses; monitoring research to determine habitat characteristics that serve as corridors or barriers on golf courses, monitoring wildlife habitat conservation programs on golf courses; effects of golfer and maintenance activities on wildlife. The United States Golf Association provides $200,000 annually to fund these grants.
Eligibility: requires golf courses as formal partners.
Assistance: Maximum request $25,000/year multi-year proposals accepted.
Website: http://www.nfwf.org.
Contact: 202-857-0166.

- The Trust for Public Lands (TPL) works with local organizations to conserve lands for a variety of uses, to include farms, ranches, natural lands and lands of historic importance.
Eligibility: local government, private not-for-profit organizations, educational organizations, and others.
Assistance: technical and informational assistance to identify lands to be protected and assist in financing and land transactions.
Website: http://www.tpl.org. Click on local programs-North Central Region.
Contact: 312-427-1979 & 314-436-7255.

- Ducks Unlimited MARSH (Matching Aid to Restore State Habitats) Program goal is to restore or enhance wetland habitat for waterfowl conservation in the Midwest.
Eligibility: local government, private not-for-profit organizations, educational organizations, and others.
Assistance: Requires 1:1 matching funds.
Website: http://www.tpl.org. Click on local programs-North Central Region.
Contact: Eric Schenck at 309-647-5651.
- River Network Watershed Assistance Grants Program
Eligibility: community-based partnerships that conserve or restore watersheds.
Assistance: Grant amounts range from $4,000-30,000.
Website: http://www.tpl.org. Click on local programs-North Central Region.
Contact: River Network at 503-241-3506 or www.rivernetwork.org.

- The Lake Michigan Ecosystem Partnership provides funding, technical and field assistance for educational, research, habitat protection or habitat improvement projects in Illinois that cover at least one IEPA watershed.
Contact: http://dnr.state.il.us/orep/c2000/ecosystem.

- Chicago Wilderness
Eligibility: natural areas enhancement, education, and research that focus on biological diversity to the Chicago region. Projects must include two or more Chicago Wilderness Partners.
Assistance: Required 1:1 matching funds or in-kind services.
Contact: 312-346-8166, ext. 30 for information.

- Riverwatch is a volunteer-driven effort to collect stream data from Illinois streams and submit the data to the Illinois Natural History Survey. Run by the National Great Rivers Research and Education Center.
Eligibility: all Illinois streams.
Assistance: monitoring training, forms, and kits.
Website: http://www.ngrrec.org/.
Contact: Vera Bojic, RiverWatch Coordinator, 618-468-4870 or vbojic@lc.edu.

- There are a number of Federal Tax Incentives for Conservation for owners of environmentally sensitive land that has been donated for conservation purposes, or has

been placed in a conservation easement, or simply managed for conservation. Individuals, organizations, and others are all eligible. Information can be found at www.gpoaccess.gov/cfr, www.irs.gov/, www.ailt.org/irs.htm, and http://www.irs.gov/pub/irs-drop/n-04-41.pdf. You can also contact the Illinois EPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois, 62794-9276. Phone: 217-782-3397.

Reference Sources

Several grant search engines and organizations exist to help identify funding sources. Fees for services or products may be charged by these organizations. When searching, be sure to clarify whether charges will be incurred. For "do-it-your-selfers," local grant data collection centers are available throughout Illinois.

- The Catalog of Federal Domestic Assistance (CFDA) is the single best place to search all federal funding sources. The catalog should be available at local libraries and can also be accessed on the CFDA website on-line at: http://www.cfda.gov. The website lists all federal funding programs available, including those for conservation. Federal agency websites will provide more detailed information about federal programs and provide information on other opportunities for assistance. All organizations applying for federal funding must have a Data Universal Numbering System (DUNS) identification number.

- Resources for Global Sustainability

RGS publishes a yearly catalog called "Environmental Grantmaking Foundations". P.O. Box 3665, Cary, NC 27519. Phone: 1-800-724-1857. http://www.environmentalgrants.com.

- Environmental Grantmaker's Association

Provides a list of environmental grant foundations. http://www.ega.org.

- The Foundation Center

79 Fifth Street, New York, New York 10003. Phone: 212-620-4230. http://www.fdncenter.org.

- Sonoran Institute

Look for Conservation Assistance Tools (CAT) at http://www.sonoran.org.

- Illinois Department of Natural Resources

IDNR has a very comprehensive grant search engine at: http://dnr.state.il.us/orep/c2000/grants/

- The Donor's Forum of Chicago

208 S. LaSalle St., Suite 735, Chicago, IL 60604. Phone: 312-578-0175. http://www.donorsforum.org. E-mail: info@donorsforum.org

- Metropolitan Association for Philanthropy

1320 Olive Street St. Louis, MO. http://www.mapstl.org. Phone: 314-621-6220.

- eCivis Grants Network

Assistance for local governments to improve their grants success through expert grant research, information, grant training, and technology. eCivis, Inc. 3452 E. Foothill Blvd, Floor 9, Pasadena, CA 91107. Phone: 877-232-4847. Email info@ecivis.com.

appendices

A

appendix A - threatened and endangered species

Tables A1 and A2 present threatened and endangered plant and animal species that are known to occur in the watershed, or have occurred in the watershed in the past. The tables include the species common name, scientific name, status (state or federally threatened or endangered), and a general indication of the type of habitat that supports the species and how that habitat is used. Table A3 lists the groups of migratory bird species that have the potential to use habitat along the Lake Michigan coastal flyway as stopover and/or breeding and foraging locations, the type of habitat that species group uses, and how the habitat is used.

Table A1 Threatened and Endangered Animal Species

Common Name	Scientific Name	Status	Habitat / Use
Black-crowned night-heron	Nycticorax nicticorax	SE	Palustrine Wetlands / Breeding, Foraging
Brewer's blackbird	Euphagus cyanocephalus	ST	Mesic Prairie / Foraging
Henslow's sparrow	Ammodramus henslowii	SE	Wet Prairies / Breeding, Foraging
King rail	Rallus elegans	SE	Palustrine Wetlands / Breeding, Foraging
Least bittern	Ixobrychus exilis	SE	Palustrine Wetlands / Breeding, Foraging
Pied-billed grebe	Podilymbus podiceps	SE	Palustrine Wetlands / Breeding, Foraging
Piping plover	Charadrius melodus	FT	
Upland sandpiper	Bartramia longicauda	SE	Foredune and Beach / migration, foraging
Veery	Catharus fuscescens	ST	Wet Woods / Migration, Foraging
Hoary elfin	Incisalia polios	SE	Sand Savanna / Breeding, Foraging
Karner Blue Butterfly	Lycaeides melissa samuelis	SE,FE	Sand Savanna, Palustrine Wetlands, Wet Mesic Prairie / Breeding,
Foraging Leafhopper	Paraphlepsius lupalus	SE	Breeding, Foraging
Redveined leafhopper	Aflexia rubranura	ST	Prairies / Breeding, Foraging
Cisco	Coregonus artedii	ST	Lacustrine / Foraging
Lake whitefish	Coregonus clupeaformis	ST	Lacustrine / Foraging
Longnose sucker	Catostomus catostomus	ST	Riverine / Breeding, Foraging
Blanding's turtle	Emydoidea blandingii	ST	Palustrine Wetlands / Breeding, Foraging
Kirtland's watersnake	Clonophis Kirtlandii	SE	Palustrine Wetlands / Breeding, Foraging

State endangered (SE); State threatened (ST); Federal endangered (FE); Federal Threatened (FT)

Table A2 Threatened and Endangered Plant Species

Common Name	Scientific Name	Status	Habitat
American sea-rocket	Cakile edentula	ST	Beach and Foredune
Balsam poplar	Populus balsamifera	SE	Sand Dunes and Mesic Prairie
Beaked rush	Rhynchospora alba	ST	Palustrine Wetlands (fens and interdunal swales)
Bearberry	Arctostaphylos uva-ursi	SE	Sand Savanna and Sand Priaire
Bearded wheat grass	Elymus trachycalus	SE	Mesic Prairie
Bog arrow-grass	Triglochin palustre	ST	Palustrine Wetlands (fens and interdunal swales)

Table A2 Threatened and Endangered Plant Species (Con't)

Common Name	Scientific Name	Status	Habitat / Use
Capitate spikerush	Eleocharis olivacea	SE	Palustrine Wetlands (interdunal swales)
Clustered broomrape	Orobanche fasciculata	SE	Dry Sand Prairie
Downey yellow-painted cup	Castilleja sessiliflora	SE	Dry Mesic Sand Priaire
Dune willow	Salix syrticola	SE	Sand Dunes
Eastern prairie fringed orchid	Platanthera leucophea	SE, FT	Wet to Mesic Priaires
Elk sedge	Carex garberi	SE	Calcareous Beach Ridges and Palustrine Wetlands (swales)
Flat-leaved bladderwort	Utricularia intermedia	SE	Palustrine Wetlands (fens and interdunal swales)
Forked Aster	Aster furcatus	ST	Seeps
Golden sedge	Carex aurea	SE	Palustrine Wetlands (fens and sedge meadows)
Grass-pink orchid	Calopogon tuberosus	SE	Palustrine Wetlands (fens)
Ground juniper	Juniperus communis	ST	Sand Dunes
Horned bladderwort	Utricularia cornuta	SE	Palustrine Wetlands (fens and peaty sands)
Jack Pine	Pinus banksiana	SE	Sand Ridges
Kalm's St. John's Wort	Hypericum kalmianum	SE	Palustrine Wetlands (interdunal swales) and Mesic Sand Priaire
Little green sedge	Carex viridula	ST	Palustrine Wetlands (interdunal swales)
Marram (beach) grass	Ammophila breviligulata	SE	Beach, Foredune and Sand Dunes
Marsh speedwell	Veronica scutellata	ST	Palustrine Wetlands (marsh and fen)
Pale false foxglove	Agalinis skinneriana	ST	Wet to Wet-Mesic Sand Priaires
Reddish bulrush	Scirpus microcarpus	SE	Palustrine Wetlands (marsh)
Richardsons rush	Juncus alpinoarcticulatus	SE	Palustrine Wetlands (fens and interdunal swales)
Redroot	Ceanothus ovatus	SE	Sand Savanna and Sand Prairie
Roundleaf sundew	Drosera rotundifolia	SE	Peaty Sand
Pinweed	Lechia intermedia	ST	Dry Sand Prairie
Pitcher's thistle	Cirsium pitcheri	ST, FT	Beach, Fordune and Sand Dunes
Purple-fringed orchid	Platanthera psycodes	SE	Mesic Sand Prairies
Seaside arrow-grass	Triglochin maritima	ST	Palustrine Wetlands (fens and interdunal swales)
Seaside spurge	Chamaesyce poligonifolia	SE	Beach and Foredune
Small bladderwort	Utricularia minor	SE	Palustrine Wetlands (fens and interdunal swales)
Sticky False-asphodel	Tofeldia glutinosa	ST	Palustrine Wetlands (fens and interdunal swales)
Trailing juniper	Juniperus horizontalis	SE	Sand Dunes
Turbercled orchid	Platanthera flava var herbiola	SE	Wet-mesic Sand Prairie
Wood orchid	Platanthera clavellata	SE	Mesic Sand Prairie

State endangered (SE); State threatened (ST); Federal endangered (FE); Federal Threatened (FT)

Table A3 Migratory Bird Species Groups

Bird group	Habitat	Use
Sea birds (gulls, terns, Scoters, Oldsquaw)	Coastal flyway, lacustrine and some palustrine wetlands	migration, foraging
Least bitterns, Sora, Virginia, & King rails	Palustrine marsh	breeding, migration, foraging
Piping Plover	Coastal flyway, nesting habitat, palustrine wetlands	breeding, migration, foraging
Hawks	Coastal flyway	migration, foraging
Waterfowl	Palustrine wetlands	migration

appendix B - Lake County Stormwater Management Commission stream inventory photographs

Appendix B includes photographs taken during the Lake County Stormwater Management Commission 2001 stream inventory. Photographs are organized sequentially by reach. The photograph identification numbers correspond to specific Geographic Positioning System coordinates within the watershed, which allows one to review the 2001 conditions in relation to the action plan recommendations (see Appendix H) or to current conditions. Photographs can also be reviewed in relation to the inventory data sheets in Appendix O.

REACH 1

Photo 425 - Lagoon/Marsh

Photo 426 - Culverts under railroad

Photo 427 - Representative reach

Photo 428 - Culverts

REACH 2

Photo 429 - Culverts at railroad tracks

Photo 430 - Culvert

Photo 431 - Other side of culvert

Photo 432 - Oil and grease in water

Photo 433 - Open channel

Photo 434 - Open channel with debris

Photo 435 - Debris - left bank

Photo 436 - Debris - log jam

Photo 437 - Open channel

Photo 438 - Open channel

Photo 439 - Debris - log jam

Photo 440- Open channel

Photo 441 - Erosion

Photo 442 - Bridge

Photo 443 - Drain pipe

Photo 444 - Open channel

Photo 445 - Drain pipe

Photo 446 - Concrete/drain pipes

Photo 447 - Armoring

Photo 448 - Representative reach

Photo 449 - Culvert/ 2 drain pipes

REACH 3

Photo 69 - Culvert/drain pipes/dam

Photo 70 - Bridge

Photo 71 - Drain pipe

Photo 72 - Drain pipe

Photo 73 - Drain pipe

Photo 74 - Dam with armoring

Photo 75 - Drain pipe

Photo 76 - Dam

Photo 77 - Drain pipes x2

Photo 78 - Bridge

Photo 79 - Drain pipes x3

Photo 80 - Bridge

Photo 81 - Culvert with drain pipe

Photo 82 - Open channel

Photo 83 - Bridge

Photo 84 - Dam

Photo 85 - Bridge

Photo 86 - Drain pipe

Photo 87 - Bridge

Photo 88 - Culverts x2 with armoring

Photo 89 - Dam

Photo 90 - Bridge

Photo 91 - Bridge

Photo 92 - Bridge

Photo 93 - Culvert and open channel

REACH 4

Photo 450 - Culvert - north side of Montesaro

Photo 451 - Representative reach

Photo 452 - Open channel

Photo 453 - Open channel

Photo 454 - Bridge (downstream)

Photo 455 - Drain pipe/ armoring

Photo 456 - Erosion

Photo 457 - Bridge (downstream)

Photo 458 - Drain pipe

Photo 459 - Bridge

Photo 460 - Culvert

Photo 461 - Culvert x3

Photo 462 - Drain pipe

Photo 463 - Culvert x2

Photo 464 - Culvert at Lewis

REACH 5

Photo 465 - Wetland

Photo 466 - Drain pipe

Photo 467 - Drain pipe with open channel

Photo 468 - Open channel

Photo 469 - Open channel

Photo 470 - Open channel

Photo 471 - Open channel - gray/blue water

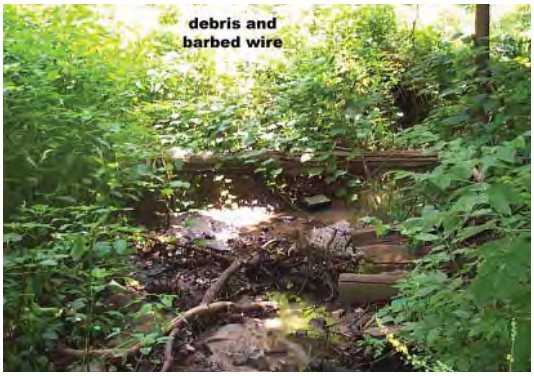


Photo 472 - Debris - barbed wire

Photo 473 - Erosion

Photo 474 - Representative reach

Photo 475 - Open channel

Photo 476 - Open channel

Photo 478 - Pond - left bank

Photo 479 -Open channel

Photo 480 - Culvert

REACH 6

Photo 63 - Culvert

Photo 64 - Drain pipe

Photo 65 - Culvert

Photo 66 - Culvert

Photo 67 - Open channel

Photo 68 - Vegetation - end

REACH 8

Photo 94 - Culverts under railroad tracks

Photo 95 - Erosion - left bank

Photo 96 - Representative reach

Photo 97 - Debris - log jam

Photo 98 - Armoring

Photo 99 - Erosion - left bank

Photo 100 - Drain pipe - left bank

Photo 101 - Open channel - left bank

Photo 102 - Open channel

Photo 103 - Erosion - right bank

Photo 104 - Drain pipe

Photo 105 - Sanitary sewer

Photo 106 - Drain pipe

Photo 107 - Drain pipe - sealed

Photo 108 - Open channel

Photo 109 - Debris - log jam

Photo 110 - Erosion - left bank

Photo 111 - Box culverts at Sheridan

REACH 9

Photo 112 - Culvert

Photo 113 - Drain pipe

Photo 114 - Open channel - left bank

Photo 115 - Drain pipe - creating open channel

Photo 116 - Open channel

Photo 117 - Erosion - right bank

Photo 118 - Debris

Photo 119 - Debris

Photo 120 - Sanitary sewer manhole

Photo 121 - Representative reach

Photo 122 - Erosion/ drain pipe

Photo 123 - Debris (downstream)

Photo 124 - Main fork - end reach

REACH 10

Photo 124 - Left fork - continued south branch

Photo 125 - Open channel - mineral in sediment

Photo 126 - Representative reach

Photo 127 - Erosion - left bank

Photo 128 - Debris

Photo 129 - Armoring - left bank

Photo 130 - Debris

Photo 131 - Armoring - left bank

Photo 132 - Drain pipe

Photo 133 - Drain pipe

Photo 134 - Armoring - left bank, failed

Photo 135 - Drain pipe

Photo 136 - Drain pipe

Photo 137 - Drain pipe

Photo 138 - Drain pipe

Photo 139 - Drain pipe

Photo 140 - Debris

Photo 141 - Debris

Photo 142 - Erosion - left bank

Photo 143 - Culverts at Talmadge

Photo 144 - Drain pipe

Photo 145 - Drain pipe

REACH 11

Photo 146 - Start of channel - fork

Photo 147 - Representative reach

Photo 148 - Erosion

Photo 149 - Drain pipe

Photo 150 - End reach - Pickford Avenue

REACH 12

Photo 151 - Drain pipe

Photo 152 - Culverts

Photo 153 - Drain pipe

Photo 154 - Drain pipe

Photo 155 - Representative reach

Photo 156 - Erosion

Photo 157 - Culvert with armoring

Photo 158 - Debris - sediment build up

Photo 159 - Open channel

Photo 160 - Erosion/ armoring - left bank

Photo 161 - Drain pipe

Photo 162 - Open channel

Photo 163 - Open channel

Photo 164 - Bridge

Photo 165 - Drain pipe

Photo 166 - Armoring

Photo 167 - Drain pipe

Photo 168 -2 bridges

Photo 169 Footbridge

Photo 170 - Footbridge

Photo 171 - Drain pipe

Photo 172 - Drain pipe

Photo 173 - Drain pipe

Photo 174 - Drain pipe

Photo 175 - Culvert at Bertrand

REACH 13

No photos included of this reach.

REACH 14

Photo 186 - Culvert at Beach Road (downstream)

Photo 187 - Drain pipe

Photo 188 - Erosion - right bank

Photo 189 - Drain pipe

Photo 190 - Armoring - right bank

Photo 191 - Culvert

Photo 192 - Drain pipes

Photo 193 - Footbridge - armoring

Photo 194 - Footbridge - armoring

Photo 195 - Armoring/ fence

Photo 196 - Bridge

Photo 197 - Bridge

Photo 198 - Concrete - armoring

Photo 199 - Bridge (downstream)

Photo 200 - Channel armoring

Photo 201 - Drain pipe

Photo 202 - Drain pipe

Photo 203 - Bridge/ armoring/ dam

Photo 204 - Bridge (downstream)

Photo 205 - Bridge

Photo 206 - Debris - log jam

Photo 207 - Drain pipe

Photo 208 - Culvert

Photo 209 - Open channel

Photo 210 - Culvert / channelization

Photo 211 - Culvert / drain pipes at Wilson Ave.

REACH 15

Photo 212 - Beginning of reach at Wilson Avenue culvert South Fork

Photo 213 - Representative reach

Photo 214 - Culvert under Wilson Avenue - drain ditch

Photo 215 - Drain pipe

Photo 216 - Drain pipe

Photo 217 - Drain pipe

Photo 218 - Drain pipe

Photo 219 - Representative reach - vegetated ditch / end of reach

Photo 220 - Culvert

Photo 221 - Drain pipe

Photo 222 - Drain pipe

Photo 223 - Bridge

Photo 224 - Drain pipe

REACH 16

Photo 225 - Drain pipe

Photo 226 - Open channel

Photo 227 - Drain pipe

Photo 228 - Drain pipe

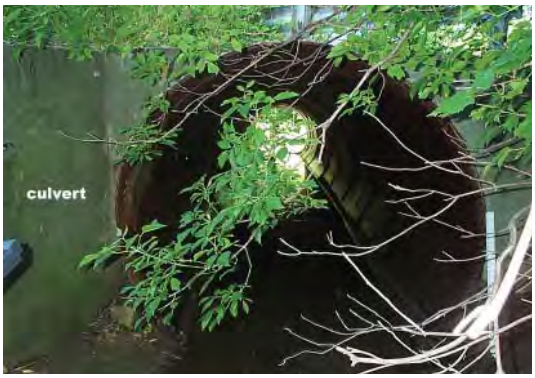


Photo 229 - Culvert

Photo 230 - Open channel

Photo 231 - Representative reach

Photo 232 - Drain pipe

Photo 233 - Culvert

Photo 234 - Debris - log jam / drain pipes

Photo 235 - Drain pipe

Photo 236 - Debris jam

Photo 237 - Bike path

Photo 238 - Culvert

Photo 239 - Drain pipe

Photo 240 - Drain pipe

Photo 241 - Culvert

Photo 242 - Open channel

Photo 243 - Erosion

Photo 244 - Drain pipe

Photo 245 - Culvert

Photo 246 - Open channel

Photo 247 - Drain pipe

Photo 248 - Drain pipe

Photo 249 - Bridge and armoring

Photo 250 - Open channel

Photo 251 - Armoring

Photo 252 - Drain pipe

Photo 253 - Drain pipe

Photo 254 - Culvert at Beach Road

Photo 255 - Drain pipe

REACH 17

Photo 256 - Fork / begin reach

Photo 257 - Open channel

Photo 258 - End of open channel

Photo 259 - Culvert / open channel

Photo 260 - Siting water (natural) vs. retention pond - developers trying to move wtater

REACH 18

Photo 261 - Culvert

Photo 262 - Culvert (downstream)

Photo 263 - Representative reach

Photo 264 - Armoring - right bank

Photo 265 - Drain pipe

Photo 266 - Open channel

Photo 267 - Culvert

Photo 268 - Bridge (downstream)

Photo 269 - Drain pipe

Photo 270 - Culvert

Photo 271 - Drain pipe

Photo 272 - Footbridge

Photo 273 - Culvert

Photo 274 - Pond

Photo 275 - Drain pipe

Photo 277 - Bridge

Photo 278 - Bridge / drain pipe

Photo 279 - Bridge

Photo 280 - Drain pipe - residential

Photo 281 - Drain pipe / amoring / debris

Photo 282 - Erosion

Photo 283 - Drain pipe

Photo 284 - Drain pipe

Photo 285 - Culvert / drain pipe

REACH 19

Photo 286 - Culvert at Lewis

Photo 287 - Culvert - right

Photo 288 - Culvert - left

Photo 289 - Bridge

Photo 290 - Drain pipe

Photo 291 - Bridge

Photo 292 - Culvert at airport

Photo 293 - Open channel

Photo 294 - Representative reach

REACH 20

Photo 295 - Fork / begin north branch

Photo 296 - Bridge

Photo 297 - Representative reach

Photo 298 - Debris - log jam

Photo 299 - Open channel

Photo 300 - Drain pipe

Photo 301 - Open channel - behind pipe

Photo 302 - Erosion - left bank

Photo 303 - Drain pipe

Photo 304 - Drain pipe

Photo 305 - Culvert / drain pipe

REACH 21

Photo 306 - Culvert (downstream)

Photo 307 - Open channel

Photo 308 - Open channel

Photo 309 - Pipe / open channel

Photo 310 - Bridge

Photo 311 - Drain pipe

Photo 312 - Erosion

Photo 313 - Culvert / armoring

Photo 314 - Drain pipe

Photo 315 - Open channel

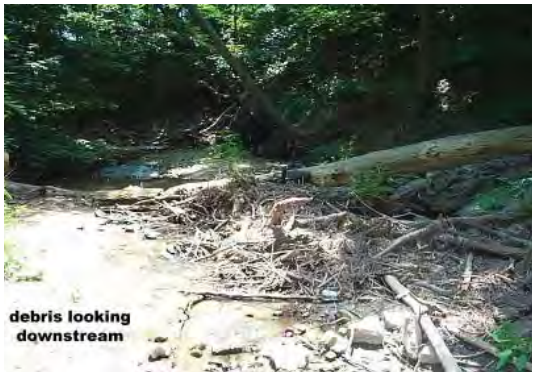


Photo 316 - Debris (downstream)

Photo 317 - Culverts x2

Photo 318 - Culvert

Photo 319 - Open channel

Photo 320 - Culvert

Photo 321 - Culvert

Photo 322 - Drain pipe

Photo 323 - Open channel

Photo 324 - Drain pipe and armoring - right bank

Photo 325 - Drain pipe

Photo 326 - Drain pipe

Photo 327 - Open channel

Photo 328 - Open pipes / open channel

Photo 329 - Culvert at bike path

REACH 22

No photos included of this reach.

REACH 23

Photo 343 - Culvert

Photo 344 - Culvert

Photo 345 - Culvert

Photo 346 - Debris (downstream)

Photo 347 - Drain pipe

Photo 348 - Culvert

REACH 24

Photo 349 - Culvert

Photo 350 - Open channel

Photo 351 - Bridge

Photo 352 - Bridge

Photo 353 - Representative reach

Photo 354 - Open channel

Photo 355 - Culvert

Photo 356 - Drain pipe / open channel

Photo 357 - Bridge

Photo 358 - Bridge

Photo 359 - Open channel

Photo 360 - Bridge

Photo 361 - Culvert

REACH 25

Photo 362 - South branch of fork

Photo 363 - Culverts x3

Photo 364 - Culvert

Photo 365 - Representative reach

Photo 366 - Bridge

Photo 367 - Culvert

Photo 368 - Culvert and drain pipes

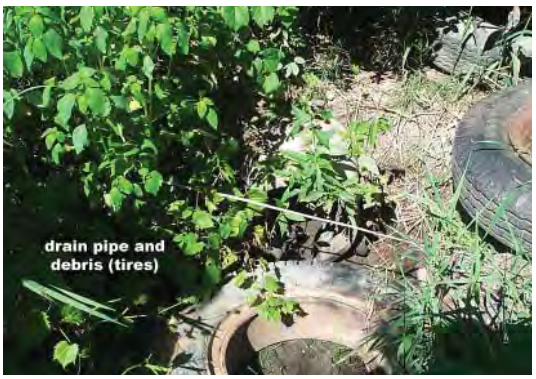


Photo 369 - Drain pipe and debris (tires)

Photo 370 - Vegetation - end reach

REACH 26

Photo 371 - Start 27th Street Tributary - fork near Wadsworth

Photo 372 - Representative reach

Photo 373 - Debris

Photo 374 - Open channel

Photo 375 - Drain pipe

Photo 376 - Culvert

Photo 377 - Culvert

Photo 378 - Culvert

Photo 379 - Vegetated end reach

REACH 27

Photo 381 - Fork at beginning of reach

Photo 382 - Residential use of vegetation as armoring

Photo 383 - Armoring

Photo 384 - Bridge

Photo 385 - Drain pipes

Photo 386 - Bridge

Photo 387 - Bridges x2

Photo 388 - Drain pipe

Photo 390 - Erosion

Photo 391 - Open channel

Photo 392 - Open channel

Photo 393 - Culvert at 33rd street

REACH 28

Photo 393 - Culvert at 33rd Street

Photo 394 - Drain pipe

Photo 395 - Drain pipe

Photo 396 - Representative reach

Photo 397 - Debris (downstream)

Photo 398 - Erosion - left bank

Photo 399 - Debris

Photo 400 - Open channel

Photo 401 - Drain pipe

Photo 402 - Open channel

Photo 403 -Drain pipe

Photo 404 - Bridge

Photo 405 - Erosion - left bank / debris

Photo 406 - Culvert at park - city stormwater outfall

Photo 407 - Drain pipe in culvert

REACH 29

Photo 411 - Debris

Photo 412 - Open channel

Photo 413 - Open channel

Photo 414 - Drain pipe

Photo 415 - Culvert x5

Photo 416 - Culverts x5 (south end)

Photo 417 - Debris - log jam

Photo 418 - Culverts / drain pipes at Sheridan

Photo 419 -Drain pipes

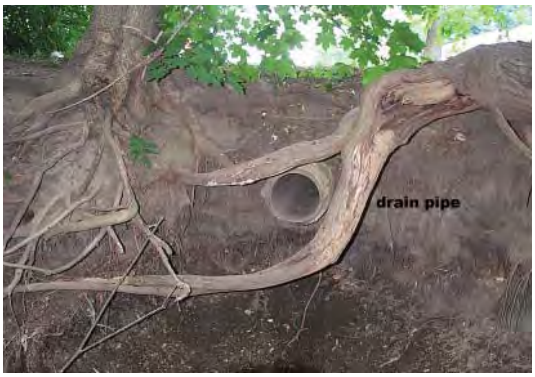


Photo 420 -Drain pipes

Photo 421 - Representative reach

Photo 422 - Erosion

Photo 408 - Begin reach - Wetland

Photo 409 - Open channel

Photo 410 - Open channel

appendix C - stream inventory methodology

Appendix C describes the methodology used by the field crew during the Lake County Stormwater Management Commission 2001 stream inventory. Though the content here is labeled as Appendix D, this was taken from another document and is, in fact, Appendix C for this watershed-based plan.

Appendix D: Stream Inventory Procedures and Form

D.1 STREAM INVENTORY PROCEDURE

During summer 1997, the Lake County Stormwater Management Commission conducted a stream inventory of the three forks of North Branch in Lake County. Water quality sampling was not performed as part of the stream inventory, but the sources and causes of water quality impairment in the streams were investigated. An important component of the assessment process is the evaluation of current hydraulic, geomorphic, and aquatic stream characteristics. The major stream characteristics that were assessed and noted include:

- channel conditions such as bank height, erosion problems and bank vegetation
- hydraulic structures such as bridges and culverts in the river or floodplain
- point discharges into the river
- land use and vegetative cover in the riparian corridor
- channel substrate and degree of sedimentation.

These characteristics were identified for each stream reach using the stream inventory procedure described below. Several procedures were considered self-explanatory and were therefore not described. The discussion below is organized in the same order as the data was collected on the stream inventory report form (SIRF).

D.1.1 Stream Inventory Report Form

D.1.1.1 Reach Boundaries

A stream reach is defined as a stream segment having fairly homogenous hydraulic, geomorphic and riparian cover and land use characteristics (such as all ditched agriculture or all natural and wooded). Reaches generally should not exceed 2,000 feet in length. Where possible, beginning and end stations should be established along the stream using permanent physical landmarks such as bridges that are readily recognized.

D.1.1.2 Channel Flow Status (Stream Stage)

The degree to which the channel is filled with water. The flow status will change as the channel enlarges (e.g., aggrading stream beds with actively widening channels) or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the amount of suitable substrate for aquatic organisms is limited. In high-gradient streams, the decrease in water level exposes logs and snags, thereby reducing the areas of good habitat. Channel flow is especially useful for interpreting biological condition under abnormal or lowered flow conditions. This parameter becomes important when more than one biological index period is used for surveys or the timing of sampling is inconsistent among sites or annual periodicity.

D.1.2 Channel Conditions (SIRF Section A)

D.1.2.1 Channelization

Channelization refers to channel modifications performed by humans. ‘The one-third rule should be applied again where low means < 33% of the reach is channelized, moderate means 33 to 66% and high means > 66% of the reach is channelized. The presence of a pilot channel should be noted under ‘Pilot Channel Formed’ for channelized streams. A narrow, meandering pilot channel may develop within the wide and flat trapezoidal ditch that was excavated during channelization. A pilot channel is indicative of recovery

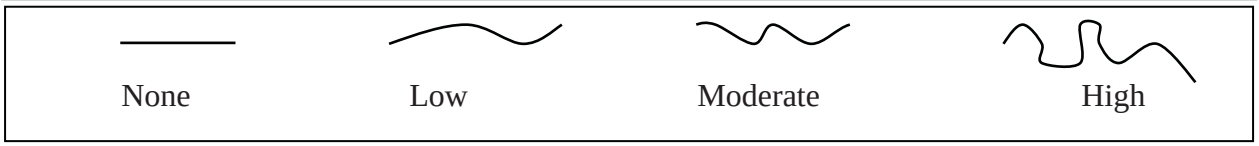
from channelization. Spoils piles refer to any excavated or dredged materials that have been deposited along the banks. If present identify which bank is affected.

D.1.2.2 Sinuosity

Sinuosity is dependent on the stream stage in many channelized reaches. For instance, in many cases a narrow, highly sinuous pilot channel has developed during low stream stage within a wider, non-sinuous channel that was excavated during channelization. Therefore, sinuosity should be estimated for both baseflow conditions (describing sinuosity in the pilot channel) and for the bankfull-flow events. However, if the stream inventory report form is completed during bankfull flow, then sinuosity during baseflow conditions will be difficult to estimate. Figure D-1 should be used for estimating the degree of sinuosity.

Figure D-1

SINUOSITY ESTIMATION GUIDE



D.1.2.3 Pool/Riffle Development

The proportion represented by riffles, runs, and pools should be noted to describe the morphological heterogeneity of the reach. Pools should be well-defined areas of deeper than average water. Pools generally do not extend in length more than three or four times the stream width. Pools should almost immediately be followed by a riffle environment for the stream to be characterized as having high pool/riffle development. A riffle is characterized by shallower water and higher velocities with rippling or disturbances to the surface water tension that allow turbulence and mixing to occur. Many streams in Lake County will have low or no pool/riffle development.

D.1.2.4 Bank Erosion

Severe bank erosion is a significant concern for Lake County's stream and rivers. Severely eroded banks have exposed soil on nearly vertical banks extending from the top of bank to the low water mark so erosion is constantly occurring. Highly eroded streambanks contribute heavy loads of sediment and erode during times of higher flows. Active slumping and sloughing may be apparent where fresh, moist, loose soil and other signs of recent bank movement such as exposed tree roots or suspended fences extending into the stream are found. Eroded areas are most prevalent in the outer edges of bends and meanders. All cases of severe erosion should be photographed and noted on the form and the map or aerial photo. If the photo is taken looking up/down stream the aspect should be noted. Structures that are present and threatened by slumping should also be recorded. Right and left bank are determined by facing upstream.

On impounded areas of streams, the absence of bank or littoral vegetation along the normal water mark resulting in constant erosion would also be considered severe.

D.1.2.5 Armoring

Armoring refers to the placement of gabions, wood, metal, riprap or other similar artificial materials along the streambank to reduce bank erosion. The one-third rule should be applied again where low means < 33% of the reach is armored, moderate means 33 to 66% and high means > 66% of the reach is armored. Portions of armoring that are failing should be noted.

D.1.2.6 Sediment Accumulations

Sediment accumulations that affect the channel capacity and flow conveyance should be described. Sediment deposition measures the amount of sediment that has accumulated in pools and the changes that

have occurred to the stream bottom as a result of deposition. Deposition occurs from large-scale movement of sediment. Sediment deposition may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increase in size as the channel is diverted toward the outer bank) or shoals, or result in the filling of runs and pools. In some cases, sediment accumulations may not impact channel conveyance.

D.1.2.7 Mid-Stream Bars and Islands

Record whether exposed mid-stream bars or islands are present. Although these structures may increase habitat availability for organisms, they also reduce the unobstructed stream width and may enhance the debris-accumulating potential of the stream reach.

D.1.2.8 Mean Water Depth

Water depth should be measured at the deepest portion of the channel cross section (known as the thalweg) with a sturdy 4- to 5-foot rod inscribed with depth marks in inches. The range of water depths should reflect the variation between the deepest and shallowest portions of the channel cross-section in the reach.

D.1.2.9 Mean Bank Height, Top Mean Channel Width and Bottom Mean Channel Width

Mean bank height should be measured from the top to the bottom of the streambank. The top of the bank occurs where there is a convex-shaped transition in bank slope between the stream bank and the outlying floodplain. The bottom of the bank occurs where there is a concave-shaped transition in slope between the stream substrate and the stream banks, and it may be below the water level.

Top and bottom mean bank widths refer to the mean bank-to-bank width across the top and across the bottom of the banks. If the top of one bank is higher in elevation than the top of the opposite bank, the top mean channel width should be measured from the elevation of the lowest bank. In estimating these and other values, the investigator should be conscious of longitudinal changes in bank dimensions in order to arrive at estimated values.

D.1.2.10 Beaver Activity

Low beaver activity includes an occasional bank slide or chewed stump within the reach. These features must become progressively more apparent to rate as moderate activity. High activity is characterized by almost constant activity in the wooded areas with felled trees in excess of 12 inches; slides and beaver cut brush being common in the stream. All dams and lodges should be noted and indicate high beaver activity.

D.1.2.11 Stream Debris Load

1. Instream Debris Load
Stream debris load refers to natural and man-made debris including leaves, sticks, logs, lumber, trash and sediment. The one-third rule should be applied again where low means < 33% of the reach contains debris obstructing or deflecting flow, moderate means 33 to 66% and high means > 66% of the reach is characterized by large accumulations of lodged and partially compacted debris spanning the entire stream width.
2. Overbank Debris Load
The overbank debris load refers to loosened, floatable materials that are prevalent enough to potentially cause debris jams at culverts and bridges during high flows events. The locations and types of debris as well as how it may impact the reach should be noted. Similarly to the instream debris load section, the one-third rule should be applied.

D.1.3 Hydraulic Structures (SIRF Section B)

Hydraulic structures include low head dams, weirs, bridges, levees, and culverts. Dimensions as well as construction materials should be measured and recorded. Structures should be photographed and their locations should be recorded by taking a GPS waypoint. Elevations will be determined from existing data or field survey dependent upon the approved scope of work. Notes should include condition, drop or change in elevation, blockages and other characteristics.

D.1.4 Point Discharges (SIRF Section C)

Point discharges include all sanitary, storm sewer and agricultural drainpipes greater than 4 inches in diameter. They also include open channels, swales, gullies and other significant tributaries. Locations of all point discharges should be recorded by taking a GPS waypoint. Check the problem column (see SIRF) if the condition of the discharge point is blocked, cracked, etc. The volume of flow should be noted in the appropriate column using the following categories: none, trickle, moderate, substantial, other. Notes should include comments on odors, sheens or high turbidity if present.

D.1.5 Vegetation and Land Use (SIRF Section D)

D.1.5.1 Floodplain Vegetation (within 100 ft of stream)

For the respective banks the land use and vegetative cover should be noted as percentages of the floodplain surface area (note: percentages should total 100%). The vegetated buffer is given a score from 0-10 (see SIRF for specific criteria).

D.1.5.2 Predominant Bank Vegetation (%) and Predominant Tree/Shrub Species

These measurements provide an indication of bank stability and the potential for the development of debris blockages in the channel. For the respective banks the predominant vegetation type should be noted as percentages of the bank surface area (note: percentages should total 100%). Due to the rapid colonization capabilities of some tree and shrub species, the presence or absence of tree and shrub types should be documented even if trees or shrubs were uncommon in the stream reach. Also, where possible, tree and shrub species included in the 'Other' category should be identified. Canopy cover should be estimated as a percentage of shaded coverage of the channel.

D.1.5.3 Aquatic Vegetation

The general type and relative dominance of aquatic plants are documented in this section. Besides being an ecological assemblage that responds to perturbation, aquatic vegetation provides a refuge and food for aquatic fauna. Filamentous algae can grow in fast or slow flowing streams over solid surfaces within the stream channel. Extensive filamentous algae coverage is indicative of excessive nutrient levels. Submergent, emergent, free floating, rooted floating or no vegetation should also be considered when estimating percentage of aquatic vegetation over the total area of the reach.

D.1.6 Substrate and Water Quality (SIRF Section E)

D.1.6.1 Substrates

The substrate in the stream channel should be classified using the following definitions:

1. Claypan (Hardpan)

Claypan is made up of particles less than 0.0002 inches in diameter, which forms a dense, gummy surface that is difficult to penetrate.

2. *Silt*
Silt particles are between 0.0002 to 0.002 inches in diameter. Silt is a fine material that generally feels "greasy" when rubbed between fingers.

3. *Sand*
Sand is made up of materials from 0.002 to 0.08 inches in diameter. Sand exhibits a gritty texture when rubbed between fingers.

4. *Gravel*
Gravel is a mixture of rounded coarse material from 0.08 to 2.5 inches in size.

5. *Cobble*
Cobble is made up of stones from 2.5 to 10 inches in diameter.

6. *Boulder*
Boulders are defined as rounded stones over 10 inches in diameter or large "slabs" over 10 inches in length.

7. *Organic*
Organic substrate refers to living or decaying plant material.

8. *Concrete*
Channels lined with concrete or other man-made materials should be noted.

D.1.6.2 Substrate Stability

Substrate stability will be assessed according to how well the stream substrate supports the weight of the observer walking within the stream. Assessing substrate stability requires that the observers walk through representative lengths of the stream channel in the reach. To help ensure the safety of the observers, waders should be worn at all times to prevent cuts and infections, and at least two observers should walk each reach together. Stream channels should not be walked if the safety of the recorder is in jeopardy at any time because of strong current, deep-water sections, soft substrate, or any other potential danger. Substrate stability classified as 'None' indicates that the substrate can't support the observer's weight and the observer quickly sinks into the substrate. These substrate types are usually deep silts that for obvious safety reasons must not be walked in. 'Low' substrate stability can be walked over, but the observer will sink several inches into the substrate if he stands for an extended time period. These substrates may include silts and loose sand or gravel. 'Moderate' substrate stability would describe substrate that can be walked over without sinking more than an inch or two into the substrate and may include coarse gravel, cobble, perhaps mixed with some boulders. 'High' substrate stability can be readily walked on without sinking into the substrate. 'High' substrate stability often occurs when cobble, boulders, shale or claypan covers the stream bottom.

D.1.6.3 Substrate Embeddedness

Substrates should be considered embedded if more than 50% of the surface of the substrates are surrounded, impacted in or covered by unnatural accumulations of fine material such as sand or silt. Embedded substrates can't be easily dislodged. Naturally silty or sandy streams are not considered embedded; however, if sedimentation has buried the natural coarse substrates with sand or silt then the stream reach should be considered embedded. The degree of embeddedness can often be determined by jabbing a sturdy rod into the stream bottom to determine whether the underlying stream substrate is coarse material, or sand and silt. Embeddedness is the extent to which cobbles, gravel, and boulder substrates are embedded. High embeddedness would occur if over 66% of the site area was embedded (as defined above), moderate embeddedness would occur if from 33 to 66% of the site area was embedded and low means less than 33% of the area was embedded. 'N/A' ratings should be applied to stream channels that are naturally composed of silt and sand, because in such channels embeddedness of coarse substrates is 'not applicable.'

D.1.7 Instream Cover (SIRF Section F)

All types of cover present should be noted. Cover should not be counted when it is in areas of the stream with insufficient depth. General comments on perceived abundance of various cover types should be reported.

D.1.8 Aquatic and Terrestrial Organisms (SIRF Section G)

Some measurements for the Aquatic and Terrestrial Organisms section (SIRF Section G) require that riffles be distinguished from runs and pools. Pools and riffles were defined in section D.1.2.3. Runs are deeper than riffles, have relatively rapid, non-turbulent flow and are generally located downstream from riffles where the stream narrows. The streambed is often flat beneath a run and therefore the water surface is not visibly broken.

Biological information (versus chemical or physical information) is widely regarded as the most reliable type of data collection for evaluating the ecological conditions of stream reaches. For a very basic yet somewhat informative assessment of ecological conditions, the following procedures should be followed. For fish and macroinvertebrate sampling, the sample locations, the type of gear used for the sample collection and the approximate sample effort (in minutes or feet of stream reach) should be noted. Although SMC did not sample for fish, macroinvertebrates or birds in the North Branch, their presence was noted when they were encountered in a stream reach.

D.1.8.1 Macroinvertebrates

If sufficient flow exists, macroinvertebrates should be sampled by kick net (approximately 3' x 3' screens) in riffle areas at least once per reach. The observer should stand upstream of the kick net and use one or both feet to disrupt the substrate and dislodge macroinvertebrates from the substrate so that they drift downstream into the kick net screen. If sufficient flow does not exist for the effective use of kick nets, macroinvertebrates should be handpicked from rocks in riffle areas. The presence should be noted of major groups of macroinvertebrates such as stonefly, mayfly and caddisfly larvae, snails, water pennies, riffle beetles, damselfly and dragonfly nymphs, isopods and sowbugs, leeches, and worms. If riffle areas and rocks do not exist such as in recently channelized streams, impounded streams, or under low-flow conditions, then macroinvertebrates should be sampled from vegetation, debris or other instream material.

D.1.8.2 Fish

Fish sampling should be performed with a seine (or ideally, electroshocking equipment) at three or more stream locations. The types and relative abundances (percent composition of the catch by species) should be noted for each fish species captured. However, high flow may in some circumstances not permit safe and effective seining. In such instances, visual observations of types of fish present should be made where water clarity permits. Based on past experience, some species or groups that can be tentatively identified by visual observation alone without sampling gear include carp, goldfish, minnows, panfish and bass. In all biological evaluations, presence of rare or threatened and endangered animal and plant species is of great interest.

D.1.8.3 Birds

During the field investigation, types and numbers of birds that utilize streams and adjacent aquatic habitat should also be noted. Such birds that are common to Lake County include ducks, geese, herons, kingfishers, sandpipers, plovers, gulls, terns, swifts and some swallows.

Note: Any reptiles, amphibians or mammals observed should be noted as specific as possible.

D.1.9 Additional Comments

Additional notes or comments should include any irregularities such as cars in the stream, floodplain construction activity, presence of livestock in the stream, foul smelling discharges, errors in existing mapping or other peculiarities. Opportunities and obstacles to access should also be noted on each form.

D.1.9.1 Suggested Equipment List

- waders (2 pairs)
- digital camera, waterproof recommended
- gps unit
- polarized sunglasses
- 100+ foot tape measure
- 4-foot wood rod with depth marks or metal yard stick
- watch with second hand
- sampling gear

D.1.9.2 Access

Approval for access on private property is important. In the North Branch watershed, SMC met with the four drainage districts to obtain permission to enter their 50-foot easements on the three forks in order to access the river. In addition, SMC staff prepared a permission letter for presentation to members of the public encountered during the stream inventory. The sample permission letter used to access private property for the West Fork assessment is in Figure D-2.

FIGURE D-2 SAMPLE ACCESS PERMISSION LETTER

To Whom It May Concern:

The Lake County Stormwater Management Commission (SMC) is currently working on a comprehensive watershed management plan for the North Branch of the Chicago River in Lake County. As part of this process, we will be performing a complete assessment of the West Fork of the North Branch of the Chicago River. This assessment will examine things such as channel conditions; outfalls; substrate condition and water quality; and instream cover and shading. SMC staff members Sean Wiedel, Watershed Specialist, and Tim Andruss, Watershed Intern, will perform the assessment along with various volunteers. All of the above individuals are authorized by the SMC and the Union Drainage District #1 to gain reasonable access to the North Branch to perform the stream assessment.

The information collected in the field assessment will be incorporated into a comprehensive watershed plan for the North Branch of the Chicago River. This plan will address water quality and flooding problems, natural resource protection and development of greenways in the watershed along with other problems and opportunities.

The anticipated completion dates of the components of the plan are:

- Field Assessment
- Public Meetings
- Draft Plan
- Final Plan

If you would like additional information on the North Branch of the Chicago River watershed project, please contact Sean Wiedel at SMC (847-918-7695). Thank you for your cooperation.

Sincerely,

Ward Miller
Executive Director
Lake County SMC

Gordon McKavanaugh
Commissioner
Union Drainage District #1

STREAM INVENTORY REPORT FORM

STREAM NAME:_____REACH ID:_____ DATE:_____

REACH BOUNDARY- DOWNSTREAM:_____ GPS Ref. #_____

REACH BOUNDARY-UPSTREAM:_____ GPS Ref. #_____

APPROX. LENGTH (ft):_____ TEMP. (°F)_____ TIME:_____

INVESTIGATORS:_____ RECENT RAIN: (Now, 12, 24, 48 hours, week)_____

GAGE READING:_____

A. CHANNEL CONDITIONS:

CHANNEL FLOW (STREAM STAGE):

NONE	LOW	MODERATE	NORMAL	HIGH
Very little water in channel and mostly present as standing pools	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed	Water fills > 75% of the available channel; or <25% of channel substrate is exposed	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed	Water levels are higher than the base of both banks
0 1	2 3 4	5 6	7 8	9 10

CHANNELIZATION: NONE_____ LOW____ MODERATE____ HIGH_____

PILOT CHANNEL FORMED (YES / NO)

SPOILS PILES ON BANKS (Left / Right / Both)

BANKFULL SINUOSITY: NONE____ LOW____ MODERATE____ HIGH____

BASEFLOW SINUOSITY: NONE____ LOW____ MODERATE____ HIGH____

POOL/RIFFLE DEVELOPMENT: % POOL ____ % RIFFLE ____ % RUN ____

DEGREE OF BANK EROSION:

NONE	LOW	MODERATE	HIGH
Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems; less than 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-33% bank has areas of erosion.	Moderately unstable; 33-66% of bank has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 66-100% of bank with erosional scars.
Left Bank 10 9	8 7 6	5 4 3	2 1 0
Right Bank 10 9	8 7 6	5 4 3	2 1 0

TYPES AND LOCATIONS OF HIGH CASES:

GPS#	PHOTO #	Side of Channel (L/R)	NOTES (aspect of photo if applicable):

DEGREE OF ARMORING: NONE____ LOW____ MODERATE____ HIGH____

TYPES AND LOCATIONS OF HIGH CASES:_____

SEDIMENT ACCUMULATIONS:

NONE	LOW	MODERATE	HIGH
Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment depositions	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 20-50% of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected, sediment deposits at obstructions, constrictions and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increase bar development; more than 80% bottom changing frequently, pools almost absent due to substantial sediment deposition
10 9	8 7 6	5 4 3	2 1 0

TYPES AND LOCATIONS OF HIGH CASES:_____

MID-STREAM BARS AND ISLANDS: YES:_____ NO:_____

MEAN BANK HEIGHT	HEIGHT (FT)	GPS #	AVERAGE	RANGE
MEAN BANK SLOPE (RUN/RISE)	SLOPE	GPS #	AVERAGE	RANGE
MEAN WATER DEPTH	DEPTH (FT)	GPS #	AVERAGE	RANGE
TOP MEAN CHANNEL WIDTH (FT)	WIDTH (FT)	GPS #	AVERAGE	RANGE
BOTTOM MEAN CHANNEL WIDTH (FT)	WIDTH (FT)	GPS#	AVERAGE	RANGE
MEAN VELOCITY (FT/S)	TRAVEL TIME (sec/ 10ft)	GPS#	AVERAGE	RANGE

BEAVER ACTIVITY: NONE_____ LOW_____ MODERATE_____ HIGH_____

DAM/LODGE: YES (NUMBER OF DAMS)_____ NO_____

STREAM DEBRIS LOAD (as defined in methodology):

INSTREAM: LOW _____ MODERATE _____ HIGH _____

OVERBANK: LOW _____ MODERATE _____ HIGH _____

NOTES:_____

_____

IMPOUNDED: YES:_____ NO:_____

COMMENT:_____

SOURCE:_____

B. HYDRAULIC STRUCTURES:

(Note sizes & locations in channel or adjacent floodplain.)

TYPE & MATERIAL	DIMENSIONS (inches)	GPS #	PHOTO #	L/R or Center of Channel	P♣	ASPECT (up/down)	NOTES:

C. DISCHARGE POINTS:

♣ **P= Problem (Check for Yes)**

(Pipes, ditches, swales, tributaries; note numbers, sizes and locations of discharges with diameters of 4 inches or more.)

TYPE & MATERIAL	DIMEN-SIONS (inches)	GPS #	PHOTO #	L/R or Center of Channel	P♣	FLOW*	NOTES

NOTES (ex: suspicious effluent etc.):_____

_____

♣ **P= Problem (Check for Yes)**

* **None, Trickle, Moderate, Substantial, Other**

D. VEGETATION & LAND USE:

FLOODPLAIN VEGETATION(within 100 ft of stream)

DOMINANT LAND USE (%):

LEFT: AGRICULTURAL:_____ OPEN SPACE:_____ RECREATIONAL: _____

COMMERCIAL/INDUSTRIAL:_____RESIDENTIAL:_____ OTHER:_____

RIGHT: AGRICULTURAL:_____ OPEN SPACE:_____ RECREATIONAL:_____

COMMERCIAL/INDUSTRIAL:_____ RESIDENTIAL:_____OTHER:_____

LAND COVER (%):

LEFT: TREES: _____ LAWN:_____ WETLANDS:_____ CROPS:_____ SHRUBS:_____

HERBACEOUS: _____ IMPERVIOUS:_____ WATER:_____OTHER: _____

RIGHT: TREES:_____ LAWN:_____ WETLANDS:_____ CROPS:_____ SHRUBS:_____

HERBACEOUS:_____ IMPERVIOUS:_____ WATER:_____OTHER:_____

WIDTH OF VEGETATED BUFFER:

NONE	LOW	MODERATE	HIGH
Width of riparian zone <20 feet; little or no riparian vegetation due to human activities	Width of riparian zone 20-40 feet; human activities have impacted zone a great deal	Width of riparian zone 40-60 feet; human activities impacted zone minimally	Width of riparian zone >60 feet; human activities (parking lots, roadbeds, lawns, crops) have not impacted zone
Left Bank 0 1 2	3 4 5	6 7 8	9 10
Right Bank 0 1 2	3 4 5	6 7 8	9 10

Notes_____

_____

_____

BANK VEGETATION (within 10 ft of stream):

PREDOMINANT VEGETATION (%)

LEFT BANK: UNMOWED GRASS:___ LAWN:___ WETLAND:___ TREES:___ SHRUB:___

CROP:___ HERBACEOUS: ___ NONE:___ OTHER:_____

RIGHT BANK: UNMOWED GRASS:___ LAWN:___ WETLAND:___ TREES:___ SHRUB:___

CROP:___ HERBACEOUS: ___ NONE:___ OTHER:_____

PREDOMINANT TREE/SHRUB SPECIES ON BANKS (CHECK ALL PRESENT)

WILLOWS_____ BOX ELDER_____ HONEYSUCKLE_____

BUCKTHORN_____ HARDWOODS_____ OTHER_____

CANOPY (PERCENT SHADED COVERAGE OF CHANNEL):_____

AQUATIC/INSTREAM VEGETATION

VEGETATION (%): ROOTED EMERGENT:_____ ROOTED SUBMERGENT:_____

ROOTED FLOATING:_____ FREE FLOATING:_____ FLOATING ALGAE:_____

ATTACHED ALGAE:_____ NO VEGETATION:_____

E. SUBSTRATE AND WATER QUALITY:

SUBSTRATE COMPOSITION (%): CLAYPAN_____ SILT_____ SAND_____ GRAVEL_____

COBBLE_____BOULDER_____ CONCRETE_____ ORGANIC MATTER_____

CATEGORIZE AS "NONE", "LOW", "MODERATE", OR "HIGH" (Locate worst cases.):

SUBSTRATE STABILITY OF ENTIRE REACH:_____

SUBSTRATE EMBEDDEDNESS OF ENTIRE REACH:_____

GREASE & OIL IN WATER COLUMN_____ GREASE & OIL IN SEDIMENT_____

TURBIDITY (including tributaries, point discharges; LOW, MODERATE, HIGH):_____

WATER COLOR: CLEAR_____ BROWN_____ GREEN_____ GRAY_____

COMMENTS/PROBABLE CAUSES:_____

F. INSTREAM COVER FOR FISH:

(Check all that apply.)

UNDERCUT BANKS_____ POOLS OVER 28" DEEP_____ MACROPHYTES_____ LOGS_____

OVERHANGING VEGETATION_____ ROOTWADS_____ BOULDERS_____ BACKWATERS_____

COMMENTS:_____

_____

G. AQUATIC AND TERRESTRIAL ORGANISMS:

(Check or note all that were observed.)

MACROINVERTEBRATES:

MAYFLIES:_____ CADDISFLIES:_____ DRAGONFLY/DAMSELFLY NYMPHS:_____

SNAILS:_____ SCUDS:_____ SOWBUGS:_____ LEECHES:_____ WORMS: _____

WATER PENNIES:_____ BEETLES:_____ OTHER:_____

FISH:

CARP:____ BLACK BULLHEADS:____ CREEK CHUBS:____ GREEN SUNFISH:____ BLUEGILL: ____

LARGEMOUTH BASS:____ JOHNNY DARTERS:___ FATHEAD MINNOWS:____ GOLDEN SHINERS:

OTHERS:_____

BIRDS:

DUCKS:___GEESE:___ HERONS:___ KINGFISHERS:___ SANDPIPERS/PLOVERS:

GULLS/TERNS:_____ OTHERS:_____

REPTILES:_____

AMPHIBIANS:_____

MAMMALS:_____

MUSSEL BEDS: NO ___ YES ___ IF YES: GPS #'S ____ ____ ____

H. PHOTO LOG: PHOTOGRAPHER:_____

GPS #	PHOTO #	L/R or Center of Channel	Aspect (Up/ Downstream)	Photo Description:

appendix D - stream inventory problem areas

This table presents a summary of problem areas as identified through a review of the Lake County Stormwater Management Commission 2001 stream inventory report and data sheets contained in Appendix P. The data in this table is mapped in Chapter 3. This table includes information that is used within these data sheets to locate the points on the ground (Global Positioning System Location). Photo numbers can be used, where provided, to view the problem identified in Appendix B. Point Discharge (PD) and Hydraulic Structure (HS) identification numbers can be used to cross-reference information on the data sheets and to identify these structures on maps in Chapter 3. They also are cross-referenced to the expanded site specific action plan in Appendix H.

Table D Stream Inventory Problem Areas

Reach ID	Global Positioning System Location	Photo #	Point Discharge/ Hydraulic Structure #	Problem Description	Erosion	Debris / Sediment	Failed Infrastructure / Armoring	Multiple / Other
BL01	260	426	HS01 & 02	culvert silting in		X		
BL01	261	428	HS03 & 04	culvert silting in		X		
BL02	267	436		debris obstructing flow		X		
BL02	269	438	PD4	open channel, check minor erosion	X			
BL02	270	439		debris obstructing flow		X		
BL02	272	441		typical 2-4' bank erosion	X			
BL02	274	443	PD6	erosion & rip rap below outfall	X			
BL02	277	446	PD9	minor channel erosion below concrete lined channel outfall	X		X	X
BL02	279	449	PD10	Elevated outfall & plunge pool, check plunge pool erosion	X			
BL03	379	74		erosion undercutting concrete lined channel	X		X	X
BL03	384	82	PD25	minor 1-2' turf edge erosion	X			
BL05	294	466	PD33	incised channel, rip rap at outfall	X			
BL05	294	467	PD33	bank erosion addressed with rip rap				
BL05	298	472		debris in channel, bricks		X		
BL05	299	473		ravine / channel erosion	X			
BL07	002	95		typical 3-4' bank erosion, left bank	X			
BL07	003	97		debris obstructing flow		X		
BL07	004	99		typical 2-4' bank erosion, left bank	X			
BL07	006	101	PD44	channel erosion / downcutting, left bank	X			
BL07	007	102	PD45	channel erosion / downcutting	X			
BL07	008	103		major 4-6' bank erosion, right bank	X			
BL07	009	104	PD46	erosion at outfall	X			
BL07	010	105		exposed sewer crossing				X
BL07	014	109		debris obstructing flow		X		
BL07	015	110		major erosion and slumping, left bank	X			
BL08	018	114	PD50	channel erosion and downcutting	X			
BL08	019	115	PD51	major erosion behind headwall and at outfall	X		X	X
BL08	020	116	PD52	channel erosion and downcutting	X			
BL08	021	117		erosion and slumping, left bank	X			
BL08	022	118		debris obstructing flow		X		

appendix D - stream inventory problem results

Reach ID	Global Positioning System Location	Photo #	Point Discharge/ Hydraulic Structure #	Problem Description	Erosion	Debris / Sediment	Failed Infrastructure / Armoring	Multiple / Other
BL08	023	119		debris obstructing flow		X		
BL08	024	120		sewer infrastructure				X
BL08	025	122	PD53	major erosion and slumping	X			
BL08	026	123		debris obstructing flow		X		
BL09	030	127		major erosion with slumping, left bank	X			
BL09	031	128		debris obstructing flow		X		
BL09	033	130		debris obstructing flow		X		
BL09	035	132	PD55	debris around outfall		X		
BL09	037	134		failed armoring, major erosion, left bank	X		X	X
BL09	043	140		debris obstructing flow		X		
BL09	044	141		debris obstructing flow		X		
BL09	045	142		major erosion and slumping, left bank	X			
BL10	048	148		major erosion and slumping	X			
BL10	049	149	PD64	erosion around capped outfall pipe	X			
BL11	051	152	HS55	debris obstructing culvert		X		
BL11	052	154	PD67	armored and debris filled outfall channel		X	X	X
BL11	053	156		major erosion and slumping	X			
BL11	054	157		erosion below outfall	X			
BL11	055	158		debris obstructing flow		X		
BL11	056	159	PD68	NP				
BL11	055	160		major erosion behind armoring, left bank	X		X	X
BL11	062	166		armoring, habitat impairment			X	
BL12	071	179		typical 1-2' erosion, right bank	X			
BL12	072	180		debris obstructing flow		X		
BL12	073	181		significant erosion with slumping, right bank	X			
BL12	074	182	PD77	channel erosion	X			
BL12	075	183	PD78	channel erosion	X			
BL12	76	185	HS65	debris and sediment		X		
BL13	077	186	HS66	debris and sediment		X		
BL13	077	187	PD81	rusting culvert, erosion below outfall	X		X	X
BL13	078	188		significant erosion and slumping, right bank	X			
BL13	079	189	PD82	failed clay outfall pipe due to erosion	X		X	X
BL13	085	195		fence across channel with rock wall armoring			X	X
BL13	087	197		concrete debris		X		
BL13	088	198		concrete lined channel needs attention			X	
BL13	090	200	HS73	failed concrete wall armoring, major erosion behind	X		X	X
BL13	096	206		debris obstructing flow		X		
BL13	100	210	HS78+79	broken concrete and CMP culvert and flow obstruction		X	X	X

Reach ID	Global Positioning System Location	Photo #	Point Discharge/ Hydraulic Structure #	Problem Description	Erosion	Debris / Sediment	Failed Infrastructure / Armoring	Multiple / Other
BL14	102	212		debris		X		
BL14	102	213		debris		X		
BL15	109	222	PD97	erosion at outfall	X			
BL15	110	223	PD98	erosion at outfall	X			
BL15	114	234	PD104&105	erosion and debris at outfalls	X	X		X
BL15	115	235	PD106	erosion at outfall	X			
BL15	116	236		debris obstructing flow		X		
BL15	119	239	PD107	erosion at outfall	X			
BL15	119	240	PD108	erosion at outfall	X			
BL15	120	241	HS90	erosion and silt fence failure	X			
BL15	122	243		typical 4-6' erosion	X			
BL15	123	244	PD110+111	erosion at outfall	X			
BL15	127	250	PD115+116	erosion at outfall	X			
BL15	129	254	HS93	erosion around culvert	X			
BL15	130	255	PD118	erosion at outfall	X			
BL17	134	261	HS95	debris blocking culvert		X		
BL17	134	262	HS95	exposed trail culvert			X	
BL17	135	264		concrete slab / habitat impairment			X	
BL17	138	270	HS99	erosion undermining culvert	X		X	X
BL17	139	272		turf grass to edge of water				X
BL17	140	273		turf grass to edge of water				X
BL17	141	274		turf grass to edge of water				X
BL17	141	275		turf grass to edge of water				X
BL17	146	281		debris at outfall		X		
BL17	146	282		significant erosion and slumping	X			
BL18	154	292	HS111	fending across culvert				X
BL19	157	298		debris obstructing flow		X		
BL19	160	302		significant erosion and slumping, left bank	X			
BL20	163	308	PD142	channel erosion / downcutting	X			
BL20	164	309	PD143	channel erosion / downcutting	X			
BL20	167	312		significant erosion and slumping	X			
BL20	168	313	HS116	significan erosion around culvert	X			
BL20	171	316		debris obstructing flow		X		
BL20	173	319	PD147	channel erosion / downcutting	X			
BL20	175	321	HS121	erosion around culvert	X			
BL20	175	322	PD148	erosion at outfall	X			
BL20	178	325	PD151	cracked concrete armoring at outfall			X	
BL21	184	331	PD155	channel erosion at outfall, rip rap	X			

appendix D - stream inventory problem results

Reach ID	Global Positioning System Location	Photo #	Point Discharge/ Hydraulic Structure #	Problem Description	Erosion	Debris / Sediment	Failed Infrastructure / Armoring	Multiple / Other
BL21	185	332	PD156	erosion at outfall	X			
BL21	192	341	PD160	erosion at outfall	X			
BL22	196	346		debris across channel		X		
BL24	217	369		debris, tires		X		
BL25	221	373		debris obstructing flow		X		
BL25	224	376	HS143	possible erosion at point discharge	X			
BL26	230	384	HS146	collapsed pedestrian bridge in channel		X		
BL26	231	386		chain link fence across channel				X
BL26	231	387		limestone wall armoring			X	
BL26	232	390		significan erosion	X			
BL27	235	394	PD178	erosion creating channel	X			
BL27	236	395	PD179	erosion, headwall and outfall pipe failure	X		X	X
BL27	237	397		debris obstructing flow		X		
BL27	238	398		typical 4-6' erosion and slumping, left bank	X			
BL27	239	399		debris obstructing flow		X		
BL27	240	400	PD180	minor channel erosion	X			
BL27	241	401	PD181	major erosion and exposed infrastructure	X		X	X
BL27	242	402	PD182	erosion	X			
BL27	244	405		significant erosion and slumping, left bank	X			
BL28	249	411		debris, tires and logs		X		
BL28	252	414	PD190	erosion below outfall	X			
BL28	253	415	HS 154-158	failing / crushed culverts			X	
BL28	254	417		debris obstructing flow		X		

appendix E - detention basin inventory

This table presents a summary of the detention basin inventory conducted by the Lake County Stormwater Management Commission. The data in this table is mapped in Chapter 3. This table includes the following information: watershed, basin identification number, whether the basin was built before or after the adoption of the Watershed Development Ordinance, active storage volume (if available), and the problems or issues identified during the basin inventory.

Watershed	Basin Number	Pre WDO?	Active storage volume (cu ft) / Not Detention Basin (NCB) / Not Assessed (NA)	Create wet or wetland basin	Plant side slopes with native vegetation	Improve and expand buffer	Inlet / outlet clean out or replacement	Stabilize / regrade shoreline	Address algae / nutrients	Address turbidity / sedimentation	Remove concrete channels	Debris, garbage, and/ or woody vegetation removal
DR	1		525,490 ft cu		X		X	X	X	X		X
DR	2		23,000 ft cu		X	X	X	X		X		
DR	3	X	NDB / 65,050ft cu									
DR	4	X	NA									
DR	5	X	12,168 ft cu	X	X	X						
DR	6	X	19,724 ft cu	X	X	X	X					X
DR	7	X	24,924 ft cu	X	X	X	X				X	
DR	8	X	140,310 ft cu			X						X
DR	37	X	103,136 ft cu				X	X	X			X
DR	38	X	31,724 ft cu		X			X		X		
DR	39	X	40,285 ft cu		X					X		
DR	41	X	121,713 ft cu		X			X		X		X
DR	42	X	189,361 ft cu		X			X	X			X
DR	44	X	16,704 ft cu						X			
DR	45	X	45,028 ft cu					X	X			
DR	46	X	10,668 ft cu					X	X			
DR	47	X	151,908 ft cu					X				
DR	50	X	4,036 ft cu					X	X			
DR	53	X	28,708 ft cu		X			X				
DR	54	X	20,948 ft cu		X			X	X	X		
DR	55	X	NA									
DR	56	X	60,096 ft cu					X	X			
DR	57	X	230,984 ft cu									
DR	58	X	237,952 ft cu						X			
DR	59	X	282,819 ft cu						X			
DR	60	X	248,767 ft cu						X			
DR	61	X	73,134 ft cu	X	X	X		X				

appendix E - detention basin inventory results

Watershed	Basin Number	Pre WDO?	Active storage volume (cu ft) / Not Detention Basin (NCB) / Not Assessed (NA)	Create wet or wetland basin	Plant side slopes with native vegetation	Improve and expand buffer	Inlet / outlet clean out or replacement	Stabilize / regrade shoreline	Address algae / nutrients	Address turbidity / sedimentation	Remove concrete channels	Debris, garbage, and/ or woody vegetation removal
DR	62	X	20,185 ft cu		X			X		X		
DR	63	X	400,052 ft cu						X			
DR	64	X	85,264 ft cu	X	X	X	X					
DR	65	X	167,319 ft cu	X	X	X						
DR	66	X	314,268		X			X				
DR	67	X	23,526		X		X	X		X		X
DR	68	X	22,112		X			X				
DR	70	X	NA									
DR	71		300,320	X	X							
DR	72		110,360	X	X	X						
DR	73			X				X				
DR	74		319,150		X	X			X	X		
DR	75		NA									
DR	76		NA									
DR	112		106,049									
DR	113		NA									
DR	114		NA									
DR	203	X	NA / 184,593									
DR	205	X	NDB / 14,807									
DR	206	X	NA / 48,578									
DR	207	X	NA / 267,929									
DR	208		36,518		X		X					X
DR	209		50,187	X	X	X	X					
DR	210		89,330									
DR	211	X	NDB / 15,734									
DR	212	X	14,388		X	X	X					
DR	213	X	NDB / 15,105									
DR	214	X	NDB / 11,249									
DR	215		NA / 112,280									
DR	216		NA / 128,705									
DR	221	X	NA / 97,710									
DR	228	X	22,151				X		X			X

*Storage for detention basins numbered in the 200s were estimated based on basin dimensions and an assumed two-foot depth.

Watershed	Basin Number	Pre WDO?	Active storage volume (cu ft) / Not Detention Basin (NCB) / Not Assessed (NA)	Create wet or wetland basin	Plant side slopes with native vegetation	Improve and expand buffer	Inlet / outlet clean out or replacement	Stabilize / regrade shoreline	Address algae / nutrients	Address turbidity / sedimentation	Remove concrete channels	Debris, garbage, and/ or woody vegetation removal
DR	229	X	NDB / 17,169									
DR	230	X	NA / 52,429									
DR	231	X	NDB / 73,073									
DR	232	X	5745		X	X						X
DR	233	X	NA / 33,060									
DR	234	X	NA / 214,901									
DR	235	X	NDB / 90,542									
DR	236	X	NDB / 52,365									
DR	237	X	NDB / 105,232									
DR	238		NDB / 13,600									
DR	239	X	NA / 82,689									
DR	240	X	NA / 12,495									

*Storage for detention basins numbered in the 200s were estimated based on basin dimensions and an assumed two-foot depth.

appendix F - watershed best management practice toolbox

This is an expanded and more detailed version of the watershed best management toolbox contained in Chapter 4.

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1 INTRODUCTION

The best management practice tools and techniques described in this chapter, when applied to the watershed, can be used to help achieve the watershed goals and objectives identified in the watershed plan. The watershed techniques presented are broadly organized into the following categories: policy and planning, water quality, flooding, and natural resources. Many watershed protection tools can be categorized as *preventive* or *remedial*, and many others can be categorized as both preventive *and* remedial, and are classified as such. Some practices also can be used to *retrofit* previously constructed landscape elements.

Preventive measures reduce the likelihood that new watershed problems such as flooding or water quality degradation will arise, or that existing problems will worsen. Preventive techniques generally target new development in the watershed and are geared toward protecting and preventing degradation of existing resources. Planning, regulatory and administrative programs, alternative site designs, and construction practices are examples of preventive 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 retrofitting landscaping with deep-rooted native vegetation. Other remedial techniques range from stabilizing eroded streambanks and restoring wetlands to floodproofing and additional runoff storage for flood mitigation.

The USEPA document *National Management Measures to Control Nonpoint Source Pollution from Urban Areas* (2005) contains additional details and additional tools and practices for watershed improvement and urban nonpoint source pollution control.

2 WATERSHED PLANNING AND POLICY

2.1 POLICY AND REGULATION

Policies and regulations establish and enforce minimum standards for protecting watershed resources, particularly water quality. Regulations are most useful when incorporated into state and federal statutes and administrative rules, or in local ordinances. Watershed issues and problems can be most effectively addressed at the local level since local units of government are responsible for land use planning and development decisions. In addition to local controls, state and federal regulations, such as the federal Clean Water Act, include requirements directed at water resource protection. Water quality and quantity 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).

2.1.1 Zoning Ordinances

Preventive

Zoning ordinances regulate development by dividing a community into zones or districts and then 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 recreational uses, conservation or agriculture. Overlay zoning adds special development limitations to the underlying zoning (i.e. residential, commercial, industrial etc.) in areas subject to flooding.

2.1.2 Lake County Watershed Development Ordinance

Preventive

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 stormwater ordinances such as the Watershed Development Ordinance 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 an existing 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.

Lake County's Watershed Development Ordinance was enacted as a preventive 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 LCSMC 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. All Illinois communities in the watershed (Winthrop Harbor, Beach Park, Zion, and Waukegan) are certified to enforce the WDO.

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 were 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), 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 less subject to loose interpretation and application.

The WDO contains three primary requirements that address water quality. One requirement is to use landscaping best management practices (BMPs) to treat at least 0.01 inch of runoff for every one percent of impervious surface in a development, with a minimum volume equal to 0.2 inches of runoff (e.g. 20% or less impervious area requires 0.2 inches to be treated; 50% impervious area requires 0.5 inches to be treated; 90% impervious area requires 0.9 inches to be treated) before releasing it to the drainage system. 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 second WDO requirement for water quality protection is the installation of soil erosion and sediment control measures on building sites for the purpose of preventing erosion, or at minimum, preventing 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 third WDO water quality requirement is to provide buffers for waterbodies to filter sheet flow runoff before it drains into the water body. This requirement applies to streams, rivers, wetlands and lakes. See section below and Article IV Section B.1.i. of the WDO for more detailed information on buffer requirements.

The WDO does not include performance standards for the required BMPs. Therefore, while the effectiveness of various BMPs has been documented, variability in the approval, application, maintenance, and monitoring of the BMPs leads to variable results for preventing water quality impacts from development. The 1999 WDO amendments clarified the level of water quality treatment required by the WDO and improved enforcement procedures. One key amendment to the soil erosion & sediment control provisions is the requirement for on-site pre-construction meetings prior to the commencement of earthmoving. The 1999 water quality amendments have resulted in more consistent implementation of BMP requirements for water quality protection by all of the watershed communities.

The Illinois Department of Natural Resources (IDNR) regulates development in the floodplain through a statewide permit program. IDNR has delegated floodplain permitting authority to the LCSMC 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.

Some of the development in the watershed was developed 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, and 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 the watershed would 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 (RVRH; Table 6).

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 cubic feet per second per acre (cfs/ac) for the 2-year 24-hour storm event and 0.15 cfs/ac for the 100 year, 24 hour storm event. An effective way to lower or maintain peak flows and to prevent new flooding problems is to establish more stringent release rates specific to the watershed.

The runoff volume reduction hierarchy specifies that sites should choose a strategy that minimizes the increase in runoff volumes and rates from development. However, there is some debate on whether some or all of the runoff reduction techniques in the WDO should be implemented on a voluntary basis, or be required as a part of a stormwater management regulatory program. Currently, the WDO does not provide explicit incentives for developers to use the hierarchy and it is not consistently enforced. 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. The Kellogg Creek watershed along with all other watersheds in Lake County would benefit from stronger and more consistent enforcement of the runoff volume reduction hierarchy, which includes:

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.

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% 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 volume reduction hierarchy is designed to mitigate the effects of increased runoff.

2.1.3 Wetland Regulation

Preventive

Another preventive measure that can benefit the watershed is the wetlands regulatory program. Since the 1970s, wetlands have been regulated through a permit program administered by the US Army Corps of Engineers (USACE) under the authority of the Clean Water Act. In 1997, the USACE, the Natural Resources Conservation Service (NRCS), Lake County Soil & Water Conservation District (LCSWCD) and the LCSMC 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, the watershed 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 Watershed Development Ordinance (WDO) to protect isolated wetlands that were no longer under regulation by the federal Clean Water Act administered by the U. S. Army Corps of Engineers (Corps). The amendments require the applicant to first submit a jurisdictional determination (JD) 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. LCSMC wetland staff are now authorized by the Corps to perform preliminary JDs under an Interagency Coordination Agreement (ICA). In this case, LCSMC sends JD information to the Corps for concurrence.

Another measure to prevent wetland losses centers on where wetland mitigation and restoration occur. Historically, wetlands lost in the watershed could have been 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 watershed.

2.2 LAND USE AND DEVELOPMENT PLANNING

2.2.1 Watershed Planning

Preventive and Remedial

Watershed planning is a broad land use management tool used to understand existing conditions, predict future land use impacts on water resources, develop water resource protection goals, identify tools needed to protect water resources, and anticipate costs for implementing watershed protection tools (Center for Watershed Protection 1998). Watershed planning typically addresses land use management strategies, such as policy changes, land use planning such as alternative site designs, open space protection, stormwater management measures, and land restoration.

2.2.2 Site Planning

Preventive and Remedial Retrofit

Site planning that incorporates open space protection and stormwater and landscaping BMPs is an effective tool for protecting and improving watershed resources. Alternative site designs and conservation developments are planning and design processes that reduce impervious cover, incorporate runoff reduction strategies, and protect open space for infiltration and recreational opportunities.

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. 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 (e.g. stormsewers, concrete-lined channels, or curbs and gutters) accelerate the delivery of runoff to the receiving water. 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 provides wildlife habitat. A number of these measures are described in detail in section 3.2 Stormwater & Landscaping Best Management Practices.

Impervious Area Reduction

Impervious surface area, water quality, and runoff volumes are directly correlated. The Chicago Metropolitan Agency for Planning (formerly 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 (NPS) pollutants carried in the runoff. Studies indicate that there is a direct relationship between the amount of impervious surface in a watershed and the quality of the receiving stream, as in the table below.

Table F.1. Relationship between Impervious Cover and Stream Quality.

Impervious Cover	Stream quality
0 -10%	good (stressed)
11 - 25%	fair (impacted)
>25%	low (degraded)

Source: Schueler and Claytor (1997)

There are several ways to reduce imperviousness through the use of alternative site designs that will result in smaller increases in runoff following development. After reducing impervious area as much as possible using the practices below, connectivity of the remaining impervious areas can be reduced to provide additional benefits. A few rather simple ways to do this include directing downspouts to vegetated, bioretention, or infiltration areas; directing flows from driveways to vegetated areas; breaking up flow directions from expansive paved areas; encouraging sheet flow through vegetated areas; and carefully locating impervious areas so that they drain as naturally as possible and runoff from the site is minimized.

Alternative Site Designs and Streetscapes

Alternative site design techniques can be used for new developments and 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, gutter and stormsewer; 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).

After building rooftops, the major contributors to high impervious surface areas are roadways, driveways, parking areas, and sidewalks. Minimizing and disconnecting these areas helps reduce total impervious area and runoff. Residential streets should be designed for the minimum required pavement width needed to support travel lanes, parking, emergency and service vehicles, and should be

based on the average expected volume of traffic rather than maximum traffic volume. Excessive pavement widths make streets the largest single component of impervious cover in a subdivision, and narrowing streets can significantly reduce the amount of impervious surface. For example, reducing low density residential street widths from 32 to 20 feet will result in an approximate 18% reduction in impervious surface for a typical ¼ acre lot subdivision, and a 6% reduction in impervious area over an entire watershed (Table 8). 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)" (Center for Watershed Protection 1998). Narrower streets also tend to discourage cut-through traffic and speeding.

Alternatives to the conventional grid road layout can potentially reduce imperviousness 26 percent, but may reduce the connectivity of road networks and impede effective and efficient traffic flow. Fragmented grids, warped parallel, and loop / cul-de-sac layouts all require fewer total feet of pavement than the grid pattern. In turn, cul-de-sac design can be altered to reduce pavement area. A few alternatives include reducing the radius of the cul-de-sac, adding a vegetated island to the middle of the cul-de-sac to serve as both an aesthetic street feature as well as a bioretention area, or using a "T" or "hammerhead" terminus rather than a cul-de-sac. Additionally, road segments can be strategically placed within the layout to fit the existing topography (such as locating roads on ridgelines). Reductions in the width of paved roads will reduce total imperviousness as well as clearing and grading impacts.

Curb and gutter features are part of many stormwater conveyance systems, collecting sheet flow from impervious areas and channeling it into a collection system or a receiving water body. For low impact developments, curb and gutter systems can be eliminated or modified to reduce runoff, increase lag time and provide water quality treatment. Eliminating curb and gutter and utilizing vegetated roadside swales may reduce paved width by 30 percent or more. If curbs cannot be eliminated completely, the number of curb cuts should be increased, preferably discharging to some sort of pretreatment or bioretention facility.

Likewise, if it is feasible to remove on-street parking from one or both sides of the street, doing so has the potential to reduce imperviousness 25 to 30 percent. The effect of driveways, while difficult to completely eliminate, can be reduced in a number of ways. Shared driveways may be an alternative in some instances, driveway width and length can be reduced (a width of 9 feet is suggested) and alternative driveway materials such as porous pavement or gravel should be considered (these also delay runoff longer than asphalt or concrete).

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, though this is not the best approach from an urban design perspective. 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. These

Table F.2. Innovative site planning techniques and their effect on impervious cover.

Strategy	Impervious Reduction (%)
Reduce residential sidewalks 50% by installing on only 1 side of the street	1.3
Reduce residential sidewalks from 5 feet to 4 feet width	0.5
Reduce local access street widths from 32 feet to 27 feet Reduce local access street widths from 32 feet to 25 feet Reduce local access street widths from 32 feet to 20 feet	2.5 3.5 6.0
Reduce commercial parking by 5 percent Reduce commercial parking by 10 percent Reduce commercial parking by 20 percent	2.7 5.3 10.7
Reduce multifamily parking by 5 percent Reduce multifamily parking by 10 percent Reduce multifamily parking by 20 percent	0.7 1.5 3.0
Reduce commercial, industrial and multifamily roof areas by 10 percent Reduce commercial, industrial and multifamily roof areas by 20 percent	4.3 8.5

"green" parking lots use techniques to reduce parking lot runoff by 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:

- 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 (USDA Natural Resources Conservation Service 1997).

When the techniques described in this section are used together on a development site to reduce runoff, this is referred to as a runoff volume 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.

2.2.3 Conservation Design Development/ Low Impact Development

Preventive

The goal of conservation development is to protect open space and natural resources for people and wildlife while at the same time allowing development. 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. Density is realized on smaller areas of land by clustering buildings and infrastructure. In addition to clustering, conservation design developments incorporate

natural riparian and natural area 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 portions 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 (PUDs) 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. Planned residential developments (PRDs) apply similar concepts to residential developments. A good example of a clustered development and permanent open space protection is Prairie Crossing a 677-acre planned development with approximately 70% open space, more than 10 miles of trails, an organic farm, school, and a large lake with a beach and boat dock.

2.2.4 Green Infrastructure Planning

Preventive

Green infrastructure encompasses a number of landscape elements, including natural areas, conservation and recreation areas, trail networks and working lands such as forests, farms, and pastures. Ideally, these elements form a network functioning to support native species, maintain natural ecological processes, sustain air and water resources and contribute to health and quality of life. Green infrastructure features form a system of “hubs” and “links.” Hubs are anchors or nodes within the network that provide an origin or destination for wildlife and ecological processes. Hubs may include such landscape elements as reserves, managed forests, working lands, parks, and natural areas. Links are the connections that tie the system together, enabling the network to function. Links may include greenbelts, conservation corridors, greenways, natural drainage or stream corridors, and buffers.

As described in the Fish Lake Drain Watershed Management Plan (LCSMC and CDF 2004), a Green Infrastructure Plan is a blueprint for water resources protection. Its purpose is to identify appropriate locations for the preservation of open space, that when preserved, will:

1. Protect and enhance the natural hydrologic functions of the watershed.
2. Allow flow of runoff through the watershed in a manner that supports and enhances aquatic life.
3. Provide natural conveyance, floodwater storage, and water quality benefits.

Before preparing a Green Infrastructure Plan, watershed communities should adopt policies that establish the identification, protection, and management of a green infrastructure network as community priority in comprehensive plans and other community documents. This establishes the foundation and framework for enacting protective zoning, subdivision, and other local ordinances, programs, and plans. It also establishes the community’s commitment to using local resources to enact the plan, laying the groundwork for including green infrastructure priorities in annual capital funding budgets and plans.
In essence, a Green Infrastructure Plan is a plan for open space and natural areas protection that also improves water quality and prevents flood damage. The first step in preparing a Green Infrastructure Plan is to identify water resources, natural features, and open space that are either already connected or that could be developed into a network natural corridors. Examples include floodplains, lakes, wetlands, wetland buffers, hydric soils, drain tiles, regionally significant depressional areas, parks, greenways and trails, and forest preserves. The next step is to outline

the network by connecting isolated water features to each other. Hydric soils are a useful connector for isolated natural resources because they provide opportunities for wetland restoration. The final step is to remove developed areas from the boundary of the plan and refine the network to work around or through existing developments.

Green Infrastructure Plans often require regulatory changes to zoning and development codes and can be difficult to implement quickly if unprotected open space must first be acquired and permanently protected. However, if incorporated into local government land use plans, Green Infrastructure Plans can be a very strong tool for protecting natural resources, improving water quality, and preventing flood damage.

2.2.5 Greenways and Trails

Preventive and Remedial Retrofit

Greenways and trails 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% 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 (Northeastern Illinois Planning Commission and Openlands Project 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 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 be 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.

2.3 POLICY AND PLANNING COORDINATION

2.3.1 Lake County – Lake Michigan Watershed Management Board

The Lake Michigan Watershed Management Board (WMB) was established in 1990 as an advisory board to the Lake County Stormwater Management Commission (LCSMC). The WMB, 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 Lake Michigan watershed in Lake County. The WMB makes recommendations to LCSMC on financial, institutional and programmatic aspects of the drainage system and stormwater management services within the Lake Michigan 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 WMB met 3-4 times per year. Because of low meeting attendance, the number of meetings was reduced to one per year beginning in 1998.WMB cost-share funding for local projects in the Lake Michigan watershed has been approximately $25,000 per year.

2.3.2 Lake Michigan Ecosystem Partnership

The Lake Michigan Watershed Ecosystem Partnership (LMEP) was formed in 2005. Portions of Lake and Cook Counties form the Illinois portion of the Lake Michigan watershed. The Partnership is a diverse group, made up of landowners, businesses, non-profit organizations, agencies and governments within the Lake Michigan watershed region. All partners in the watershed are eligible to apply for Conservation 2000 funds through the Illinois Department of Natural Resources. C2000 funding applications are evaluated once per year with an application deadline during February.

3. WATERSHED TOOLS TO PROTECT AND IMPROVE WATER QUALITY

The watershed inventory and assessment for the watershed suggests that the most significant potential impairments of water quality are hydrologic / flow alteration and associated symptoms, suspended solids and sedimentation, streamside alterations, and low dissolved oxygen. The primary sources of impairment are probably urban runoff / storm sewers, loss of riparian habitat, land development, and streambank modification. In general, the diverse and diffuse nature of nonpoint pollutant sources presents a challenge for improving water quality. Therefore, to effectively address the scattered and cumulative impacts of nonpoint source pollution, various techniques including those described below, can be applied at numerous sites throughout the watershed.

Preventive measures will address how land needs to be developed and maintained to reduce future increases in nonpoint source pollutant loads. History has demonstrated that as land is developed in a watershed through conventional development practices, water quality declines. If land continues to be developed in a conventional manner in the watershed, it is anticipated that water quality will continue to degrade. Improvements will need to be made in development designs and in land management practices in order to protect water quality. Development design features are addressed in the water quality measures described below and in the following flood reduction section. Maintaining streams and riparian buffers can also help prevent water pollution. 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.

Water quality can 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 properly maintaining septic tanks and fields to improve water quality, retrofitting existing detention basins, stormwater outfalls, and other stormwater infrastructure, and stabilizing streambanks.

3.1 CONSTRUCTION PRACTICES

3.1.1 Site Clearing and Grading

Preventive

Strategic clearing and grading of development sites can reduce the amount of land and vegetation disturbed and the amount of soil compaction, helping to reduce the volume and rate of runoff generated during both construction and build-out. Strategic clearing and grading refers to a combination of two general practices: reducing the area extent of disturbance and strategically locating cleared areas away from soils with high permeability, vegetated areas, and other zones that offer high stormwater management benefits.

Fingerprinting refers to the process of restricting ground disturbance by identifying the smallest possible area and clearly delineating it on the site. This may include minimizing the size of construction easements, materials and storage areas, and soil stockpiles within the development envelope. Home layout, clearing and grading should strive to avoid the removal of existing trees. Well-drained soils should be preserved wherever possible since covering these areas with impervious surfaces causes the greatest possible change in pre- and post-development conditions and watershed impacts. Site plans should also maintain existing topography to the greatest extent possible in order to preserve natural drainage patterns and encourage dispersed flow paths.

During development, contractors should install fencing or other barriers around areas to remain undisturbed. Site grading and construction can be phased so that only portions of the site are disturbed at a given time, while already developed areas are being stabilized with vegetation and

other measures. Lot benching is a development technique used on hilly or rolling topography that establishes drainage patterns on individual lots and directs runoff to a stable outlet rather than to another lot. This practice reduces the length and slope of the disturbed area and its erosion potential. This practice also preserves some of the natural topography, soil structure, and drainage patterns.

3.1.2 Soil Erosion and Sediment Control

Preventive

Soil erosion and sediment control practices, as outlined in the Lake County Watershed Development Ordinance and detailed in the Illinois Urban Manual (2002, NRCS and IEPA), are required and enforced in Lake County. These practices include mulching, blankets, and mats, vegetative stabilization, structural methods, silt fence and other filter barriers, inlet protection, sedimentation basins and traps, and check dams.

Mulches, Blankets and Mats

These practices involve the installation of organic materials, typically as a pre-made blanket or applied loose as a mulch, to form a temporary, protective soil cover. Next to vegetative stabilization, these are the most effective and practical means of controlling runoff and erosion on disturbed land, and blankets are particularly effective on steep slopes and in swales and channels.

Organic mulches include wood fiber, straw, and hydro mulch, a processed material mixed with water and applied in a stream from a hose or other applicator. Erosion control blankets or fabrics are biodegradable, open-weave blankets with netting on one or two sides used for establishing and reinforcing vegetation on slopes, ditch bottoms and shorelines. Blankets need to be secured in place with staples or stakes. Turf-Reinforced Mats (TRM) are synthetic, non-degradable mats that are typically buried to add stability to soils that are prone to erosion, such as on slopes and in channels. TRMs are often filled with soil and vegetation or seed after installation, and covered with an erosion-control blanket or mulch for added protection.

Vegetative Methods

Vegetation, whether left undisturbed on the site or established after disturbance, is very good at preventing erosion. Vegetation should be established as soon after disturbance as possible on exposed soils. Native species, though slower to establish, require less maintenance, fertilizers, and irrigation than nonnative species, and because of their deep root systems are desirable for soil stabilization. A temporary cover crop of annual grasses like oats or rye are quickly established and provide good protection, and thus may be desirable to be mixed into native species seed mixes. Deep rooted native species and wildflowers also can be installed and provide habitat, water infiltration, and aesthetic values.

Structural Methods

Three structural erosion control measures include inlet and outlet riprap, permanent diversion of water, and temporary diversion of water using dikes and water bars. Riprap is heavy stone placed around inlets and outlets of pipes or channels to prevent erosion where concentrated water flow, turbulence, or wave energy are present. A stilling basin or impact basin may be installed along with riprap to help reduce the velocity and energy of water flow before being discharged to an outlet channel. Because riprap provides stabilization without water quality or habitat benefits, it should be considered as a secondary treatment method if vegetative and bioengineering methods are not feasible.

A permanent or temporary slope diversion structure is a channel and dike constructed across steep or long slopes, a ridge of compacted soil, or a flexible conduit or pipe designed to intercept runoff and divert it to stabilized outlets at a low velocity. The temporary slope diversion structure can sometimes be used instead of a silt fence. Dike and channel diversions can be used to prevent stormwater from entering, if built upslope, or leaving, if built downslope, the work area. A water bar is a ridge and channel constructed across a sloping road, right-of-way, or path that is subject to erosion. These bars capture and divert runoff from the path into side channels or swales.

Silt Fence

This temporary geotextile fabric barrier is staked and

trenched into the ground and designed to retard runoff and retain sediment on the construction site while allowing some water to pass. They are not appropriate for channels or other areas of concentrated flow, but good for perimeter uses and for side slopes if applied along the contour. Shallow ponding of water will occur with silt fence and should be released via outlet channels. A few different types and weights of silt fence can be specified for different applications.

Inlet Protection
Inlet protection methods prevent sediment from entering storm drainage systems before disturbed areas can be permanently stabilized. This may include a sediment filter, sedimentation basin, or geotextiles barrier installed around a storm drain inlet. These methods detain water causing ponding and settling of sediment before entering the storm drain. Sand bags and geotextiles are typically used together in this application.

Sedimentation Basins and Traps
A sedimentation basin is a controlled stormwater release structure formed by constructing an embankment of compacted soil across a drainageway with an outlet structure and pipe. Water is detained long enough for most sediment to settle out in the basin. Sediment traps are settling ponds with simple spillways stabilized with geotextiles and riprap without an outlet structure or pipe. Both of these 'settling pond' practices located at the downstream end of the site are the principal preferred sediment-control practices for construction sites.

Check Dams
Check dams are used with erosion control blankets in areas of concentrated flow, such as ditches and swales, to slow flow velocities, pond water, and filter and settle sediment. Rocks, silt dikes, wattles and excelsior logs can be used to form check dams, but silt fence and hay bales are NOT considered to be effective for building check dams.

3.1.3 Construction Sequencing

Preventive

Construction sequencing is the practice of scheduling development so that land-disturbing activities are coordinated with the installation of erosion and sediment control practices. Construction sequencing generally follows the schedule outlined in Table F.3. (from *Minnesota Urban Small Sites BMP Manual, Metropolitan Planning Council*, 2001).

Table F.3: Typical construction sequencing

	Construction Activity	Schedule Consideration
1	Identify and label protection areas (e.g., buffer zones, filter strips, trees).	Site delineation should be completed before construction begins.
2	Construction access. Construction entrance, construction routes, equipment parking areas, and cutting of vegetation.	First land-disturbing activity. Establish protected areas and designated resources for protection. Stabilize bare areas immediately with gravel and temporary vegetation as construction occurs.
3	Sediment traps and barriers. Basin traps, sediment fences, and outlet protection.	Install principal basins after construction site is accessed. Install additional traps and barriers as needed during grading.
4	Runoff control. Diversions, silt fence, perimeter dikes, water bars, and outlet protection.	Install key practices after principal sediment traps and before land grading. Install additional runoff control measures during grading.
5	Runoff conveyance system. Stabilize stream banks, storm drains, channels, inlet and outlet protection, and slope drains.	Where necessary, stabilize stream banks as early as possible. Install principal runoff conveyance system with runoff-control measures. Install remainder of system after grading.
6	Grubbing and grading. Site preparation: cutting, filling and grading, sediment traps, barriers, diversions, drains, surface roughening.	Begin major grubbing and grading after principal sediment and key runoff control measures are installed. Clear borrow and disposal areas only as needed. Install additional control measures as grading progresses.
7	Surface stabilization: temporary and permanent seeding, mulching, sodding and installing riprap.	Apply temporary or permanent stabilization measures immediately on all disturbed areas where work is delayed or complete.
8	Building construction: buildings, utilities, paving.	Install necessary erosion and sedimentation control practices as work takes place.
9	Landscaping and final stabilization: topsoiling, planting trees and shrubs, permanent seeding, mulching, sodding, installing riprap.	Last construction phase. Stabilize all open areas, including borrow and spoil areas. Remove and stabilize all temporary control measures.
10	Maintenance	Maintenance inspections should be performed weekly, and maintenance repairs should be made immediately after periods of rainfall.

Following site development, cleared and graded areas should be revegetated as soon as possible to decrease the post-development imperviousness and runoff as much as possible. Minimal disturbance techniques may be impractical, particularly when developing a group of lots. Therefore, revegetation can mitigate some of the negative impacts of site development.

3.2 STORMWATER & LANDSCAPING BEST MANAGEMENT PRACTICES

A number of best management practices (BMPs) can be implemented to reduce water quality impacts of developed areas by filtering and infiltrating runoff. Some of these and other BMPs can also be incorporated into farming practices.

3.2.1 Site Landscape Preparation

Preventive and Remedial Retrofit

It is essential that prior to establishing the final landscaping on a site, the ground and soil be adequately prepared. First, the subsoil (the existing soil following grading and construction) should be either tilled to a depth of a few inches or the surface roughed up to a depth of two inches. Topsoil should then be spread to a minimum depth of six inches and tilled or otherwise mixed into the top couple of inches of the subsoil. This 'zipping' together of the topsoil and subsoil significantly helps water infiltrate into the ground and prevents it from running off quickly. This may be codified in a municipality's development regulations as well as be included in site plans and specifications.

3.2.2 Filter Strips and Level Spreaders

Preventive and Remedial Retrofit

Filter strips are linear sections of the landscape covered with dense, preferably native, deep-rooted vegetation installed between pollutant source areas and a downstream receiving water body. The vegetation slows, absorbs, and filters stormwater runoff before it reaches an adjacent water body. When used in conjunction with level spreaders, filter strips effectively protect the water quality of adjacent wetlands and streams. Filter strips can be used on slopes less than 15% and should be between 20 and 150 feet wide.

Level spreaders are wide, shallow trenches filled with rock, crushed stone, or gravel with an overflow structure at the top. The trench is installed along the slope contour to slow and redistribute runoff across a vegetated slope to prevent erosion, increase infiltration, and to discharge it to treatment devices such as filter strips or bioretention areas. Because the effectiveness of the level spreader will be compromised if high amounts of sediment enter the system, level spreaders require some sort of pretreatment for sediment unless the tributary area contributes little or no sediment to the system. Level spreaders are best utilized in combination with an upstream or downstream treatment mechanism to achieve maximum water quality benefits.

Filter strips and level spreaders can be used alone but are better utilized as one component of a stormwater management system that combines a few different BMPs.

3.2.3 Riparian Buffers

Preventive and Remedial Retrofit

While the term *buffer* is commonly associated with riparian protection, buffers can be employed just about anywhere as a stormwater BMP. Vegetated buffers are strips of natural or planted vegetation around sensitive areas such as water bodies, wetlands, woodlands, or highly erodable soils. In addition to protecting sensitive areas, vegetated buffers help to reduce stormwater runoff impacts by trapping sediment and pollutants, providing infiltration, intercepting rainfall and slowing and dispersing stormwater flows over a wide area. Maintaining buffers along stream and river channels and lakeshores can reduce some of the water quality and habitat degradation effects associated with increased imperviousness (and runoff) in the watershed. 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 F.4). 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 depending on adjacent land uses, topography, runoff velocity and soil and vegetation types. Where regulatory requirements for buffer width are absent, 50 to 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).

Table F.4. Potential Pollutant Removal capability of Urban Stream Buffers

Pollutant	Potential Removal Rate*
Sediment	75%
Total nitrogen	40%
Total phosphorus	50%
Trace metals	60-70%
Hydrocarbons	75%

Source: Schueler (1995).
*Potential removal rate based on combined 25-foot grass strip in outer zone and 75 foot forested buffer in middle and streamside zone.

The Watershed Development Ordinance requires the designation of buffers along all stream channels, lakes and wetlands. 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. High quality streams (with an Index of Biotic Integrity or IBI) rating greater than 40 require a 100-foot buffer. For all non-linear water bodies or wetlands with a total surface area of less than one (1) acre, a minimum buffer width of thirty (30) feet is required. For lakes and wetlands with a total surface area greater than one (1) acre but less than two and one half (2 ½) acres, a forty foot buffer is required, and for all water bodies or wetlands with a total surface area greater than two and one half (2½) acres, a minimum buffer width of fifty (50) feet must be maintained. Non-linear high quality aquatic resources shall have a minimum buffer width of one hundred (100) feet. LCSMC's buffer requirements are considered to be the minimum standard for the county. Individual communities have the option of adopting wider buffer requirements.

Another buffer system designates three zones. The streamside zone (25 feet) is densely vegetated to help maintain the physical integrity of the stream, and provides shade, litter, debris, and erosion protection. The middle zone (50 feet) is grassed or forested and its width depends on the size of the stream and its floodplain and the location of protected areas such as wetlands or steep slopes. The upland zone (25 feet wide) is an additional setback from the buffer and usually consists of turf grass lawn or other landscaping. Allowable land uses in the three zones vary. The streamside zone is limited to footpaths, runoff channels, and utility or roadway crossings. The middle zone may be used for recreation and runoff control practices. The upland zone may be used for many purposes, with the exception of septic systems, permanent structures, or impervious covers. A depression incorporated into the design of the upland zone can detain runoff during storms. This runoff is released slowly to the middle zone as sheet flow, which is then transferred to the dense streamside zone, designed to have minimal to no discharge of surface water to the stream.

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.

3.2.4 Bioretention (Bioswales and Rain Gardens)

Preventive and Remedial Retrofit

A subset of stormwater and landscaping BMPs can be categorized as *bioretention* practices, which use a conditioned planting soil bed and vegetation to filter and infiltrate runoff stored within a shallow (6 to 18 inch deep) depression. Deep-rooted vegetation is vital to these systems to take up a portion of the runoff, transpire it back to the atmosphere, and to create flow pathways for infiltration of runoff into the ground, primarily via root systems. A bioretention system can include a pre-treatment filter strip or grass swale (channel) inlet, a shallow surface water ponding area, a bioretention planting area, a soil zone, an underdrain system, and an overflow outlet structure connected to the municipal stormwater system.

Bioswales are often constructed with an infiltration trench below a vegetated swale to encourage infiltration and provide temporary stormwater storage, particularly in areas with low soil permeability. Infiltration trenches are shallow excavations (3-12 feet) lined with filter fabric and backfilled with washed gravel, creating an underground reservoir for runoff that percolates into subsoils over several days.

Rain gardens are typically used to accept stormwater runoff from small areas such as residential lots, and from rooftops or downspouts. Both practices are helpful for preventing on-site or on-lot flooding, and can be incorporated into new or existing development in front and back yards, along roadside parkways and shoulders, within parking lot islands, and below roof downspouts. Bioretention systems are most effective when accompanied by some sort of pretreatment, such as swales or vegetated filter strips.

The bioretention facility should have a permeable soil planting bed at least 2-4 feet in depth with 6-12 inches of ponding area at the surface. Accumulation or ponding areas should collect water to depths not to exceed 12 inches and should be designed to drain / infiltrate ponded water within two days. Bioretention areas should occupy an area between 5 and 10 percent of the size of the tributary area, not including pretreatment areas such as filter strips, which are particularly important when receiving runoff from impervious surfaces. If the system is designed to filter to an underdrain, it should be constructed beneath the soil bed with perforated piping encased in gravel and separated from the permeable soil bed by filter fabric. The bottom of rain gardens and bioswales should be a minimum of 3 feet above the seasonally high water table to avoid the possibility of groundwater contamination.

3.2.5 Vegetated Swales

Preventive and Remedial Retrofit

Vegetated swales are stormwater conveyance, filtration, and infiltration features similar to bioswales except that they are not typically constructed with infiltration trenches. They are commonly located along roadways and rights of way, between lots or buildings, and in parking areas, and can accept runoff from one or a few development parcels. Swales may be either “wet” or “dry,” depending upon the proximity of the channel bottom to the water table and the intended function of the system. Swales should provide a shallow ponding depth up to 18 inches and a bottom width of 2 to 8 feet, wider if the swale has check-dams, interior berms, and/or wetland sections, and maximum side slopes of 3:1.

Wet swales are broad, vegetated, open channels constructed near or intersecting the water table. Water quality treatment occurs through settling suspended solids, adsorption, and microbial breakdown of pollutants. Secondary benefits may include reduced runoff flow velocity and increased infiltration. Check-dams that trap sediment and slow runoff velocities during storm events can also be used with wet swales. Due to the likelihood of near-constant saturation or inundation, wet swales are typically planted with water-tolerant vegetation.

Dry swales store and convey runoff following storm events, but are dry much of the time. Dry swales may be an extension of a mown lawn or may be planted with native vegetation. In order to slow runoff, dry swales are typically equipped with a check-dam between the inlet and the main body of the swale. Unless the existing soils are highly permeable, dry swales must be constructed with an underlying filtering bed of permeable soil and an underdrain system, a perforated pipe encased in a layer of gravel separated from the permeable soil layer above by filter fabric. The bottom of the excavated area should be at least 3 feet above the seasonally high water table to prevent saturation of the soil or the potential for groundwater contamination.

3.2.6 Green Roofs

Preventive and Remedial Retrofit

Green roofs are roof-top gardens designed to absorb, temporarily store, and filter rainwater before it is released into downspouts or released by the vegetation to the atmosphere. Green roofs can be elaborate landscape

features with aesthetic and recreational benefits, or be simple systems designed specifically for stormwater benefits. Green roof systems involve high quality water proofing and root-repellant, a drainage system, filter cloth, a lightweight growing medium, and plants of varying rooting depths and species, depending on the type of green roof used. These elements may be modular or each component may be installed separately.

3.2.7 Naturalized Detention Basins

Preventive and Remedial Retrofit

Detention basins are used to temporarily store stormwater and release it at a rate specified by local ordinances. Naturalized detention basins may include both wet and dry basins (though wet are preferred) that are planted with deep-rooted, native vegetation, designed to approximate a natural element of the landscape, and provide greater water quality and habitat benefits relative to standard detention basin designs. Constructed "wetland" detention basins, or wet-bottom basins, are either shallow marsh systems planted with native emergent vegetation or open water ponds with a fringe of wet prairie vegetation and a natural buffer of 25 to 50 feet. Wetland basins 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. Native plants aid in the water cleansing process by absorbing pollutants. The settling and filtering process results in cleaner water being discharged from the basin than the water entering the basin. Naturalized detention can be used to replace standard basins in virtually all applications. Pretreatment measures, such as a settling forebay immediately upstream of the basin, should be employed to reduce sediment loads and water level fluctuations and to make sediment removal easier and less costly.

Wet and wetland basins contain a permanent pool of water where sediment and other pollutants settle out, are absorbed by deep rooted vegetation along the basin edges, and broken down by microbial action. In general, relatively large tributary areas, approximately 10 to 640 acres, are required to maintain and not overload pool elevations. Building these basins on medium to fine textured soils is optimal to help establish vegetation, retain surface, permit groundwater discharge/recharge, and capture pollutants. More permeable soils that do not remain permanently saturated may require an impermeable liner, such as geotextile fabric or clay.

Littoral shelves 6 to 18 inches below normal pool elevation are recommended for safety and to promote aquatic and emergent vegetation growth. The Watershed Development Ordinance requires a minimum 8-foot wide safety shelf a maximum of three feet below normal pool elevation in all detention facilities. A length to width ratio of 3:1 is recommended to maximize the time water takes to get from the inlet to the outlet, which should be located at opposite ends of the basin. Average pool depth of 3 to 6 feet is optimal, unless fish are desired, which require deeper water. Side slopes above the shelf line should be no steeper than 3:1 and no steeper than 2:1 below the shelf.

3.2.8 Detention Basin Retrofits

Remedial Retrofit

The goal of detention basin retrofitting is to enhance a basin's water quality values. This is accomplished by changing the basin's 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 deep-rooted native 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)

The watershed includes numerous detention basins constructed to temporarily store excess stormwater runoff to reduce flood peaks. When properly designed, constructed and maintained, detention basins control stormwater release rates from developed sites. Although many 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 the creek.

LCSMC conducted a detention basin inventory in the watershed in 2004 to document existing conditions in the basins, and to identify opportunities for detention basin retrofits. During the inventory, detention basins were physically located, photographed and identified as one of three design types: dry bottom, wet bottom, and wetland. In addition to identifying basin type, location and pollutant removal effectiveness, maintenance and design problems such as shoreline erosion, clogged inlets/outlets and short-circuiting (water rushing straight through the basin rather than being stored for a period of time), and potential retrofit and restoration opportunities were recorded. Section XXXX Design Drainage System contains a detailed summary of detention basins in the watershed.

Appendix XX contains a table that includes a description for each detention basin that was inventoried in the watershed. In general, provided there are no design problems such as short circuiting, wet bottom and wetland detention basins are considered to have positive water quality benefits (or 'good' pollutant removal effectiveness). All dry bottom detention basins are assumed to have poor pollutant removal effectiveness, unless specifically designed with water quality features (such as sand filters).

Several key design and maintenance problems were identified for watershed detention basins:

- Shoreline and side slope structure and condition: Steep side slopes are more likely to contribute to erosion and can present potential safety hazards. Another problem seen was side slopes overgrown with herbaceous weeds (i.e. reed canary grass or purple loosestrife) and excess woody vegetation.
- 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.
- Insufficient buffer: buffers around detention basins provide habitat and filtration benefits.
- Inlet or outlet problems: Most of the problems identified include litter and clogging in outlets.
- 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.
- Concrete 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.

- Debris, garbage and woody vegetation: These can clog inlet and outlet pipes, reduce aesthetic quality, and introduce toxic or other harmful material to the water column.

Several different types of retrofit opportunities were identified during the detention basin inventory and subsequent analysis by the planning team:

- 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.
- Plant side slopes 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. Basin edges constructed of riprap or other armoring practice can also be retrofitted and replaced with native vegetation, but may also require regrading.
- Improve / expand buffers: Native vegetation buffers should be established around the perimeter of all basins where possible to stabilize shorelines, encourage native wildlife and discourage nuisance geese (and their pollution contribution) and filter pollutants. In many cases, buffers can be expanded to provide improved filtering functions and greater wildlife habitat.
- Clean or replace inlets and outlets: Clogged inlet and outlet structures collect trash and fill up with sediment that can back up water upstream. Trash racks could be installed to limit trash collecting in pipes. Inlets and outlets should be routinely monitored for obstructions. Failed pipes should be replaced.
- Stabilize / regrade shorelines: Shorelines of wet basins with erosion problems could be stabilized by regrading to 3:1 slope or flatter and planting native vegetation. Eroding shorelines within the basin can contribute to the amount of sediment, nutrients and other pollutants eventually draining downstream.
- Remove algae: Excessive algal growth decreases water clarity (increased turbidity) and prevents light from penetrating deeper waters to promote healthy aquatic plant growth. Algae can be removed over a short period of time using copper sulfate algicide treatments, or over a longer period of time using a combination of ecologically sensitive methods such as alum treatments, aquatic plant vegetation, and nutrient control. These longer term methods are recommended over quick fixes and will typically cost less over time than repeated copper sulfate treatments.
- Address turbidity / sedimentation: sediment accumulation can reduce the storage volume, clog inlet and outlet pipes, and reduce the water quality of detention basins. Checking for and removing sediment periodically can help alleviate these problems.
- Remove concrete 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 should be planted in native vegetation to improve infiltration and pollutant removal rates.
- Reduce woody vegetation cover, debris, and garbage: Woody vegetation can shade suppress and reduce cover of understory herbaceous plants, which have deep fibrous root systems to hold soil in place. Exotic woody plants such as buckthorn and honeysuckle spread quickly and should be controlled, if not eliminated. Other debris and garbage should be removed regularly to preserve aesthetics and reduce the potential for leaching of toxic materials.

3.2.9 Permeable Paving

Preventive and Remedial Retrofit

Porous or permeable pavement is the term given to a family of materials, structures, and pavement designs that allow runoff to infiltrate through the pavement and into the subsurface. In general, these pavements are not used for high-volume or high-speed roadways, but may be appropriate for off- and on-street parking areas, emergency drives, overflow or seasonal parking lots, alleys, driveways, and pedestrian areas. Permeable paving blocks are interlocking paver systems containing openings that are filled with gravel and placed on a gravel setting bed. These blocks present a more traditional or formal look than porous asphalt and concrete, which use large size aggregate material that allows precipitation to infiltrate through the paving material and into the ground or gravel setting bed. These may be more appropriate than paving blocks in pedestrian use areas, and otherwise can be used in many applications. Porous pavement uses large size aggregate material so that precipitation can rapidly infiltrate into the ground. Gravel grass is a mixture of gravel and a growing medium that allows grass to grow within the paved area but provides a strong and stable surface. It has been used in parking lot applications. Using permeable paving blocks and porous pavement can reduce runoff volumes and pollutant loadings (Dreher and Price 1997).

3.2.10 Rainwater Harvesting and Dry Wells

Preventive and Remedial Retrofit

Rain barrels and cisterns are temporary storage facilities that capture rainwater from rooftops and hold that water for other uses such as landscape irrigation. A general rule for rainwater harvesting is that 1 inch of rain falling on a 1,000 square foot roof yields approximately 600 gallons of water, a much greater volume than the typical residential rain barrel size of 50 to 80 gallons. Rain barrels should be constructed with a screen or filter for mosquito protection, a lid to prevent algae growth, a spigot to allow for use of harvested water, and an emergency overflow that discharges away from structures and preferably to another BMP. Water harvested in rain barrels can be used for a number of applications, including watering gardens and washing cars, but should not be used as a source of potable water.

Cisterns are larger storage tanks for rainwater and can be located above or below ground. They generally have much larger storage capacities than rain barrels and can collect water from several homes or buildings. Cisterns should be constructed of non-reactive materials such as reinforced concrete, galvanized steel, or plastic. Cisterns should be placed in areas that are sloped to drain surface water away from the structure. Underground cisterns should not be located near sewer lines or other potential sources of contamination and should not be located near trees because the roots can crack cistern walls. Because of their larger size, cisterns may have to be periodically treated and/or cleaned. Like rain barrels, water harvested in cisterns can be used to wash cars or water plants, but because it may pick up dust, soot, microorganisms or animal droppings, it is not suitable for human consumption.

Dry wells or “soakaway pits” are subsurface structures that receive and temporarily store runoff from roofs and slowly discharge into the surrounding soils. Dry wells can be a structural chamber inserted into an excavated pit or an excavated pit filled with aggregate located downslope or adequate distance from basements and foundations. Because dry wells discharge directly to the ground, the structures are not appropriate in areas with potential for groundwater contamination. Dry wells should drain runoff within 72 hours and therefore must be sized with consideration of both drainage area (1 acre maximum) and soil type (NRCS hydrologic soil groups A and B). Additionally, the bottom of the well should be at least 2 feet above the seasonal high water table.

3.2.11 Native Landscape Systems

Preventive and Remedial Retrofit

Native landscape systems utilizes deep-rooted vegetation such as grasses, wildflowers and wetland plants rather than

turf grass in both new and existing developments to help filter and infiltrate rainwater. Native or natural landscaping promotes biodiversity and open space protection by providing habitat for endemic wildlife, can be applied at large and small scales, and require less irrigation, mowing, pesticide, and fertilization than turf grass or ornamental landscaping approaches. Native landscape designs should be appropriate to site characteristics including topography, soils, drainage, and solar exposure. Plant diversity and health is maximized by annual burning, but in some smaller applications and in more urban settings mowing may be the best alternative to burning. Native plants are components of many of the landscaping and stormwater best management practices described in this toolbox.

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; USDA Natural Resources Conservation Service, 1997; Buslaff 1997; Highland Park Environmental Commission 1998).

3.2.12 Infiltration Devices

Preventive and Remedial Retrofit

Infiltration trenches and basins are two similar runoff reduction devices. Infiltration trenches and basins are 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 can be used in the watershed with 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), which are found primarily within the middle and eastern half of the watershed. When properly installed on sites with permeable soils, infiltration devices can be an effective tool for reducing runoff rate, volume and pollutant loads (Dreher and Price 1997, Department of Environmental Resources Prince George’s County, 1997).

3.2.13 Surface and Underground Filters

Preventive and Remedial Retrofit

Also known as filtration basins, filter systems, or media filtration facilities, surface sand filters consist of a pretreatment basin, a water storage reservoir, a flow spreader, sand, and underdrain piping. The pretreatment basin reduces the amount of sediment reaching the filter and helps ensure that stormwater reaches the filter as sheet flow rather than concentrated flow. A filter liner may also be necessary if infiltration into the underlying groundwater is undesirable. Underground filters are similar to surface filters except that the sand is installed below grade in a vault. The filter traps sediments and pollutants and provides a media for microbial removal of bacteria, but is not effective at reducing runoff volumes. These filters are typically used in constrained sites with high imperviousness and little area available for stormwater management facilities. They are appropriate for drainage areas up to 10 acres and should drain within 24 hours. Filters are appropriate for new and existing development area but should not be used in areas with high sediment loading or unstabilized development sites.

3.3 LANDSCAPE AND STREET MAINTENANCE

3.3.1 Landscape Maintenance

Preventive

Landowners should use sustainable lawn care practices whenever possible. Inappropriate application of fertilizers, pesticides, and irrigation can cause environmental degradation, and should be addressed by each land owner or manager. Selecting plant species and planting location appropriate to local conditions can reduce the need for irrigation, fertilizers, and pesticides. Where lawn chemicals are absolutely necessary, land owners and managers should strictly follow the application instructions. Applying more than the recommended amounts will not produce better lawn and garden results and will have a greater negative impact on water quality. Slow-release fertilizers (organic or synthetic) can reduce the loss of excess nitrogen into groundwater or surface water. Favor small, frequent applications rather than large occasional applications. Create areas around your yard or garden where runoff can infiltrate into the ground so that excess fertilizers and pesticides can be absorbed and filtered by the soil. Raingardens installed in yard depressions can serve this function.

Yard wastes such as grass clippings, prunings, and leaves should be properly disposed in compost piles, chopped up and used as mulch, or disposed of in yard waste collection facilities or programs that utilize large scale composting facilities. Throwing yard waste into the garbage merely accelerates the filling of our landfills with material that can be utilized on our yards and gardens as a valuable resource. Decaying organic matter thrown into a stream or streambank can compete with marine animals for the limited oxygen supply and smother vegetation that helps hold streambanks in place. For this reason mulch and compost piles should be located at a distance from water bodies.

The goals of environmentally sound irrigation are to maximize water infiltration and minimize runoff. Reduce the potential for runoff by reducing the need for supplemental irrigation, either through appropriate plant selection (i.e., plants adapted to the local climate), reducing the area needing irrigation, or irrigation with harvested rainwater (see rain barrels and cisterns above). Overwatering, which occurs when water is applied faster than the ground can absorb it, can wash away soil, pesticides, and nutrients, which eventually find their way into surface water or groundwater. Hand watering, either with a hose or a watering can, is generally appropriate for containers or small beds only. Soaker hoses reduce runoff and evaporative losses because they apply water slowly. Trickle or drip irrigation is also efficient, reducing water use by 50% to 80% compared with overhead irrigation. Landowners should water when the plants need it, not according to the calendar, and apply mulches to conserve soil moisture. If drought conditions occur, understand that a brown lawn is just dormant, not dead, and consider tolerating a brown lawn during the hottest, driest months rather than squandering precious water supplies in an effort to maintain a pristine green lawn.

Attempts to maintain a pest-free garden often result in heavy use of pesticides, which in turn increase the potential for water contamination. Try to keep pest populations below the level at which they cause unacceptable damage. Allowing low levels of pests to survive will help maintain a population of their natural enemies. Pest-resistant plant species and varieties may be available in your area. Rotate vegetables and annual flowers so that the same plant or plant family does not occupy the same space every year; rotation can reduce insect infestations and the buildup of soil-borne diseases. Remember that most such problems are cultural or environmental and will not respond to pesticide applications. If it is a pest problem, proper identification is also important in selecting the safest and most effective pest control strategy. Determine if a plant problem really justifies treatment; many pest problems are not life threatening to the plant and may cause only cosmetic damage.

Try the least toxic control strategies first. Hand picking weeds or insects may be adequate for small infestations. If you are going to use pesticides, choose those that pose the least threat to water quality; examples include pyrethrins, insecticide soaps, horticultural oils, and Bacillus thuringiensis (BT). If using insecticides, spot treat only those plants or plant parts affected. Compared to cover sprays, spot treatments can drastically reduce insecticide use (by

over 90% in some cases) and still achieve good pest control. If pesticides are to be used, carefully read the label for directions, usage restrictions, and health and environmental precautions.

3.3.2 Street Maintenance

Preventive

Pollutants that are carried from roads and streets into our water resources can be reduced through proper maintenance such as regular street sweeping and reduced use of road salt in winter. Regular street sweeping in high traffic areas, particularly commercial districts, can substantially reduce runoff pollutants and debris such as leaves and other organic matter. Street sweeper debris should be stored greater than 100 feet than or at a higher elevation than the nearest ditch, storm drain inlet or surface water, and should be disposed of at a landfill.

Street and road construction projects also can contribute significant pollutants to our streams. During bridge repair work, such as sandblasting or painting, nets and drop cloths should be used to catch falling debris and materials. Waste and debris from bridge and other highway maintenance work should be swept and vacuumed after project completion. During maintenance work within 25 feet of storm drain, inlets should be protected with sediment capture and control methods. Chip sealing, striping, marking, and painting should be terminated during rainstorms to prevent potentially toxic materials from running off. Spill prevention and cleanup plans and techniques, such as drip pans, absorbents, and standard operating procedures, should be in place to immediately address these occurrences.

Reducing the use of road salt (sodium chloride) or substituting with less damaging chemicals, such as calcium chloride, can reduce winter runoff impacts on sensitive wetlands, streams, native prairies and woodlands. Some plants and animals, including roadside vegetation, are impacted at very low chloride concentrations. Salt storage facilities can have a greater potential for causing water pollution than roadway application. Rock salt and sand/salt mixes (if used) should be stored only on paved, bermed areas or in areas lined with impervious materials or under cover. Adequate drainage controls also should be used to prevent runoff water from contacting the salt pile.

Salt is the most commonly used highway de-icer due to its effectiveness and low cost. The second most commonly used de-icing chemical, calcium chloride, is effective in much lower temperatures than salt but is more expensive and equally as toxic and corrosive as salt. Sand is sometimes considered an alternative to salt, providing traction rather than deicing, but it is more difficult to clean up after the winter season and may exacerbate sedimentation issues in water bodies. Calcium magnesium acetate (CMA) much less toxic and corrosive than salt but nearly 15 times as expensive.

Salt application procedures can also be modified to reduce its impact. Salt application rates and frequency should be based on traffic volume, road grade and curvature, intersections, and weather conditions. Sensitive areas, such as streams, should be identified and made known to salt applicators so that they can reduce the application or use de-icing alternatives in these areas. Ground-speed controllers should be used for all spreaders to avoid over-application at stop signs or slow areas. For lesser traveled roads, consider applying salt in a four to eight foot strip along the centerline of a two lane road. Less salt is wasted with this pattern and quickly gives vehicles clear pavement under at least two wheels. Traffic will soon move some salt off the centerline and the salt brine will move toward both shoulders for added melting across the entire road width.

3.4 AGRICULTURAL PRACTICES

Agricultural practices can significantly impact water quality in the watershed. The Natural Resource Conservation Service (NRCS) publishes guidelines for farmers to prevent soil erosion and to improve or protect water quality and water resources. Some of the following information was taken from the NRCS Field Office Technical Guide (FOTG) and other Department of Agriculture resources and websites. Several of the practices described below are similar to

BMPs for riparian sites (such as filter strips and buffers), but specific suggestions are given for agricultural sites.

3.4.1 Residue Management, No till / Strip till

Preventive

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 thereby promoting 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 desiccation, 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 maintains loose residues on the field and uniformly distributes them 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% 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 spacing.

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 desiccation increases with stubble height. Variable height stubble patterns may be created to further increase snow storage.

3.4.2 Residue Management, Mulch till

Preventive

Mulch tillage (also known as chiseling or disking) 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 are the same as no till practices. 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 used as part of a residue management system that includes other tillage methods such as no till. Like no till, mulch till requires production of adequate amounts of crop residue to function properly.

3.4.3 Nutrient Management

Preventive

Nutrient management is the management of the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments to minimize the transport of applied nutrients into surface water or ground water. Nutrient management seeks to supply adequate nutrients for optimum crop yield and quantity while also helping to sustain the physical, biological and chemical properties of the soil.

Nutrient management plans are developed with assistance from the Natural Resources Conservation Service (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 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.

3.4.4 Pesticide Management

Preventive

Insecticides, herbicides and fungicides used to kill agricultural pests (any plant or animal judged to be undesirable to the production of crops or animals) can contaminate ground and surface water through direct application, runoff, and atmospheric deposition. They can poison fish and wildlife, disrupt reproduction, contaminate food sources, destroy habitat, and pose a health risk to humans. Pesticides also contribute to pesticide-resistant pest populations, which may lead to the development of more toxic control chemicals.

Integrated Pest Management (IPM) is an approach to pest control that combines biological, natural, cultural and other alternatives to chemical control with the judicious use of pesticides. The objective of IPM is to maintain pest levels below economically damaging levels while minimizing harmful effects of pest control on human health and environmental resources. IPM depends on a detailed understanding of pest growth and development, and in particular, what causes outbreaks and determines survival. IPM depends first on maximum use of naturally occurring control forces in the pest's environment, including weather, pest diseases, predators, and parasites. The second level of management focuses first on non-chemical measures that help prevent problems from developing, rather than relying on chemicals to kill infestations after they've occurred. Finally, IPM relies on chemical pesticides only if close inspection shows they are needed to prevent severe damage. If pesticides are to be used, they should be matched with field site features so that the risk of contaminating water is minimized.

Cultural methods of pest control used in IPM programs are those "good farming" (or "good horticultural") practices that break the infestation cycle by making the living and non-living environment less suitable for pest survival. Examples include crop rotation, tillage of infested plant material, altering planting and harvesting dates, and cover crops. Biological controls use living organisms to suppress populations of other pests, such as natural predators and parasites.

3.4.5 Animal Management

Preventive

Approximately 500 million tons of manure are produced on the thousands of animal feeding operations nationwide, contributing pathogens such as bacteria and viruses, nutrients, and oxygen-demanding organics and solids that cause water quality problems. Appropriate waste and waste water management systems can help address this issue.

High livestock concentrations in some areas have also led to applications of manure as a source of nutrients, primarily nitrogen and phosphorous, which may contribute to excessive levels of phosphorous being applied to crops and an increased risk of water contamination. Farmers should determine the nitrogen and the phosphorous content of manure to calculate appropriate application rates and consider fall rather than spring applications. Manure should not be applied to frozen or wet soils. Risk factors need to be explored as well including proximity to streams and water bodies and the presence of wells and field tile inlets. Manure can be injected into the soil to reduce the runoff risk.

In pastures, land managers can use shallow tillage tools to increase the infiltration and reduce the runoff of manure or fertilizer. Rotational grazing from one field to another reduces compaction, overgrazing and nutrient runoff. Livestock should be excluded from streams and other water bodies, except for those specifically constructed for watering.

One focus of grazing management measures is the protection of riparian areas and the control of erosion from other grazing lands above the riparian zone. These measures can reduce the physical disturbance to sensitive areas and reduce the discharge of sediment, animal waste, nutrients, pathogens, and chemicals to surface waters. The loss of stream bank stability, riparian vegetation, stream habitat, and modification of the hydrologic regime due to poor grazing practices can have a devastating effect on stream life.

Appropriate grazing management systems adjust grazing intensity and duration, maintain enough live vegetation and litter cover to protect the soil from erosion, and protect riparian and stream health objectives. Practices that accomplish this include: planting and cultivating appropriate forage plant species; managing the frequency, intensity, and season of grazing to optimally use and not abuse pasture resources; maintenance of a cover of living vegetative cover to reduce erosion potential; and exclusion of animals from sensitive areas such as stream corridors and wetlands.

Providing water and salt supplement facilities away from streams will help keep livestock away from streambanks and riparian zones. In some locations, artificial shade areas may be constructed to encourage use of upland sites for shading and loafing. For grazing areas with erosion problems, it may be necessary to improve or reestablish the vegetative cover on range or pastures or on streambanks. Streambank restoration efforts, exclusion fencing, stream buffer establishment, and pasture and range planting programs can significantly reduce erosion impacts due to grazing livestock.

The water quality problems associated with animal feeding operations (AFOs) result from accumulated animal wastes, facility wastewater (from watering, cleaning, or cooling animals), and storm runoff, all of which may be controlled with proper management techniques. Nutrients, suspended solids, pathogens, oxygen-demanding materials, and heavy metals all have the potential to migrate to water resources. The goal is to minimize the discharge of contaminants in facility wastewater, runoff, and seepage to ground and surface water resources.

The diversion of clean runoff water from upslope areas and roof runoff away from the animal lot and waste storage structure (e.g. installing roof gutters on facility buildings) can reduce waste volume and storage requirements. Management activities like scraping manure from pavement areas or proper storage of feeds and bedding can significantly reduce the availability of pollutants for transport. Structures such as detention basins can affect pollutant transport by regulating runoff movement and increasing settling within the facility. Vegetated filter strips, riparian buffers, or other vegetated areas located around animal facilities can reduce delivery of pollutants to surface waters by infiltrating, settling, trapping, or transforming nutrients, sediment, and pathogens in runoff leaving the facility. For new facilities and expansions to existing facilities, serious consideration should be given to siting the facility away from surface waters, critical or sensitive areas, residential areas, and areas with high leaching potential.

In addition to properly siting these practices, other measures can be utilized to successfully minimize impacts. These include diverting clean water away from the facility, proper waste storage and impoundment practices, proper waste management, and practices for dealing with animal mortality.

3.4.6 Filter Strip

Preventive

A filter strip is an area of permanent herbaceous vegetation situated between environmentally sensitive areas and cropland, grazing land, or otherwise disturbed land. Filter strips improve water quality by reducing sediment, particulate organic matter, sediment adsorbed contaminants and dissolved contaminants in runoff. Filter strips also help restore or maintain sheet flow from a concentrated flow and restore, create, and enhance herbaceous habitat for wildlife. This practice is most effective when used in conjunction with other conservation practices as part of a conservation management system.

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. Ideally overland flow entering the filter strip should be sheet flow, though the strip can help to disperse and distribute concentrated flow. 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 maintained to function properly.

Filter strips should be 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 in 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.

3.4.7 Contour Buffer Strip

Preventive

Contour buffer strips are narrow strips of permanent, herbaceous vegetative cover established across the slope between parallel rows of crops. Contour buffer strips reduce sheet and rill erosion, reduce transport of sediment and other water-borne contaminants, and 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). The buffer strips are generally of equal width, unless a varying width buffer strip is needed to maintain crop widths or grades. 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.

To enhance wildlife habit, a native, warm season, grass species mixture, recommended for wildlife purposes, can be used. 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 re-growth before the growing season ends. To enhance wildlife cover, the width of buffer strips should 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.

3.4.8 Contour Farming

Preventive

Contour farming is the tillage, planting, and other farming operations performed along 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, is less effective on slopes exceeding 10 percent and is ineffective on slopes exceeding 25 percent. Contour farming requires that all tillage and planting operations be 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.

3.4.9 Selecting Appropriate BMPs

To choose an appropriate BMP, it is essential to first

determine the objectives, cost, and relative effectiveness of alternative BMPs. Once a BMP has been selected, expertise is needed to insure that the BMP is properly installed, monitored and maintained over time. BMPs and their potential effectiveness in meeting water quality objectives are found in Table F.5.

Table F.5. BMP effectiveness toward meeting BMP objectives.

	BMP OBJECTIVE						
BEST MANAGEMENT PRACTICE	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)

Tables F.6 and F.7 depict pollutant removal rates for different BMPs from data collected and reported by the Center for Watershed Protection (CWP) in June 1997. These removal efficiencies are based on 123 performance-monitoring studies that the CWP 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 F.6. Comparison of median Pollutant Removal Efficiencies among selected BMP groups: Conventional pollutants.

Median Stormwater Pollutant Removal Rate (%)							
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	92	25
Wet pond	30	77	47	51	30	4	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

Table F.7. Median Pollutant Removal reported for selected BMP groups: Fecal coliform, hydrocarbons and selected trace metals.

Median Stormwater Pollutant Removal Rate (%)						
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.

3.5 STREAM MAINTENANCE AND STABILIZATION

Stream maintenance is most effective when part of an ongoing program to repair eroded streambanks and remove blockages caused by accumulated sediment, debris, fallen trees and overgrown weedy, non-native vegetation. *Debris* refers to a wide range of materials that may include tree limbs and branches that accumulate naturally, discarded tires, appliances, and other litter, and lawn waste accidentally or intentionally dumped into channels or drainage swales. Routine clearing of debris from streams is a cost effective way to reduce the potential for flooding. In addition to sediment and debris removal, stream maintenance can also involve using best management practices (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.

The Lake County Stormwater Management Commission (LCSMC) has developed "Riparian Area Management: A Citizen's Guide" to educate landowners about debris removal and riparian landscaping. There are currently no coordinated programs 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.

LCSMC anticipates adopting environmentally friendly stream maintenance standards in the future to provide guidance and consistency for projects throughout Lake County. In the interim, LCSMC recommends that the guidelines adopted by DuPage County (1995) or the American Fisheries Society (1983) be used. In addition, the following list of potential maintenance standards and other recommendations related to stream and buffer maintenance were compiled as part of other watershed planning efforts.

1. Identify, map and prioritize all stream reaches that municipalities and townships should include in annual maintenance plans.
2. Develop guidelines for bridges and culvert construction that will minimize habitat destruction and impediments to fish migration and require highway departments and municipalities to follow the guidelines.
3. Develop and enforce an anti-dumping ordinance.
4. Continue to enforce buffer requirements outlined in the Lake County Stormwater Ordinance and work with developers to restore stream reaches and implement maintenance programs.
5. Work with landowners to remove and replace failing hard armoring along streams with bioengineering alternatives.
6. Develop and implement ordinances prohibiting new dams and on-line detention for stormwater and flood control. Remove all unnecessary dams.
7. Retrofit as many storm sewer structures as possible to reduce runoff velocity and scouring.
8. Develop a stream clean-up program to encourage local citizens and organizations to participate in periodic clean up days.
9. Restore native understory vegetation and remove as many non-native weedy trees and shrubs as possible for at least 10-20 feet along stream corridors.
10. Avoid fertilizing along streambanks.
11. Avoid any channel modification unless the modification is included in an approved stream restoration plan.
12. Remove debris jams when they cause unacceptable flow problems or are causing at least moderate sediment accumulation.
13. Enforce erosion control measures on all new development.
14. Maintain all created and natural riffles, pools, and other high quality in-stream habitat at least twice a year to ensure they are functioning properly.
15. Eliminate livestock access to streams to reduce bank erosion and degraded water quality conditions downstream.

3.5.1 Streambank Stabilization

Remedial

Streambank erosion is a moderate problem for streams in the watershed and has the potential to become more severe. 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). Erosion occurs not only along the streambanks but also at stormwater discharge pipes and channels, sometimes severe enough to cause failure of outlet pipes, headwalls, and other infrastructure.

Streambank erosion can be reduced using a number of techniques that range from soft, natural solutions such as native vegetation to hard solutions like rock riprap and concrete armoring. The preferred technique for streambank stabilization is soil and vegetation 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. Bioengineering solutions start weak and get stronger and more stable over time, while hardscaping solutions are strongest after installation and get weaker 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 stormwater flow 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 the river.

At stormwater discharge points and channels, the erosive force of stormwater must be reduced. Using runoff volume and rate reduction techniques throughout the watershed can significantly reduce the discharge and the erosional effects at these points. However, assuming that all rate and volume reductions will not be handled upstream, practices at the outfall points will be needed. Those practices described above are needed to stabilize the streambanks surrounding the discharge points so that they are not so easily eroded. Additional practices include reducing the fall distance from outlet pipes and creating splash pads that disperse erosional energy. Additional practices are suggested in Outfall Retrofits above.

Stream channel stabilization is also necessary in some locations where downcutting and headcutting are destabilizing the bottom of the stream. Landowners have attempted to line the stream bottom with rock or poured concrete, though this may cause more problems than it solves and reduces the health of stream habitat. More appropriate measures include the establishment of pools and riffles through the strategic placement of boulders and gravels, and the use of check dams and naturalized low head weirs.

3.5.2 Outfall Retrofits

Remedial Retrofit

Creating Wetland Meanders

Outfalls, especially stormsewer pipes, can be retrofitted to add water quality benefits. One technique for retrofitting outfalls is to daylight stormsewers so they 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. 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.

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 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.

Several proprietary retrofit products (such as Stormceptors and others) use cyclonic action to remove pollutants from stormwater runoff. These retrofits are 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 (Claytor 1999).

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 wets. 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 of oil/grit separators is extremely limited (Shepp 1995).

3.6 Nonpoint Source Pollution Prevention Program

Preventive

Pollution prevention and source reduction programs reduce the generation and migration of pollutants that collect on streets, parking lots and other surfaces into streams, rivers and lakes. Because nonpoint source 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 strategies are community programs that include a combination of regulation, guidance and education.

Source controls prevent pollutants from entering the stormwater stream from the point where the rainwater falls. 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 typically includes 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 the land. 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 F.8.

Table F.8. 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
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

4. WATERSHED PROTECTION TOOLS TO MINIMIZE AND REDUCE FLOOD DAMAGE

Flood prevention and reduction techniques seek to prevent flooding problems before they occur and minimize damage where they do occur. Flood prevention techniques take the form of land use controls that include programmatic/ regulatory controls and implementation of infiltration techniques in existing and new developments. Regulatory controls such as zoning, floodplain, and stormwater ordinances seek to prevent flood damages by limiting development in areas where flooding is most likely to occur, and by standardizing stormwater runoff requirements for new developments. Infiltration techniques, whether applied to old or new developments, decrease runoff that can lead to flooding. 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.

Programmatic/Regulatory Controls are covered within Watershed Protection Policy and Planning Tools above. Infiltration Techniques for Existing Developments are covered within Stormwater and Landscaping Best Management Practices above. Infiltration Techniques for New Development are covered within Watershed Protection Policy and Planning Tools above.

4.1 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, the US Army Corps of Engineers (USACE) and the USDA Natural Resources Conservation Service.

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 F.9. (Association of State Floodplain Managers 1996)

Table F.9. 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.

4.1.1 Reservoirs/ Regional Detention

Preventive and Remedial Retrofit

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.

4.1.2 Detention Basins

Preventive and Remedial Retrofit

Enlarging or adjusting flows through existing detention basins, or constructing new basins, can remedy some localized flooding problems. 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.

The known flood problem areas in the watershed suffer flood damage primarily caused by poor local drainage or a depressional location rather than flood damage from the river overbank flooding. Older developments in the watershed built prior to adoption of the WDO, as well as more open landscapes such as parks and open space, may lack adequate detention. Undeveloped areas are also without detention. 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 mitigate flood damage at some flood problem sites.

4.1.3 Levees and Floodwalls

Preventive and Remedial Retrofit

Earthen levees or concrete floodwalls are erected between rivers 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.

4.1.4 Barriers

Preventive and Remedial Retrofit

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.

4.1.5 Improved Channel Conveyance

Preventive and Remedial Retrofit

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 areas 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 because pool/riffle and riparian habitat are lost, negatively impacting both aquatic and terrestrial plants and animals. Increased water temperature and higher turbidity are two common water quality impacts associated with improved channel conveyance.

4.1.6 Drainage Improvements

Preventive and Remedial Retrofit

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.

4.2 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 countywide 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 existing flooding problems.

4.2.1 Building Relocation

Preventive and Remedial

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.

4.2.2 Buyouts/ Acquisition

Preventive and Remedial

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. With acquisition, the flooded structure is removed 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% 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.

4.2.3 Floodplain Acquisition

Preventive

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 flood damages, floodplain acquisition can provide multiple benefits with the addition of amenities such as greenways, recreational trails, river access points and

wildlife habitat corridors.

4.2.4 Building Elevation

Preventive and Remedial

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.

4.2.5 Floodproofing

Preventive and Remedial

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 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 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.

4.2.6 Runoff Reduction

Preventive and Remedial

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, which are described elsewhere in this toolbox. Disconnecting downspouts is also relatively simple and inexpensive. In these cases, runoff from rooftops is collected in rain barrels 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; Baxter & Woodman 1989). Since public participation is necessary for watershed effectiveness, an aggressive public information and outreach effort should be used for implementation of these techniques.

4.2.7 Insurance

Preventive

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 National Flood Insurance Program (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. Many communities in the Kellogg Creek watershed participate in the NFIP. Some communities may also participate in the Community Rating System (CRS), which is a program that credits a community for exceeding the minimum requirements of the NFIP. Residents of CRS communities pay reduced flood insurance rates as a result of their community's flood mitigation activities. LCSMC provides technical and planning assistance to municipalities regarding NFIP compliance and to a limited extent for the CRS program.

5. WATERSHED TOOLS TO PROTECT, RESTORE AND ENHANCE NATURAL RESOURCES

Natural resources in the watershed can be protected and enhanced by the following techniques, many of which are described elsewhere in the toolbox, and others which are described below:

- Developing and changing zoning ordinances,
- Acquiring and protecting open space with conservation easements,
- Promoting conservation developments,
- Developing greenways and trails,
- Protecting threatened and endangered species and their habitat,
- Preserving and restoring wetlands,
- Developing and implementing green infrastructure plans, and
- Restoring streams and riparian buffers.

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. All remaining undeveloped land in the watershed has been identified and prioritized as part of the watershed planning process. The highest priority natural areas should be acquired by public agencies or donated to public agencies dedicated to land conservation through a conservation easement. Other open space can be protected using conservation design development techniques, and be managed by private landowners or homeowner's associations. Protection of land by donation, deed restriction, conservation easement, etc. is a type of land use control that prevents future development or modification of natural or open space.

Stream maintenance, such as outfall remediation and streambank stabilization, are covered within Stormwater and Landscaping Best Management Practices above.

5.1 THREATENED AND ENDANGERED (T&E) SPECIES

Preventive and Remedial

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 T&E species. One technique is to acquire sites where T&E 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 a large 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 T&E 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.

5.2 WETLAND AND STREAM PROTECTION

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.

Stream and wetland restoration practices maintain and restore natural water quality protection features of these landscape elements. It includes activities such as repairing eroded streambanks, naturalizing detention basins, and enhancing wetlands with native plants, practices described in greater detail elsewhere in this toolbox.

5.2.1 No-Net-Loss/Wetland Mitigation

Preventive and Remedial

Since the 1970s, wetlands have been regulated through a permit program administered by the US Army Corps of Engineers (USACE) under Section 404 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.

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 in the Kellogg Creek watershed be mitigated or replaced in the same watershed.

5.2.2 Management Plans for ADID Wetlands

Preventive and Remedial

A number of wetlands in the Kellogg Creek watershed, most significantly those within Illinois Beach State Park, are classified as high quality (ADID) wetlands by the 1992 Lake County Wetland Inventory. Management plans, developed cooperatively between the wetland owners and local, state and federal agencies, are a measure that could 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 the watershed plan.

5.2.3 Acquisition of High Priority Wetlands

Preventive

Acquisition as a protection technique is covered under Protected Ownership in Protecting Open Space and Natural Areas. The location of T&E species, ADID wetlands and high quality natural areas are several criteria, among others, that could be used to prioritize wetlands for acquisition.

5.2.4 Protected Ownership/ Conservation Easements

Preventive

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.

5.2.5 Wetland Enhancement and Restoration

Preventive and Remedial

Because agriculture and urbanization have degraded many of the remaining wetlands in the Kellogg Creek watershed, 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 impact on wetlands from future development in the Kellogg Creek watershed will likely be a shift in the types of wetlands. 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 are proposed in the Kellogg Creek watershed 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 regional greenways or trail networks, 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.

5.2.6 Riparian and Wetland Buffers

Preventive and Remedial

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 Illinois Native Plant Guide (USDA-NRCS 2003, the updated 1997 *Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois*) is the minimum standard for re-vegetation of disturbed 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 and other water bodies (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.

5.2.7 Stream Restoration

Remedial

Stream restoration techniques are used to improve stream conditions so they more closely mimic natural conditions. For 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.

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, removing nuisance plants from the stream banks and buffer area, performing stream channel maintenance and debris removal, stabilizing streambanks using bioengineering techniques, and, where appropriate, by removing manmade 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. Additional details are provided in Stream Maintenance Program above.

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).

5.2.8 Wetland Incentives and Cost-Share Opportunities

Preventive and Remedial

There are a number of incentive programs to implement wetland projects. Funding 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.

US Army Corps of Engineers (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% towards the total project cost.

US Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS) Programs

The USDA - NRCS has four incentive programs that may have applicability in the Kellogg Creek watershed: the Environmental Quality Incentives Program (EQIP), the Wetland Reserve Program (WRP), the Conservation Reserve Program (CRP), and the Wildlife Habitat Incentive Program (WHIP). 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% 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 the planning committee successfully nominates the Kellogg Creek watershed as a natural resource "priority area". EQIP and WRP are only applicable to agricultural lands.

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% cost share. Rental payments are boosted by 20% 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% cost share. This grant program is competitive and funding depends on the project's ranking compared to others in the state. Contact David Misek at the local USDA-NRCS office for details at (847) 223-1056.

US Fish and Wildlife Service (USFWS) Partners for Wildlife

Up to 100% cost-share funding is available for private landowners with restorable wetlands through the Partners for Wildlife program of the USFWS 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.

Illinois Department of Natural Resources (IDNR) Conservation 2000

Because Kellogg Creek is within the area of the Lake Michigan Watershed Ecosystem Partnership, funding is available on a competitive basis from the State of Illinois' Conservation 2000 Ecosystems Program (C2000). The C2000 program, administered by the Illinois Department of Natural Resources (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.

Illinois Environmental Protection Agency (IEPA) Section 319

Funding for wetland related projects is provided by the IEPA 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 (NPS), improve Illinois water resources, and promote the public's knowledge and awareness of NPS 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 available 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 six-county Chicago region.

Lake County Soil and Water Conservation District (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.

Sources: National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Office of Water, 2005.

Table F.10. Community Best Management Practices

Community Best Management Practice	Lead Partner	Relative Cost (High, Medium, Low)	Ease of Implementation (Difficult, Moderate, Easy)	Implementation Obstacles	Implementation Time Frame / Schedule (Short, Medium, Long)	Maintenance (Routine, Quarterly / Annual, Infrequent)	Technical Assistance Required? From Whom?	Financial Assistance Required or Available?
Streambank stabilization	SMC, municipality, township, drainage district	Medium - High	Moderate - Difficult	Easements, access, equipment, funding, permitting	Medium	Quarterly - Annual	SMC, LCSWC, municipality, consultant, FPD	Yes
Stream and wetland restoration	FPD, drainage district, park district, state	Low - High	Moderate - Difficult	Easements, access, equipment, funding, permitting	Short	Quarterly - Annual	SMC, LCSWC, municipality, consultant, FPD	Yes
Stormwater outfall retrofits (e.g., stabilizing/ extending pipe outfalls, outfall daylight filters)	Municipality, LCDOT, IDOT, drainage district	Medium - High	Moderate - Difficult	Easements, access, equipment, funding, permitting	Medium	Quarterly - Annual	SMC, LCSWC, municipality, consultant	Yes
Detention basin retrofits	Homeowners association, municipality, landowner	Medium	Moderate	Education, maintenance	Short - Medium	Quarterly - Annual	SMC, LCSWC, municipality, consultant, LCHD	Yes
Naturalized detention basins	Homeowners association, municipality, landowner	Medium	Easy	Education, maintenance	Short - Medium	Quarterly - Annual	SMC, LCSWC, municipality, consultant, LCHD	May be available
Low impact development practices	Municipality, county, developer	Low	Moderate	Education	Short	Quarterly - Annual	Consultant, SMC, municipality	No
Construction practices – soil erosion/ sediment control	Municipality, county, developer	Low	Easy	Acceptance, site management	Short	Routine	Municipality, SMC, SWCD	No
Filter strips and level spreaders	Municipality, county, developer	Low	Easy	Education	Short	Quarterly - Annual	Municipality, SMC, SWCD, consultant	No
Surface and underground filters	Municipality, county, developer	Medium	Moderate	Education	Short	Quarterly - Annual	Municipality, SMC, SWCD	May be available
Street cleaning	Municipality	High (start-up), Moderate (operation)	Easy	Education / training	Short	Routine	No	No

Table F.10. Community Best Management Practices (Continued)

Community Best Management Practice	Lead Partner	Relative Cost (High, Medium, Low)	Ease of Implementation (Difficult, Moderate, Easy)	Implementation Obstacles	Implementation Time Frame / Schedule (Short, Medium, Long)	Maintenance (Routine, Quarterly / Annual, Infrequent)	Technical Assistance Required? From Whom?	Financial Assistance Required or Available?
Stormwater system maintenance	Homeowners association, municipality, drainage district	Low - High	Difficult (homeowners association), Moderate (municipality, drainage district)	Landowner resistance, education / training, funding	Short	Routine	Municipality, SMC, consultant	No
Eliminate stormwater/ sanitary cross connections	Municipality	High	Difficult	funding, landowner resistance, locating problems and solutions	Long	Infrequent	Legal, consultant	Yes (SRLF, CDBG)
Drainage improvements	Municipality, county, LCDOT, township, drainage district	Medium - High	Easy - Difficult	Landowner resistance	Short - Long	Quarterly - Annual	Legal, consultant	Yes (CDBG, MFT, WMB)
Regional detention	SMC, IDNR, COE	High	Difficult	Landowner resistance, funding, locating facilities	Long	Quarterly - Annual	Consultant, SMC, IDNR, COE	Yes
Stream maintenance	Landowner, drainage district, municipality, SMC	Medium	Moderate	Public support, education	Short	Routine	Legal, consultant, SMC, municipality, drainage district	Available (WMB)
Riparian/ wetland buffer enhancement program	SMC, municipality, drainage district	Medium	Moderate	Landowner resistance	Medium	Infrequent	SMC, consultant	Yes
Green infrastructure acquisition/ protection	Park district / department, municipality, FPD, land trust	High	Difficult	Funding, landowner resistance	Long	NA	Legal, consultant, land trust	Yes
Nonpoint source pollution prevention	Municipality, LCDOT, IDOT, township, drainage district	Low - High	Easy - Difficult	Education / training	Short	Routine	Consultant, SMC	No

Table F.11. Landowner Best Management Practices

Landowner Best Management Practice	Relative Cost (High, Medium, Low)	Ease of Implementation (Difficult, Moderate, Easy)	Implementation Obstacles	Implementation Time Frame / Schedule (Short, Medium, Long)	Maintenance (Routine, Quarterly / Annual, Infrequent)	Technical Assistance Required? From Whom?	Financial Assistance Required or Available?
Disconnect downspouts	Low	Easy	Legal, basement flooding, destination for water	Short	Infrequent	No	No
Bioretention – rain gardens	Medium	Moderate	Site topography, soils	Medium	Routine	Contractor, landscaper	No
Vegetated swales	Low (existing), Medium - High (new)	Easy (existing) - Moderate - Difficult (new)	Legal, engineering / design	Short - Medium	Routine	Local government, contractor	No
Rainwater harvesting – rain barrels and cisterns	Low (rain barrels) - Medium (cisterns)	Easy (rain barrels) - Moderate - Difficult (cisterns)	Maintenance	Short (rain barrels) - Medium (cisterns)	Routine	No (rain barrels), Yes (cisterns), design	May be available
Native landscape system	Low - Medium	Moderate	Local ordinance, maintenance	Medium	Routine	Landscape architect, FPD	No
Green roofs	High	Moderate - Difficult	Education, engineering / design, funding	Short	Quarterly / Annual	Consultant	Yes (Section 319)
Permeable paving	High	Moderate - Difficult	Maintenance, funding, education	Short	Quarterly / Annual	Consultant	May be available
Landscape maintenance	Low	Easy	Education, local landscape ordinances, acceptance	Short	Routine	Consultant, SMC, SWCD / extension	No
Landowner outfall stabilization BMPs	Low - Medium	Easy - Moderate	Education	Short	Quarterly / Annual	Consultant, municipality, SMC, SWCD / extension	No
Impervious surface maintenance (e.g., parking lots)	Low	Easy	Education	Short	Routine	LCHD	No
Riparian/wetland buffer	Low - Medium	Easy - Moderate	Education, invasive species, aesthetics	Short	Quarterly / Annual	SWCD, extension, SMC, consultant	Yes
Conservation easements	Low - High	Moderate	Legal, party to hold easement	Short	Quarterly / Annual	Legal, land trust	May be available
Flood insurance	Low - Medium	Easy	None	Short	Quarterly / Annual	No	No
Floodproofing	Low - High	Easy - Difficult	Funding, knowledge, technical assistance	Medium	Quarterly / Annual	Consultant, SMC	May be available

USEPA watershed-based plan element #3:
best management practices and critical areas
where those practices are needed
(also see Chapter 5).

appendix G - expanded programmatic action plan

This is an expanded version of the Programmatic Action Plan Tables included in Section 5.2. In addition to the information included in Section 5.2, these tables also include location, goals and objectives addressed, priority, lead implementor, supporting implementor, time frame, projected cost, and status (to be filled in by the committee or organization responsible for tracking plan implementation.)

ID#	Location	Stream and Riparian Corridor Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
1	Watershed wide	Stabilize and retrofit stormwater outfall structures and the associated streambanks and channel. Install flow attenuation and outlet protection measures to reduce erosion and improve filtration of stormwater runoff entering the stream.	A3 A5 A8 A11 E1 E2	1	M BPDD RL	SMC	S	$3000 to $6000 each	
2	Watershed wide	Stabilize eroding streambanks, toe, and side slopes using bioengineering practices with deep-rooted native plants to reduce erosion and sediment loads downstream and to reduce property loss. Bioengineering practices include A-Jacks, lunkers, fiber rolls, geotextile mats, live stakes, fascines, brush and branch layers, cribwalls, and vegetated geogrid lifts.	A3 A11 A8 C3 E1 E2	1	RL BPDD GC	SMC IEPA	M	$50 to $150 per linear foot, on average	
3	Watershed wide	Where feasible, replace failing or crude armoring and concrete lined channels with more sustainable, natural and habitat friendly stabilization measures.	A1 A3 A11 C3	2	RL BPDD	SMC	L	$250 per linear foot	
4	Watershed wide	Preserve, enhance or establish native riparian buffers along all unbuffered or inadequately buffered stream reaches using emergent wetland and wet prairie vegetation to stabilize streambanks, filter out pollutants, and enhance aquatic habitat. Development within buffer areas should be strictly limited.	A1 A3 A6 A7 C3 E1 E2 E4 A7 G1	2	RL BPDD GC	M	S	$25 per linear foot	
5	Watershed wide	Restore stream channels, streambeds, and aquatic habitat to a healthy condition. This includes instream habitat features, such as natural channel substrates and pools & riffles, to improve water quality and aquatic biodiversity.	A1 A3 A8 C3 E1	1	RL BPDD	IDNR SMC M	S	$250 to $575 per linear foot	
6	Watershed wide	Where feasible, daylight and remeander streams that have been contained in ditches or moved underground into culverts or pipes.	A1 C3	3	RL BPDD	IDNR SMC M	L	$575 per linear foot	
7	Watershed wide	Modify bridges, culverts, and other hydraulic structures that are directing flow into the streambanks, eroding around the edges, blocking flows and fish passage or otherwise problematic.	A2 A3 A11 C6	3	RL M BPDD DOT GC	SMC	M	$5000 each	
8	Watershed wide	Restore hydrologic connections to Lake Michigan to promote recolonization of the aquatic community.	C3 C6 G4	3	IDNR	CMP	L	varies	
9	Watershed wide	Develop and implement a regular stream inspection and maintenance program among the Beach Park Drainage District, municipalities, homeowners, and SMC to remove accumulated woody debris and other debris and litter and to target restoration needs.	A9 A10 D1 E8 F7	2	SMC	BPDD M RL	S	varies	
10	Watershed wide	For moderately and severely eroded stream reaches, develop a stream restoration plan and cost estimate.	A4	1	M BPDD RL	SMC	S	varies	

ID#	Location	Water Quality and Stormwater Management Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
11	Watershed wide	Use green infrastructure BMPs such as natural stormwater drainage, infiltration, and detention practices and lot level BMPs in new and existing development to reduce surface runoff volumes, to filter pollutants from stormwater runoff, and to improve infiltration of precipitation into the ground. Stormwater BMPs should use, to the extend possible, native plants that are appropriate for the location in which they are being planted. Reducing runoff rate and volume will also minimize sediment loadings from in-stream and surface erosion and riparian habitat degradation .	E1 E2 E7 E9 G1 G3	1	M PRL CBL DH	SMC IEPA PD LC	M	varies	
11a	Watershed wide	Where feasible, convert existing swales and open drainage ways to infiltrate runoff with natural landscaping.	E1 E2 E7 E9 F6 G1	1	M BPDD DOT	SMC PRL CBL DH LC	S	$1 per linear foot to $650 per acre	
11b	Watershed wide	Retrofit curb and gutter areas along roadways, parking lots, and other impervious surfaces to allow stormwater to enter swales or other naturalized filtration and infiltration measures such as parking lot and roadside rain gardens.	E1 E2 E7 F6 G1 G3	1	M CBL DH DOT	LC	M	$1 per linear foot to $650 per acre	
11c	Watershed wide	Install bioswales into parking lots as construction and reconstruction occurs.	E1 E2 E7 F6 G1 G3	1	M CBL DH DOT	LC	M	$1 per linear foot to $650 per acre	
11d	Watershed wide	Install vegetated filter strips or rain gardens where sheet flow leaves impervious surface to capture pollutants and infiltrate runoff.	E1 E2 E7 G1 G3	1	M CBL DH DOT	LC	S	$1 per linear foot to $650 per acre	
11e	Watershed wide	Install sand filters, filtration basins, treatment wetlands, other bioretention practices, or other filtration practices downstream of industrial, commercial facilities and other land uses potentially generating a heavy load of pollutants. Install sand filters, appropriate proprietary water treatment units, or settling basins at the storm sewer inlets in parking lots	E1 E2 E7 G1 G3	1	M CBL DH DOT	LC	M	$1 per linear foot to $650 per acre	
11f	Watershed wide	Install green roofs where feasible to capture, filter, and evaporate stormwater.	E1 E2 E7 G1 G3	2	PRL CBL DH	M	L	$5 to $25 per square foot	
11g	Watershed wide	Reduce the hydraulic connectivity of impervious surfaces by disconnecting roof downspouts from discharging to impervious areas and instead directing the flow into a lawn or naturally landscaped area, raingarden, filter strip, rain barrel, or dry well. Substitute swale and raingarden systems for curbs and gutters to increase infiltration.	E1 E2 E7 G1 G3	1	PRL CBL DH	M LC	S	varies	
11h	Watershed wide	When replacing existing pavement, or installing newly paved areas, use pervious or porous pavement or permeable paving blocks for parking lots, emergency access roads, driveways and streets where appropriate to increase infiltration and reduce runoff volumes and pollutant loads.	E1 E2 E7 F6 G1 G3	1	PRL CBL DH DOT M	PD LC	M	$2 to $6 per square foot	
12	Watershed wide	Utilize naturalized wet bottom or wetland detention basin designs and retrofit existing single function dry bottom detention basins to provide multiple benefits including reduced pollutant loads, and to provide habitat. Upgrade and maintain existing stormwater detention basins and online water storage ponds to provide water quality benefits and slower release rates where feasible.	E1 E2 E9 F6 G3	2	M PRL CBL DH GC	DOT SMC BPDD	M	varies	
12a	Watershed wide	Stabilize eroding shorelines and replace rip rap, concrete and turf pond and detention basin edges with deep-rooted native landscaping for shorelines and buffers.	E1 E2 E9 F6 G3	2	M PRL CBL DH GC	DOT SMC BPDD	M	$100 per linear foot	
12b	Watershed wide	Install settling basins upstream of wet and wetland detention where feasible and where the catchment area contains a large amount of impervious surface to capture sediment in runoff. Where settling basins can not be installed upstream, install a forebay in the basin and remove accumulated sediment to maintain detention capacity.	E1 E2 E9 F6 G3	2	M PRL CBL DH GC	DOT SMC BPDD	M	varies	
12c	Watershed wide	Monitor, maintain, and clean out stormwater detention facilities, storm drains, and catch basins to ensure effective operation and provide maximum detention, water quality benefits and habitat. Develop a monitoring and maintenance plan that identifies who is responsible, a maintenance schedule, budget and funding source.	E1 E2 E9 F6 G3	2	M PRL CBL DH GC	DOT SMC BPDD	S	varies	
12d	Watershed wide	Where possible, restrict discharge rates from detention basins to mimic natural instream flow rates.	E7 E9 F6 G1 G3	2	M PRL CBL DH GC	DOT SMC BPDD	M	varies	

ID#	Location	Water Quality and Stormwater Management Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
13	Watershed wide	Preserve and protect natural drainage and storage (green infrastructure) features of the landscape to filter and infiltrate runoff and to reduce the threat of flood damage, including native vegetation, natural riparian buffers, floodplains, flood prone areas, natural depressional and regional storage areas, and wetlands. Prevent fill, excavation, development, and other modifications. Smaller depressional areas may potentially be incorporated into development as raingardens, bioswales, and other measures that retain runoff rather than releasing it offsite.	A6 A7 B1 C2 C3 E1 E2 E7 G1 G2 G3 G4	2	M DH PRL	SMC LC	L	varies	
14	Watershed wide	Maintain the drainage system conveyance including cleaning out catch basins, channel maintenance, swale maintenance, culverts, and removing excess debris, trash, and other obstructions to improve aesthetics maintain flow capacity, and minimize erosion. Some natural elements such as rocks and woody debris should be left as in-stream habitat features.	A1 A2 A11 C3 E5 E9 F6 G2 G3 G4	2	M BPDD RL	DOT SMC	S	$20 per linear foot	

ID#	Location	Planning and Development Standards Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
15	Watershed wide	Lake County, municipalities, park districts, the Forest Preserve District and other local governments units should incorporate the goals and recommendations of the watershed plan into comprehensive land use plans, development policies (zoning and subdivision regulations) capital improvement plans and budgets, and land preservation/acquisition strategies.	C1 D3 D4 F3 F4 F6	1	M	BPDD LCFPD SMC T LC	S	varies	
16	Watershed wide	Use the site development planning and approval process to encourage watershed-friendly development practices and designs that protect watershed resources and water quality by right rather than by exception.	A7 D3 D4 F3 G3	1	M	LC	S	varies	
17	Watershed wide	Establish incentive programs for developers to implement conservation and low impact development planning and design practices and techniques. These incentives could include expedited permitting and review procedures, density bonuses, tax credits, cost-share, or fee reductions for early projects that serve as demonstrations and free technical assistance.	A7 F3	3	M LC		M	varies	
18	Watershed wide	Make it easy for developers and builders to incorporate best management practices recommended by this watershed plan into new developments or redeveloped areas. Modify zoning and development standards to facilitate implementation of the watershed plan recommendations. This could include the following: review and update development standards, add incentives such as density bonuses, park and open space donation credits, and other incentives, for preserving the green infrastructure system. Within new developments, easements or deed restrictions should be placed on lands identified as Category 1 parcels on the Green Infrastructure Plan.	A7 F3	2	M	LC	M	varies	
19	Watershed wide	Establish and adopt bluff-and-ravine protection standards.	A7 F3	1	M LC		S	varies	
19a	Watershed wide	Establish a 30' minimum buffer distance between bluff edges and development.	A7 F3	1	M LC		S	varies	
19b	Watershed wide	Require appropriate deep-rooted native plants as ground cover to help stabilize erodable soils on ravine slopes, edges, and buffers. Erodable soils are found in reaches BL02, BL05, BL07, BL08. BL09, BL10, BL11, BL13, BL19, BL20, BL21, BL25, BL26, and BL27. Allow cutting of trees on ravine slopes where appropriate for ground cover vegetative restoration. Require proper removal and proper disposal of cut trees.	A7 C3 F3	1	M		S	varies	
19c	Watershed wide	Prohibit dumping of grass clippings, leaves, or other natural or man-made fill or debris that may damage underlying vegetation or prevent re-vegetation on ravine slopes.	A7 C3 E1 E2 F3	2	M		S	varies	
19d	Watershed wide	Encourage the use of on site infiltration techniques to reduce direct stormwater flow from impervious surfaces into the ravines. Where stormwater can not be infiltrated on site, prohibit downspout pipe and/or sump pump outlets on or within 10 feet of or on steep ravine slopes. Allow discharge at the bottom of the ravine.	E1 E2 E7 F3	1	M LC SMC		S	varies	
19e	Watershed wide	Limit concentrated stormwater discharges to ravines to storm events larger than the 1-year frequency. Level spreaders may be required to distribute concentrated flows across a large area.	E7 F3	1	M SMC		M	varies	
20	Watershed wide	Adopt and enforce flexible local zoning and subdivision standards that allow adaptable, nontraditional designs for development that minimize negative impacts from stormwater runoff and nonpoint source pollution. Standards should limit runoff volume increases, minimize impervious surface area, manage stormwater on site using BMPs, and minimize land disturbance during and following construction. This action is most relevant for Highly Vulnerable Critical Subbasin #35, which is at risk for land use conversion that may result in significantly higher imperviousness.	D3 D4 E1 E2 E7 F3 F6 G3	2	M	LC	M	varies	
20a	Watershed wide	Reduce minimum street widths to those necessary to carry the expected average traffic volume rather than the maximum traffic volume.	E1 E2 E7 F3 F6 G1 G3	3	M	LC	L	varies	
20b	Watershed wide	Use alternative parking lot designs including: ensure that the number of spaces built reflects actual, everyday demand rather than infrequently needed maximums; reduce the dimensions of the normal parking spaces where feasible; convert parking lot islands and landscaping to depressed bioretention areas; allow shared parking between adjacent facilities with alternating times of parking needs (e.g., a church and an office building).	E1 E2 E7 F3 F6 G1 G3	2	M	LC	M	varies	

ID#	Location	Water Quality and Stormwater Management Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
20c	Watershed wide	Allow permeable paving practices for plazas and pedestrian areas, parking, driveways and low volume traffic streets.	E1 E2 E7 F3 F6 G1 G3	2	M	LC	M	varies	
20d	Watershed wide	Allow reduced street setbacks, frontages, and lot sizes in areas where riparian or sensitive natural areas need protection and to reduce the impervious surface area for streets and driveways.	E1 E2 E7 F3 F6 G1 G3	2	M	LC	M	varies	
20e	Watershed wide	Allow cluster / conservation design development to reduce the disturbed area and preserve green infrastructure (open land) for infiltration and treatment of runoff.	E1 E2 E7 F3 G1 G3	1	M	LC	M	varies	

ID#	Location	Green Infrastructure Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
21	Watershed wide	Land planning jurisdictions such as municipalities, park districts etc. adopt the Green Infrastructure Plan to use as a tool in prioritizing and implementing green infrastructure preservation and restoration programs.	C1 C2 F3 F4	1	M PD LCFPD	LC	S	varies	
21a	Watershed wide	Clearly identify and designate areas prioritized in the Green Infrastructure Plan as green infrastructure conservation areas in county, park district and municipal comprehensive plans and maps.	C1 C2 F3 F4	1	M PD LCFPD	LC	S	varies	
21b	Watershed wide	Identify and conserve connecting greenways, especially along streams and other water features. Provide passage and remove or mitigate barriers to fish & wildlife movement (such as highways, dams, and weirs) throughout the corridors and between the green hubs.	A2 C1 C2 C3 F3 F4	1	M PD LCFPD	LC	L	varies	
21c	Watershed wide	Avoid development and installation of gray infrastructure through Category 1 green infrastructure system parcels wherever possible.	C1 C2 F3 F4 F6	2	M	LC T DOT	S	varies	
21d	Watershed wide	For lands not readily protected through land use planning and zoning, develop a preservation strategy to prioritize and purchase or otherwise protect Category 1 Green Infrastructure parcels and the natural drainage system of stream corridors, and wetland complexes. The strategy may include purchase funds, developer fees and donation funds, conservation easements, purchase of development rights programs, or other measures.	B1 C1 C2 F3 F4	1	M PD LCFPD	LC	S	varies	
22	Watershed wide	Actively manage, restore, buffer and expand Category 1 and 2 Green Infrastructure Parcels by controlling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer. These areas may include Illinois Natural Areas Inventory sites, forest preserve holdings, private conservation lands, and other public agency lands such as park districts.	A6 C2 C3	1	PRL CBL M	PD IDNR LCFPD	L	varies	

ID#	Location	Natural Area Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
23	Watershed wide	Actively manage, restore, buffer and expand natural areas (riparian zones, wetlands, and high quality habitat sites) by controlling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer. These areas may include Illinois Natural Areas Inventory sites, forest preserve holdings, private conservation lands, and other public agency lands such as park districts.	A6 A7 C2 C3 E4	1	M IDNR PD LCFPD	CBL PRL	L	$25 per linear foot	
24	Watershed wide	Protect, and restore degraded, drained, and/or farmed wetlands to improve water quality, provide surface water storage, and improve habitat. Vegetative management, prescriptive burning, invasive species management, and hydrologic restoration can all be used to help improve wetland quality. The strategic removal and/or blockage of wetland drainage tiles, flood control structures, or other drainage structures can help restore wetland hydrology. Approximately 754 acres are available as potential wetland restoration sites.	B1 C2 C3 E1 E2 G4	2	M LCFPD PRL	IDNR PD	L	$500 per acre	
25	Watershed wide	Restore stream channels to natural state by preserving and/or installing pools and riffles, removing excessive debris, stabilizing steam banks and the stream bed.	A1 A3 A8 A11 C3	3	RL	BPDD IDNR	L	$225 per linear foot	
26	Watershed wide	Stabilize upstream hydrology to reduce erosion, pollution runoff, and sediment loading to downstream natural areas and preserve valuable and unique resources within Illinois Beach State Park and Lyons Woods Forest Preserve.	A3 A8 C3 E1 E2 E7 G4	2	M PRL		L	varies	
27	Watershed wide	Replenish and stabilize the Lake Michigan shoreline to protect this valuable and unique habitat.	C3 C4	1	IDNR CMP	USACE USFWS	L	varies	
28	Watershed wide	On private lands, actively manage, restore, buffer and expand on-site natural areas by controling non-native and invasive plant species, planting native vegetation, using prescribed burning, and thinning the tree canopy so that a minimum 15% of available sunlight is reaching the ground layer.	A6 C3 E4	2	PRL RL CBL		L	$7500 per acre	

ID#	Location	Land Management Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
29	Watershed wide	Improve road maintenance practices, such as street and parking lot sweeping and reduce application of de-icing salt, to reduce the flow of particulates, sediment, chlorides, and other pollutants into the stormwater system, stream, and ultimately Lake Michigan.	E1 E2 E4 E10 F3 F6 G1	1	M DOT CBL	T	S	varies	
30	Watershed wide	Investigate and address potential contamination issues in Illinois Beach State Park and the Dead River. Remediate, cap, cover, or install other controls for any potential sources of toxic or other pollutants including waste storage piles, landfills or facilities, hazardous materials, nuclear contamination sites, and salt piles to prevent stormwater contact or to capture runoff if stormwater contact does occur.	C5 E1 E2	2	IDNR CMP USEPA IEPA	LCHD CAG LMGLO	L	varies	
31	Watershed wide	Reduce fecal coliform contamination on Lake Michigan beaches by controlling gull populations, human sewage, and other contributing sources. Further study is needed to identify the non-gull sources of fecal coliform contamination.	E1 E5 E6	1	LCHD IDNR	IEPA LMGLO	S	varies	
32	Watershed wide	Use sustainable site and land management practices (including golf courses and agricultural operations).	E1 E2 E4 E5	1	PRL CBL GC	M PD LCFPD	S	varies	
32a	Watershed wide	Avoid disposal or burning of yard waste in or near the stream or riparian buffer, which adds excess nutrients to the stream system and kills the plant buffer that stabilizes the streambanks and filters runoff to the stream. Properly dispose of yard and pet wastes, household chemicals, and trash. Do not dispose of these in stormsewers, roadside swales, or the stream.	A7 E1 E2 E4 E5	1	PRL GC	CBL M PD LCFPD	S	varies	
32b	Watershed wide	Utilize deep-rooted native vegetation wherever possible for landscaping rather than turf grass to increase stormwater infiltration and evapotranspiration, reduce the need for watering, pesticides and fertilizers, filter pollutants from surface runoff, and provide habitat for native species. Plant native trees appropriate to the local area to increase interception, evapotranspiration, and uptake of precipitation.	C3 E1 E2 E4	2	PRL CBL GC PD	M	S	$3000 to $6000 per acre	
33	Watershed wide	Protect water resources from sedimentation due to construction site erosion by inspecting and enforcing soil erosion and sediment control standards as required by the Lake County Watershed Development Ordinance. Require an approved SESC plan to help protect water resources from sedimentation by filtering and trapping sediments out of stormwater before it leaves a development site. Assess erosion and sediment control practices after storm events and ensure SESC plan implementation.	E1 E2 E3 F3 G1 G3	1	M DH LC	NRCS/SWCD	S	varies	
33a	Watershed wide	Minimize soil compaction, clearing and mass grading to only where absolutely necessary to build and provide access to structures and infrastructure (site fingerprinting). Avoid clearing and grading in or immediately adjacent to water resources and steep slopes. Clearing should be done immediately before construction, rather than leaving soils exposed for months or years.	E1 E2 E3 E7 G1 G3	1	M DH LC	NRCS/SWCD	S	varies	
33b	Watershed wide	During construction protect and retain existing vegetation to decrease concentrated flows, maintain site hydrology, and control erosion.	E1 E2 E3 E7 G1 G3	1	M DH LC	NRCS/SWCD	S	varies	
33c	Watershed wide	Limit soil exposure by phasing construction so that only a portion of the site is disturbed at any one time to complete the needed building in that phase. Other portions of the site are not cleared and graded until exposed soils from the earlier phase have been stabilized and the construction is nearly completed.	E1 E2 E3 G1 G3	1	M DH LC	NRCS/SWCD	S	varies	
33d	Watershed wide	Stabilize / revegetate exposed and disturbed soils including soil stockpiles within 14 days after disturbance with seeding, mulch cover, erosion control blankets, or other stabilization practices. Topsoil stockpiles can be reapplied as a soil amendment to reestablish vegetation following construction.	E1 E2 E3 G1 G3	1	M DH LC	NRCS/SWCD	S	varies	
33e	Watershed wide	Employ a soil erosion sediment control treatment train, and install perimeter controls and risers as a last line of defense to retain and filter sediments before runoff exits the site.	E1 E2 E3 G1 G3	1	M DH LC	NRCS/SWCD	S	varies	
34	Watershed wide	The Waukegan Regional Airport should continue to update and implement the Storm Water Pollution Prevention Plan and Spill Prevention, Control and Countermeasure Plan, sweep impervious surfaces regularly, and find more environmentally-friendly de-icing compounds for airplanes and runways.	E1 E2 F3 G1	2	Waukegan Regional Airport		S	varies	

ID#	Location	Flood Management Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
35	Watershed wide	Adopt and continue to enforce floodplain protection standards within zoning, subdivision, and building codes or a 'stand-alone' floodplain protection standard that prohibits new building and roadway development, fill, or other encroachment within the floodplain.	B1	2	M LC SMC		M	varies	
36	Watershed wide	Address Flood Problem Area Inventory and Illinois Department of Transportation flooding sites, and avoid potential flood damage within 10- and 100-year floodplains.	B1 B2 B3 B4	2	M PRL FEMA DOT	LC SMC	L	varies	
36a	Watershed wide	Preserve riparian and depressional floodplain and wetlands as open and undeveloped to maximize flood storage and conveyance.	B1	2	M LC		L	varies	
36b	Watershed wide	Mitigate flood damages through floodproofing of at-risk structures such as raising the structure, sealing basement windows and doors, floodplain buyouts, and installing landscape features such as floodwalls or levees.	B2	1	PRL CBL	M LC FEMA	L	varies	
36c	Watershed wide	Mitigate sanitary sewer backup flood damages through remediation / correction of infiltration and cross connections with the sanitary sewer system and installation of one-way valves.	B3	2	PRL NSSD		L	varies	
36d	Watershed wide	Mitigate local drainage capacity flood damage by providing additional flood storage and or maintaining / improving local drainage system through installation of new or larger sewer pipes, larger culverts, or improving or increasing the conveyance capacity of ditches and overland flow path.	B4	2	PRL M	LC SMC	L	varies	

ID#	Location	Stakeholder Coordination Programmatic Actions	Goals + Obj	Priority	Lead Implementor	Supporting Implementor	Time frame	Projected Cost	Status
37	Watershed wide	Form a watershed organization to coordinate and lead watershed plan implementation activities.	F2 F4 F5	1	SMC M	WPC IEPA	S	varies	
38	Watershed wide	Coordinate watershed restoration projects and develop cost-share funding for best management practices.	F1 F5	1	SMC	M WPC	S	varies	
39	Watershed wide	Establish regular (e.g., quarterly) stakeholder coordination meetings to discuss projects, watershed plan implementation, and land use planning and development activities.	F2 F4	1	SMC	M WPC	S	varies	
40	Watershed wide	Incorporate plan recommendations into regional, county, and municipal plans and budgets.	F6	1	M LC CMAP		S	varies	

appendix H - expanded site specific action plan

This is an expanded version of the Programmatic Action Plan Tables 5.10 to 5.15 in Chapter 5 Section 5.2. In addition to the information included in Section 5.2, these tables also include location, goals and objectives addressed, priority, lead implementor, supporting implementor, time frame, projected cost, and status.

Table H1 City of Zion Expanded Site Specific Action Plan

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		1.0.1	Zion				*Preserve Category 1 and 2 green infrastructure open space areas to connect the North and South units of Illinois Beach State Park, enhance recreational opportunities, and expand and restore important rare habitat. Decommission and remove the power plant and associated structures. Acreage count includes private / utility owned land within the area. It is assumed that restoration would address the potential pollutant loading hotspots identified as Critical Subbasins #15 and #74.*	C1, C2, C3, E1, E2	1	3		L	382	acres	1	IDNR/Utility	Zion	0
	X	2.0.3	Zion				*Manage / minimize runoff impacts of commercial land uses along Sheridan Road, particularly at Sheridan and 33rd St and Sheridan and 27th, 28th, and 29th along the stream. Cost estimate assumes 8400 lf of Sheridan Road frontage treated with improved, 10' swales (approximately 2 acres) as a proxy for on-site source control BMPs.*	E1, E2, E7, E9, G1	1	3		S	2	acre	1	Zion	Owner Developer	0
	X	2.0.6	Zion			DB01	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2		S-M	1100	lf	1	Owner		0

Table H1 City of Zion Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	2.0.7	Zion			DB41	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin; remove excess debris. This is depressional area #54.	E1, E2, E9	2	2		S-M	2000	lf	1	Zion Park District		0
	X	2.0.8	Zion			DB42	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2		S-M	2100	lf	1	Zion Park District		0
	X	2.0.9	Zion			DB44	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1		S-M	1	ea	1	Owner	Zion	0
X		2.28.1	Zion				Restore stream channel and improve instream habitat by installing pools and riffles.	A1, A10, C3	3	3		S	2700	lf	1	Zion Park District		0
X	X	2.28.2	Zion				*Restore and manage the channel, native riparian buffers, and ravine woodland system, particularly the reach running through Ophir Park west of Sheridan Road, and Carmel Park east of Sheridan Road. Management practices include controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.*	A1, A3, A5, A6, A10, C3, E2, E4	1	2		S	2700	lf	2	Zion Park District		0
X	X	2.28.3	Zion				*Stabilize and reduce downcutting of the incised channel through Ophir Park, and install a naturalized riparian buffer. Cost estimate assumes stabilization of streambanks with Moderate erosion problem.*	A6, A10, A11, B1, B4, C3, E1	1	2		S	750	lf	2	Zion Park District		0

Table H1 City of Zion Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	2.28.4	Zion				Manage the culvert outflow at the upstream end of the reach for energy dissipation and pollutant removal, possibly with a settling basin or small constructed wetland.	A10, A11, B4	2	3		S	1	ea	1	Zion Park District		0
X		2.28.5	Zion				*Stabilize Moderate streambank erosion along the entire reach using bioengineering stabilization measures, which will help reduce the instream silt / sedimentation load within this reach.*	A1, A3, A8, C3, E1	1	3		M	2700	lf	2	Zion Park District, Owner		0
X		2.28.6	Zion	249	411		Remove debris, tires, and logs using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Owner	SMC	0
X		2.28.7	Zion	254	417		Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Owner	SMC	0
X		2.28.8	Zion	No #	421		Remove concrete debris and remove or repair failed headwall and outfall pipe.	A10, A11, B4	2	3		S-M	1	ea	1	Zion Park District	Zion	0
X		2.28.9	Zion	258	422, 424		*Stabilize major erosion, bank slumping / blowout, and headwall failure at upstream end of the reach near the culvert. Use bioengineering stabilization measures if possible, and more structural measures if necessary. Cost estimate reflects stabilization of severe erosion problem.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Zion Park District	Zion	0
X		2.28.10	Zion	252	414	PD190	*Stabilize 4 foot diameter plunge pool erosion below outfall. If feasible use bioengineering measures, though rip rap and structural measures may be necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Zion Park District	Zion	0
X		2.28.11	Zion	257	420	PD193	*Stabilize bank erosion caused by stormwater outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Zion Park District	Zion	0

Table H1 City of Zion Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		2.28.12	Zion	253	415	HS 154-158	Inspect and, if necessary, repair five culverts under trail, which may be crushed and/or failing.	A10, A11, B4	3	3		S	5	ea	1	Zion Park District	Zion	0
X	X	3a.0.3	Zion				Preserve approximately 21 acres of wetland and stream corridor open and partially open Category 1 green infrastructure areas and greenways within the headwaters of the 27th St tributary. Target areas are located (1) southwest of 25th St and Galilee, (2) south of Jethro and 26th Street, (3) west of 26th and Lewis, (4) southeast of 26th and Lewis, (5) northwest of 29th and Lewis.	A6, B1, C2, C3, G2, G4	1	3		L	21	acre	1	Zion Park District, Zion, Owner		0
	X	3a.0.7	Zion				Manage the golf course grounds and detention / water features in Shiloh Park, in the northeast corner of the SMU for water quality and habitat benefits, including installation of a 5 foot riparian buffer along shoreline / banks of water features.	B1, C3, E1, E2, E4, E9, G2, G4	2	1		S	2300	lf	1	Zion Park District		0
		3a.0.8	Zion				FPAI site 20-13 experiences local drainage problems due to runoff from the west. Retrofit David Park and the school property west of the problem area with detention or infiltration practices to reduce runoff rate and volume.	B4	2	3		S	NA	NA	NA	Zion	SMC	H
	X	3a.0.9	Zion			DB02	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a minimum 5 ft buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2		S-M	350	lf	1	HOA	Zion	0

Table H1 City of Zion Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
		3a.0.10	Zion			DB04	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
	X	3a.0.11	Zion			DB05	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	300	lf	1	HOA		0
	X	3a.0.12	Zion			DB06	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	E1, E2, E9	2	2		S-M	400	lf	1	HOA		0
	X	3a.0.13	Zion			DB07	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; retrofit bottom concrete channel.	E1, E2, E9	2	2		S-M	400	lf	1	HOA		0
	X	3a.0.14	Zion			DB08	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; remove excess debris.	E1, E2, E9	2	1		S-M	700	lf	1	HOA		0
	X	3a.0.15	Zion			DB37	Stabilize / regrade shoreline using bioenginnering practices and native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2		S-M	760	lf	1	Zion Park District	Zion	0
	X	3a.0.16	Zion			DB38	Stabilize / regrade shoreline and plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation.	E1, E2, E9	2	2		S-M	800	lf	1	Zion Park District		0
	X	3a.0.17	Zion			DB39	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	1		S-M	1400	lf	1	Zion Park District		0

Table H1 City of Zion Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X	X	3a.27.1	Zion				Restore and manage the native riparian buffer plant communities along this reach within Sharon Park by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer may be appropriate in the lower parts of the reach.	A6, A10, B1, C3, E1	2	2		S	2000	lf	2	Zion Park District		0
X		3a.27.2	Zion				Address High streambank erosion along entire reach using bioengineering stabilization measures, some of which may threaten buried sewer lines.	A1, A3, A8, C3, E1	1	3		M	2000	lf	2	Zion Park District		0
X		3a.27.3	Zion	237	397		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Zion Park District	SMC	0
X		3a.27.4	Zion	238	398		*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Zion Park District		0
X		3a.27.5	Zion	239	399		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Zion Park District	SMC	0
X		3a.27.6	Zion	241	401	PD181	*Stabilize significant erosion and exposure of manhole and sewer infrastructure using bioengineering stabilization measures and other hardscape solutions to ensure protection of the infrastructure elements. Length difficult to determine from photo; assume 100 lf for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Zion	NSSD?, Zion Park District	0

Table H1 City of Zion Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3a.27.7	Zion	242	402	PD182	*Stabilize erosion creating open channel at discharge point using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Zion	Owner (Bd. Of Edu.)	0
X		3a.27.8	Zion	244	405		*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 150 lf for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	150	lf	1	Zion Park District		0
X		3a.27.9	Zion	235	394	PD178	*Stabilize erosion at outfall that is creating an open channel using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Zion Park District	Zion	0
X		3a.27.10	Zion	236	395	PD179	*Stabilize major erosion, headwall, and outfall pipe failure using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Zion Park District	Zion	0
X		3a.27.11	Zion	240	400	PD180	*Stabilize minor channel erosion using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Zion Park District		0
X	X	3c.22.1	Zion				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2		S	1200	lf	2	Owner		0
X		3c.22.2	Zion	196	346		Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Zion	SMC	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		1.0.3	Beach Park				Preserve and restore open and partially open green infrastructure bounded by North Ave, York House Road, Sheridan Road, and residential areas to the north (spanning SMUs #1, #3b, and #3c) for natural resource restoration and management and recreation. Preserving two corridors (19 acres) east of Sheridan Road would connect this piece to the larger Illinois Beach State Park system. The area also contains storage area #30 and potential storage area #27, which may help reduce flooding in the area of FPAI 20-02 along Coolidge Ave.	B1, C1, C2, C3, G2, G4	1	3		L	99	acres	1	Owner	Beach Park	0
		1.0.8	Beach Park				Monitor IDOT-recorded flooding location at Sheridan and York House Road for further problems.	B4, F7	3	1		S	1	ea	1	IDOT	SMC	L
		1.0.9	Beach Park				Monitor IDOT-recorded flooding locations at Sheridan and Beach Road for further problems.	B4, F7	3	1		S	1	ea	1	IDOT	SMC	0
	X	1.0.14	Beach Park				Install filtration and infiltration BMPs for existing commercial properties along Sheridan Road. Cost estimate reflects 10' wide swale improvements (as a proxy for lot level / source control BMPs) along 1500 lf of Sheridan Road frontage.	E1, E2, E7, E9, G1	2	3		S	0.3	acres	1	Beach Park	Owner Developer	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	1.0.15	Beach Park				Improve any swale and other surface stormwater drainage systems within the developed areas of the western part of this SMU, which is mostly unsewered, and install stormwater filtration and infiltration BMPs. Details reflect 54,000 lf (approximately 12.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of roads within this part of the SMU.	E1, E2, E7, E9, G1	1	3		S	12.5	acres	1	Beach Park		0
		1.0.23	Beach Park			DB230	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		1.0.24	Beach Park			DB233	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		1.0.27	Beach Park			DB240	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		2.0.5	Beach Park				Monitor past IDOT-recorded flooding at Sheridan and Wadsworth for further problems and remediate if flooding continues.	B4, F7	3	1		S	1	ea	1	IDOT		0
X		3a.25.4	Beach Park	221	373		Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X	X	3a.26.1	Beach Park				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	A6, A10, B1, C3, E1	2	2		S	2000	lf	2	Owner		0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3a.26.2	Beach Park				Restore stream channel and improve instream habitat by installing & enhancing pools and riffles.	A1, A10, C3	3	3		S	2000	lf	1	Owner	Beach Park, BPDD	0
X		3a.26.3	Beach Park				*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt and sediment load.*	A1, A3, A8, C3, E1	1	3		M	2000	lf	2	Owner	Beach Park, BPDD	0
X		3a.26.4	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	2000	lf	2	Owner		0
		3a.26.5	Beach Park	231	386		Remove chain link fence placed across stream channel.	A1, A10, B4	2	1		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3a.26.6	Beach Park	232	390		*Remediate significant erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3a.26.7	Beach Park	230	384	HS146	Investigate and remediate collapsed pedestrian bridge in the stream channel.	A10, A11	2	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3b.0.2	Beach Park				Consider daylighting and restoring as much of the Wilson Avenue Tributary (not inventoried) as possible through the residential areas. Daylighting and restoration should address concerns about the tank cars and transite pipes that are reported to transmit the flow below ground in this location.	A1, A6, C3, G2	3	3		L	4000	lf	1	Beach Park	Owner	0
X		3b.0.3	Beach Park				Buffer the Wilson Avenue Tributary from encroachment by preserving open Category 2 green infrastructure areas.	B1, C1, C2, C3, G2, G4	1	3		L	3	acres	1	Owner	Beach Park	M

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X	X	3b.0.5	Beach Park				Restore and manage the wetlands within the open and partially open Category 1 Green Infrastructure areas just north of Lyons Woods Forest Preserve; reconnect these wetlands to the Lyons Woods system.	B1, C1, C2, C3, E1, E2, G2	3	3		L	7	acres	1	Owner	SMC	M
		3b.0.8	Beach Park				FPAI site 20-04, in the Village of Beach Park, experiences sewer backup into homes due to an inadequate drainage system. Investigate whether the remedial measure, a large pipe and ditch installed as part of the Monarch Point development to the north, fixed the problem. If not, remedial action should be taken, which may include working with the open areas identified on the SMU map to relieve drainage issues.	B2, B3	2	3		S	9	acres	1	Beach Park	SMC	H
		3b.0.9	Beach Park				FPAI site 20-05, in the Village of Beach Park, experiences road, home, and backyard flooding due to inadequate conveyance capacity of the open ditch and culvert, particularly the culvert under Yorkhouse Road. Remedial action may include retrofit / restoration of open green infrastructure areas to help absorb / store flood water.	B1, B2, B4	2	3		S	14	acres	1	Beach Park	SMC	H
X		3b.0.10	Beach Park				The area where BL13, BL14, and BL15 come together is in need of a stream restoration plan to remediate the buildup of debris, concrete lined channels, underground culverts and railroad tank cars, yard waste in the stream channel, and other impacts from nearby residential areas.	A1, A6, A10, A11, C3, E5, E9, G2	1	3		S	400	lf	1	Beach Park SMC Owner		0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	3b.0.11	Beach Park			DB62	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2		S-M	800	lf	1	Waukegan Park District		0
	X	3b.0.13	Beach Park			DB64	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	2		S-M	500	lf	1	Owner HOA		0
	X	3b.0.14	Beach Park			DB65	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	500	lf	1	HOA		0
		3b.0.17	Beach Park			DB113	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		3b.0.18	Beach Park			DB114	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		3b.0.19	Beach Park			DB208	Plant banks with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	E1, E2, E9	2	1		S-M	650	lf	1	HOA		0
		3b.0.20	Beach Park			DB209	Convert to wet or wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	2		S-M	850	lf	1	HOA		0
		3b.0.21	Beach Park			DB232	Plant banks and a surrounding buffer with native vegetation; remove excess debris.	E1, E2, E9	2	1		S-M	1200	lf	1	Owner		0
X		3b.12.1	Beach Park				*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.*	A1, A10, C3	1	3		S	1900	lf	1	Owner	Beach Park, BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3b.12.2	Beach Park				*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	A1, A3, A8, C3, E1	1	3		M	1900	lf	2	Owner	Beach Park, BPDD	0
X	X	3b.12.3	Beach Park				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	1900	lf	2	Owner		0
		3b.12.4	Beach Park				Investigate / inspect failed / broken concrete dam along west of Cheney / North Ave. for impact on stream, and remove impacting dam elements if found be have a negative impact.	A1, A2, A11, C3	3	1		S-L	1	ea	1	Owner	Beach Park, BPDD	0
X		3b.12.5	Beach Park	71	179		*Stabilize typical 1-2 foot erosion on right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3b.12.6	Beach Park	72	180		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3b.12.7	Beach Park	73	181		*Stabilize significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3b.12.8	Beach Park	76	185	HS65	*Remove debris and sediment from culvert under Beach Road.*	A10, A11, C3, E1, E7, E8, F7	1	3		S	1	ea	1	Owner	Beach Park, BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3b.12.9	Beach Park	74	182	PD77	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3b.12.10	Beach Park	75	183	PD78	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3b.13.1	Beach Park				Manage and restore the wooded ravine along reach BL13. Assumes an area 2500 lf by 150 ft in width for cost estimating purposes.	A6, A7, A10	3	2		S	8.5	acre	1	Owner	Beach Park	0
X		3b.13.2	Beach Park				*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and removing numerous debris jams according to the American Fisheries Society guidelines.*	A1, A10, C3	1	3		S	3000	lf	1	Owner	Beach Park, BPDD	0
X		3b.13.3	Beach Park				*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	A1, A3, A8, C3, E1	1	3		M	3000	lf	2	Owner	Beach Park, BPDD	0
X	X	3b.13.4	Beach Park				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	3000	lf	2	Owner	Beach Park SMC	0
X		3b.13.5	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	3000	lf	2	Owner	Beach Park SMC	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	3b.13.6	Beach Park				Inspect footbridges and armored / concrete-lined banks and remediate if found to be negatively impacting the stream.	A1, A10, A11	3	3		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3b.13.7	Beach Park				*Restore channel reach near Wilson Avenue by installing pool and riffle structures and stabilizing streambanks.*	A1, A6, A9, A10, C3, E5, G2	1	3		M	200	lf	1	Owner	Beach Park BPDD	0
	X	3b.13.8	Beach Park				Remove concrete debris dumping / fill just upstream of Beach Rd culvert from property / operation at Tewes and Beach.	A10, A11, B4	2	2		S	1	ea	1	Beach Park	Beach Park, BPDD	0
X		3b.13.9	Beach Park	78	188		*Remediate significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park BPDD	0
		3b.13.10	Beach Park	85	195		*Inspect and assess fencing across channel and rock wall armoring and remove if found to impair the conveyance of water.*	A1, A10, A11	1	1		S	1	ea	1	Owner	Beach Park BPDD	0
X		3b.13.11	Beach Park	87-88	197-198		*Remove concrete from channel and restore stream channel by stabilizing streambanks and installing habitat features such as pools and riffles and rootwads. Assumes 150 lf of stream channel needs attention for cost estimation purposes.*	A10, A11, A11, B4	1	3		S	150	lf	1	Owner	Beach Park BPDD	0
X		3b.13.12	Beach Park	96	206		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, A11, B4	1	2		S	1	ea	1	Owner	Beach Park BPDD	0
X		3b.13.13	Beach Park	77	186	HS66	*Remove debris and sediment from culvert under Beach Road.*	A10, A11, C3, E1, E7, E8, F7	1	3		S	1	ea	1	Owner	Beach Park BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3b.13.14	Beach Park	90	200	HS73	*Address failed concrete wall armoring and major erosion behind the armoring by removing the concrete and using bioengineering stabilization measures. Assumes 100lf of stream channel needs attention for cost estimation purposes.*	A1, A3, A11	1	3		S-M	100	lf	1	Owner	Beach Park BPDD	0
X		3b.13.15	Beach Park	100	210	HS78-79	*Repair or replace broken concrete and corrugated metal pipe culvert and remove debris obstructing flow.*	A1, A3, A11, C3	1	3		S-M	1	ea	1	Owner	Beach Park BPDD	0
X		3b.13.16	Beach Park	77	187	PD81	*Stabilize erosion at and below outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park BPDD	0
X		3b.13.17	Beach Park	79	189	PD82	*Repair failed clay outfall pipe and address erosion around outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park BPDD	0
X	X	3b.14.1	Beach Park				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	500	lf	2	Owner	Beach Park BPDD	0
X		3b.14.2	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	500	lf	2	Owner	Beach Park BPDD	0
X	X	3b.14.3	Beach Park	102	212-213		*Conduct major channel restoration by removing debris and restoring a natural channel to this concrete-lined drainage ditch.*	A1, A10, A11, C3	1	3		S	50	lf	1	Owner	Beach Park BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3b.15.10	Beach Park	109	222	PD97	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	1	ea	1	Owner	Beach Park BPDD	0
X		3b.15.11	Beach Park	110	224	PD98	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	1	ea	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.15.12	Beach Park	114	234	PD104 & 105	*Remove debris at the outfall discharge points.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.17.1	Beach Park				Restore stream channel and improve instream habitat by enhancing pools and riffles.	A1, A10, C3	3	3		S	2400	lf	1	Owner	Beach Park BPDD	0
X		3b.17.2	Beach Park				Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3		M	2400	lf	2	Owner	Beach Park BPDD	0
X	X	3b.17.3	Beach Park				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2		S	2400	lf	2	Owner		0
X		3b.17.4	Beach Park				Inspect footbridges and armored / concrete-lined banks along this reach for impacts on the stream corridor and remediate if necessary.	A1, A10, A11, C3	3	3		S	1	ea	1	Owner	Beach Park BPDD	0
X		3b.17.5	Beach Park	135	264		Remove broken concrete slab streambank armoring and restore channel to natural channel condition. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	A1, A10, A11, C3	2	3		S	50	lf	1	Owner	Beach Park BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3b.17.6	Beach Park	139-141	272-276		Restore a minimum 5 foot wide, deep-rooted native plant buffer to the stream edge within the golf course.	A6, C3	2	1		S	600	lf	2	Waukegan Park District		M
X		3b.17.7	Beach Park	146	281		Remove debris at outfall.	A10, A11, B4	2	2		S	1	ea	1	Owner	Beach Park BPDD	0
X		3b.17.8	Beach Park	146	282		Stabilize significant erosion and bank slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	A1, A3, A7, C3, E1	1	3		M	50	lf	1	Owner	Beach Park BPDD	0
X		3b.17.9	Beach Park	134	261-262	HS95	Remove debris blocking culvert and repair, remediate, and/or stabilize the exposed culvert.	A10, A11, B4	2	3		S-M	1	ea	1	Owner	Beach Park BPDD	0
X		3b.17.10	Beach Park	138	270	HS99	Stabilize erosion undermining the culvert, preferably using bioengineering stabilization measures but also using more structural measures if necessary.	A1, A3, A5, A8, A11, C3, E1	2	3		S-M	1	ea	1	Waukegan Park District	Beach Park BPDD	0
		3c.0.9	Beach Park				FPAI site 20-02, in the Village of Beach Park, experiences flooding due to inadequate outlets and poor drainage. There is a backyard drainage ditch between Beach and Howard, Sheridan and Geraghty (depressional storage #49) and extending along Coolidge Rd to the north (depressional storage #50) that are likely part of the cause of flooding. Investigate whether the new storm sewer along Coolidge Avenue has eliminated flooding in this location. If flooding persists, additionial solutions may include improvement of drainage overland flow paths and installation of additional storm sewer capacity to alleviate the problem.	B4, F7	3	1		S	NA	NA	NA	Beach Park		L

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
		3c.0.10	Beach Park				Monitor past IDOT-recorded flooding locations at Sheridan and Wadsworth, Sheridan and Talmadge / Michigan, and Sheridan and Beach Rd. to determine whether flooding is still occuring at these sites. If so, develop and implement flood mitigation strategies.	B4, F7	3	1		S	1	ea	1		IDOT	0
	X	3c.0.14	Beach Park			DB53	Stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	650	lf	1	Owner		0
	X	3c.0.15	Beach Park			DB54	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin.	E1, E2, E9	2	2		S-M	600	lf	1	Owner		0
	X	3c.0.16	Beach Park			DB61	Retrofit as wet / wetland basin; stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	300	lf	1	Owner		0
		3c.0.18	Beach Park			DB212	Plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	E1, E2, E9	2	1		S-M	375	lf	1	Owner		0
X		3c.7.3	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	1800	lf	2	Owner, Bull Creek Stakeholder Assn.		0
	X	3c.7.4	Beach Park				Assess side slope seeps for restoration potential. Restore if possible.	C3	1	3		S	2	acre	1	Owner, SMC		0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.7.5	Beach Park				Remove massive debris jam approximately 300' downstream of Sheridan Road and stabilize channel.	A10, A11, B4	2	3		S	1	ea	1	Beach Park, Bull Creek Stakeholder Assn., SMC		0
X		3c.8.1	Beach Park				*Address High streambank erosion along entire reach, some threatening homes and property, using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	2000	lf	2	Owner	Beach Park, BPDD	0
X	X	3c.8.2	Beach Park				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2		S	2000	lf	2	Owner		0
X		3c.8.3	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	2000	lf	2	Owner		0
X		3c.8.4	Beach Park				*Repair broken cement outfall pipe and stabilize surrounding erosion using bioengineering stabilization measures. Location is approximately 300' upstream of Sheridan Rd.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Beach Park	Beach Park, BPDD	0
X		3c.8.5	Beach Park				*Stabilize streambank erosion across from the sewer / manhole stabilization project along the reach near the Garaghty / California intersection. Length of problem is unknown; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	50	lf	1	Owner	Beach Park, BPDD, NSSD, USACE,	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.8.6	Beach Park	18	114	PD50	*Stabilize minor channel erosion and downcutting of channel outfall using bioengineering stabilization measures and energy dissipation measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.8.7	Beach Park	19	115	PD51	*Stabilize major erosion behind headwall and below outfall preferably using bioengineering stabilization measures but may also require more structural measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.8.8	Beach Park	20	116	PD52	*Stabilize moderate channel erosion and downcutting using bioengineering stabilization measures and, if necessary, check dams.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.8.9	Beach Park	21	117		*Address major erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	50	lf	1	Owner	Beach Park, BPDD	
X		3c.8.10	Beach Park	22	118		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.8.11	Beach Park	23	119		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.8.12	Beach Park	24	120		*Monitor sewer manhole, which rises 6 feet above stream elevation, for leakage and infiltration problems.*	F7	1	1		S	1	ea	1	NSSD		0
X		3c.8.13	Beach Park	25	122	PD53	*Stabilize major erosion and slumping of ravine bank using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.8.14	Beach Park	26	123		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park, BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.9.1	Beach Park				*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.*	A1, A10, C3	1	3		S	2500	lf	1	Owner	Beach Park, BPDD	0
X		3c.9.2	Beach Park				*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	2500	lf	2	Owner	Beach Park, BPDD	0
X	X	3c.9.3	Beach Park				*Restore the native riparian buffer (manage native riparian plant communities within this reach: control invasive species, plant native species, thin shrub layer to allow more understory growth, and manage vegetation such as through prescribed burning.)*	A6, A10, B1, C3, E1	1	2		S	2500	lf	2	Owner		0
X		3c.9.4	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	2500	lf	2	Owner		0
X		3c.9.5	Beach Park	30	127		*Stabilize major erosion with slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	50	lf	1	Owner	Beach Park, BPDD	0
X		3c.9.6	Beach Park	31	128		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.9.7	Beach Park	33	130		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.9.8	Beach Park	35	132	PD55	*Remove debris around plastic outfall pipe.*	A10, A11, B4	1	2		S-M	1	ea	1	Owner	Beach Park, BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.9.9	Beach Park	37	134		*Stabilize major erosion on the left bank using bioengineering stabilization measures.*	A1, A10, A11, C3	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3c.9.10	Beach Park	43	140		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.9.11	Beach Park	44	141		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.9.12	Beach Park	45	142		*Stabilize major erosion and slumping of the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1, E5	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3c.10.1	Beach Park				*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation within this reach.*	A1, A3, A8, C3, E1	1	3		M	800	lf	2	Owner	Beach Park, BPDD	0
X	X	3c.10.2	Beach Park				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	800	lf	2	Owner		0
X		3c.10.3	Beach Park	48	148		*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.10.4	Beach Park	49	149	PD64	*Stabilize erosion around capped outfall pipe using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.11.1	Beach Park				*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	2500	lf	2	Owner	Beach Park, BPDD	0
X	X	3c.11.2	Beach Park				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	2500	lf	2	Owner		0
	X	3c.11.3	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	2500	lf	2	Owner	Beach Park	0
X		3c.11.4	Beach Park	51	152	HS55	Remove debris obstructing culverts.	A10, A11, B4	2	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.11.5	Beach Park	52	154	PD67	Remove debris from outfall channel and assess armoring for impact on stream; if negative impact is found, remove armoring and stabilize with bioengineering approach.	A10, A11, B4	2	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.11.6	Beach Park	53	156		*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3c.11.7	Beach Park	54	157		*Repair / remediate erosion below outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.11.8	Beach Park	55	158		Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.11.9	Beach Park	55	160		*Stabilize major erosion occurring behind armoring on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3c.11.10	Beach Park	62	166		*Assess wood armoring / retention wall for stability and feasibility of bioengineered approach to bank stabilization. Assumes 100lf of stream channel, both sides for cost estimation purposes.*	A1, A3, C3	1	3		M	100	lf	2	Owner	Beach Park, BPDD	0
X		3c.19.1	Beach Park				*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	1900	lf	2	Owner	Beach Park, BPDD	0
X	X	3c.19.2	Beach Park				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	1900	lf	2	Owner		0
X		3c.19.3	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	1900	lf	2	Owner	Beach Park	0
X		3c.19.4	Beach Park	157	298		Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Owner	Beach Park, BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.19.5	Beach Park	160	302		*Stabilize significant erosion and slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3c.19.6	Beach Park	163	308	PD142	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams or other grade stabilization measures if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.19.7	Beach Park	164	309	PD143	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.20.1	Beach Park				Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.	A1, A10, C3	3	3		S	3600	lf	1	Owner	Beach Park, BPDD	0
X		3c.20.2	Beach Park				*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	3600	lf	2	Owner	Beach Park, BPDD	0
X	X	3c.20.3	Beach Park				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	2	2		S	3600	lf	2	Owner		0
X		3c.20.4	Beach Park				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	3600	lf	2	Owner		0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.20.5	Beach Park	167	312		*Stabilize significant erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park, BPDD	0
X		3c.20.6	Beach Park	168	313	HS116	*Stabilize significan erosion and attempted stabilization debris around culvert using bioengineering stabilization measures*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.20.7	Beach Park	171	316		Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.20.8	Beach Park	173	319	PD147	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.20.9	Beach Park	175	321	HS121	*Stabilize erosion around culvert using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.20.10	Beach Park	175	322	PD148	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	1	ea	1	Owner	Beach Park, BPDD	0
X		3c.20.11	Beach Park	178	325	PD151	Repair or remediate cracked concrete armoring at outfall.	A1, A3, A5, A8, A11, C3, E1	2	3		M	10	lf	1	Owner	Beach Park, BPDD	0
X	X	3c.24.1	Beach Park				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2		S	2000	lf	2	Owner	Beach Park, BPDD	0
X		3c.24.2	Beach Park	217	369		Remove debris including tires.	A10, A11, B4	2	2		S	1	ea	1	Owner	Beach Park, BPDD	0

Table H2 Village of Beach Park Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		4.0.1	Beach Park				Preserve and restore the ravine within the open Category 1 green infrastructure area between Ganster Road and Sheridan Road, just east of Lyons Woods Forest Preserve.	B1, C1, C2, C3, G2, G4	1	3		L	10	acres	1	Owner	Beach Park	M
		4.0.6	Beach Park				Expand / enlarge detention basins #28, #75, and #76 to reduce IDOT-recorded flooding locations along Sheridan Road north of Blanchard.	B4, F7	2	1		S	1	ea	1	DOT		0
		4.0.9	Beach Park			DB228	Inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrients by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2		S-M	650	lf	1	FPD		0
X		4.05.3	Beach Park	298	472		Remove debris / bricks in channel.	A10, A11, B4	2	3		S	1	ea	1	Owner	Beach Park, BPDD	0
X		4.05.4	Beach Park	299	473		*Stabilize bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	2		M	50	lf	1	Owner	Beach Park, BPDD	0

Table H3 City of Waukegan Expanded Site Specific Action Plan

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		1.0.7	Waukegan				Preserve and restore the green infrastructure areas in the southwest corner of the SMU, east of the Union Pacific rails and west of industrial land uses (Midwest Generation, North Shore Sanitary District, and Outboard Marine Corporation). This area has been identified by the City of Waukegan for restoration as the 'Waukegan Moorlands'.	B1, C1, C2, C3, G2, G4	1	3		S	52	acres	1	Waukegan	Owner	0
	X	1.0.10	Waukegan				Investigate the wetlands adjacent to the Johns Manville lagoons for restoration and remediation potential and as a possible water quality improvement facility for water runoff from nearby industrial sites. Cost reflects standard wetland restoration and management rather than clean up and remediation.	B1, C3, C5, E1, E2, G4	3	3		S	35	acres	1	IDNR		0
X	X	1.1.1	Waukegan				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	2000	lf	2	Owner, Utility, C&NW RR	Waukegan	0
X		1.1.3	Waukegan				*Restore stream channel and instream habitat by reducing / remediating channelization, possibly through a remeandering and other restoration projects such as installing boulders, large rocks, and / or rootwads.*	A1, A10, C3	1	3		S	2000	lf	1	Owner/Utility	Waukegan	0
	X	1.1.5	Waukegan	260	426	HS01 & 02	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	A10, A11, C3, E1, E7, E8, F7	3	3		S	1	ea	1	C&NW RR	SMC	0

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	1.1.6	Waukegan	261	428	HS03 & 04	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	A10, A11, C3, E1, E7, E8, F7	3	3		S	1	ea	1	C&NW RR	SMC	0
	X	3b.0.12	Waukegan			DB63	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1		S-M		lf	1	Owner		0
		3b.0.15	Waukegan			DB70	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
	X	3b.0.16	Waukegan			DB72	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	400	lf	1	HOA		0
X		3b.16.5	Waukegan				*Stabilize the eroding, 4 foot deep cut channel within the turf grass landscape at the upstream end of BL16, just downstream of the Beach Rd. culvert.*	A1, A3, A6, C3, G2	1	3		S	300	lf	2	Owner		0
X		3b.16.6	Waukegan				*Repair or replace the steel Beach Road culvert that is eroding around the edges and beneath, possibly due in part to the additional plastic drain pipe.*	A3, A11	1	3		S-M	1	ea	1	Waukegan		0
	X	3c.0.3	Waukegan				For Waukegan Airport property, implement the spill prevention and response plan and reduce the use of salt and/or deicers. Install filtration and infiltration BMPs to capture and treat runoff from airport landscapes, particularly impervious surfaces such as runways and fueling areas, before being discharged to the stream system of Bull Creek.	E1, E2, E5, E10	2	3		S	A/R	-	-	Waukegan Port District		0
	X	3c.0.17	Waukegan			DB71	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	1300	lf	1	Owner		0

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	4.0.5	Waukegan				Improve swale and other surface stormwater drainage systems within the developed areas of the SMU, particularly those residential areas off Miraflores and Montesano, with lot level stormwater filtration and infiltration BMPs. Details reflect 28,000 lf (approximately 6.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	E1, E2, E7, E9, G1	1	3		S	6.5	acres	1	Waukegan, Owner		0
		4.0.7	Waukegan			DB75	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		4.0.8	Waukegan			DB76	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
X		4.05.5	Waukegan	294	466	PD33	*Stabilize and strengthen the incised discharge channel.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Waukegan	0
X		5.0.1	Waukegan				Preserve the ravine within the 7-acre open Category 1 green infrastructure area between Circle Court and the Amstutz Expressway.	A6, B1, C2, C3, G2, G4	1	3		L	7	acre	1	Owner/Utility		M

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	5.0.2	Waukegan				Preserve and restore wetland complexes where these resource remain, including those along the entire length of reach BL04 and those adjacent to Lake County Gardens (depressional storage areas #22 and #23). Wetland / depressional area #23, bordered by Pine, Lorraine, Wilson, and the McClory Bike Trail, contains some elements of a decent quality wetland indicative of good restoration potential. Two additional potential restoration areas are the small park between Butrick and Yeoman and the upstream drainage corridor north of and paralleling Rice St.	A6, B1, C2, C3, G2, G4	1	3		S-L	65	acre	1	Waukegan, Owner, Utility		0
X		5.0.3	Waukegan				Preserve the wetlands / stream corridor within Category 1 and 2 open green infrastructure areas between Rice and MacArthur, west of Lewis Avenue, and the area between Pine, Wilson, and the McClory bike path.	A6, B1, C2, C3, G2, G4	1	3		L	34	acre	1			0
	X	5.0.4	Waukegan				*Install filtration BMPs for commercial and institutional uses along Greenwood Avenue and at the York House Rd / Lewis Ave intersection to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S43, and S73. Details reflect 10,000 lf (approximately 2.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontage.*	E1, E2, E7, E9, G1	1	3		S	2.5	acres	1	Waukegan, Owner		0

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	5.0.5	Waukegan				*Install lot level filtration and infiltration BMPs, to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S39, S43, and S73. Details reflect 228,000 lf (approximately 52 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	E1, E2, E7, E9, G1	1	3		S	52	acres	1	Waukegan		0
	X	5.0.6	Waukegan			DB66	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	1500	lf	1	Golf Course		0
	X	5.0.7	Waukegan			DB67	Stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin; remove excess debris.	E1, E2, E9	2	2		S-M	900	lf	1	Golf Course		0
	X	5.0.8	Waukegan			DB68	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	600	lf	1	Golf Course		0
	X	5.0.9	Waukegan			DB73	Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation.	E1, E2, E9	2	2		S-M	900	lf	1	Waukegan, Owner		0

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	5.0.10	Waukegan			DB74	*Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and address turbidity / sedimentation by naturalizing the basin. This may reduce pollutant loading within potential pollutant loading hotspot S39.*	E1, E2, E9	2	2		S-M	750	lf	1	Owner		0
		5.0.11	Waukegan			DB203	*Inventory detention basin and identify resolutions to any noted functional problems.his may reduce pollutant loading within potential pollutant loading hotspot S14.*	-	3	1		S-M	1	ea	1	SMC		0
X	X	5.2.1	Waukegan				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. Restoration and management of Bowen Park and the residential areas along Miraflores is important to enhance the habitat quality of this reach.	A6, A10, B1, C3, E1	2	2		S	4000	lf	2	State of IL/ Waukegan Park District, Owner, Utility		0
X		5.2.2	Waukegan				Reduce impacts of surrounding golf course and park property such as landscape waste dumping, turf grass stream edges. Filter and infiltrate runoff from parking lots, such as those within Bowen Park, with BMPs. Details reflect installation of lot level BMPs.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1		S	2000	lf	2	State of IL/ Waukegan Park District, Owner		0

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		5.2.3	Waukegan				Reduce impacts of residential homes along Miraflores: cease yard waste dumping, replace mown turf grass to the edge of the stream with a minimum 10 foot native vegetation buffer, infiltrate runoff discharge from roof or footing drains with rain gardens or rain barrels, and naturalize the stream channel by replacing poured concrete and rip rap with bioengineering stabilization measures.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1		S	2000	lf	2	Owner		0
X		5.2.4	Waukegan				Gully erosion occurring in the ravines of Bowen Park should be remediated through ravine woodland restoration and management along reach BL02. Assumes 4000 lf of stream reach by 500' width. Costs reflect woodland restoration; load reduction reflects Moderate erosion stabilization.	A6, A10	1	2		S	46	acre	1	State of IL/ Waukegan Park District, Owner		0
X		5.2.5	Waukegan				Stabilize erosion around the Sheridan Road culvert and replace the broken stormsewer that is discharging to the opposite streambank.	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Waukegan		0
X		5.2.6	Waukegan	267	436		Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Waukegan	Waukegan Park District, SMC, Owner	0
X		5.2.7	Waukegan	270	439		Remove debris obstructing flow using American Fisheries Society guidelines.	A10, A11, B4	2	2		S	1	ea	1	Waukegan	Waukegan Park District, SMC	0
X		5.2.8	Waukegan	272	441		Stabilize typical 2-4 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.	A1, A3, A8, C3, E1	2	3		M	100	lf	1		Waukegan Park District, SMC	0

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		5.2.9	Waukegan	269	438	PD4	Stabilize minor erosion of open discharge channel using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	3	3		S-M	1	ea	1	Waukegan Park District		0
X		5.2.10	Waukegan	274	443	PD6	Stabilize significant erosion below outfall using bioengineering stabilization measures.	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Waukegan, Waukegan Park District		0
X		5.2.11	Waukegan	277	446	PD9	Stabilize minor channel erosion below concrete lined channel outfall. Consider removing concrete and stabilizing channel with more habitat-appropriate measures.	A1, A3, A5, A8, A11, C3, E1	3	3		S-M	1	ea	1	Waukegan		0
X		5.2.12	Waukegan	279	449	PD10	Install energy dissipation measures to address the eroding plunge pool created by discharge from the elevated outfall.	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	1	ea	1	Waukegan		0
X	X	5.3.1	Waukegan				*Restore a 5 foot wide native riparian buffer and replace turf grass lawn edges to native riparian plant communities as is feasible within the golf course.*	A6, A10, B1, C3, E1	1	2		S	3000	lf	2	Owner		0
		5.3.2	Waukegan				Glen Flora Country Club: replace or remediate online detention, armored dams and wiers with more habitat appropriate structures that allow fish passage.	A1, A2	3	3		L	3	ea	1	Owner		
X		5.3.3	Waukegan	379	74		*Stabilize erosion undercutting the concrete-lined channel outfall / dam; if feasible, remove concrete and replace with bioengineered channel stabilization measure.*	A1, A2, A3, A5, A10, A11	1	3		S-M	20	lf	1	Owner		0
X		5.4.1	Waukegan				Restore stream channel and improve instream habitat by reducing channelization, such as through a remeandering project.	A1, A10, C3	3	3		S	7000	lf	1	Waukegan, Lake County DOT		0

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X	X	5.4.2	Waukegan				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.	A4, A10, B1, C3, E1	1	2		S	7000	lf	2	Waukegan, Lake County DOT		0
		5.4.3	Waukegan				Implement the mitigation planfor FPAI site 20-06, in the City of Waukegan, Lake County Gardens subdivision. There also may be opportunities to increase the detention and/or drainage capacity of the drainage system in this area, particularly within the community park to the north. However, improvement of the wetlands to increase their storage capacity may also be an option.	B1, B2, B3. B4	2	3		S	145	acres	1	Waukegan		H
X		5.4.4	Waukegan				Restore the upper end of this reach, a fairly undefined channel that is choked with cattails, through invasive species removal and management.	A1, A6, C3	3	2		S	2200	lf	1	Waukegan, Owner		0
X	X	6.0.1	Waukegan				*Manage and restore the wooded ravine, wetland, and depressional area #3 that lies between the Amstutz and Sheridan Road for storage. Load reduction details reflect impact of restored wetland.*	A6, A7, A10, G4	1	3		S	14	acre	1	Owner	Waukegan	0
X		6.0.3	Waukegan				Open and partially open Category 1 green infrastructure areas between the waste water treatment plant and the Union Pacific tracks should be restored and integrated into the planned Waukegan Moorlands area to the north. Details reflect natural area restoration.	C2, C3	1	3		L	28	acre	1	Waukegan, Owner		0

Table H3 City of Waukegan Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	6.0.4	Waukegan				*Install filtration BMPs for commercial, industrial, and institutional uses in the eastern and southwestern portions of the SMU to help improve water quality in potential pollutant loading hotspot S10, S11, and S75. Details reflect approximately 15,000 lf (approximately 3.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontages of these land uses.*	E1, E2, E7, E9, G1	1	3		S	3.5	acre	1	Waukegan	Owner	0
	X	6.0.5	Waukegan				*This SMU is primarily sewerd but undetained. Install source controls and lot level filtration and infiltration BMPs, including detention basin improvements, which may help address pollutant loading in potential pollutant loading hotspot S10, S11, and S75. Details reflect 96,000 lf (approximately 22 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	E1, E2, E7, E9, G1	1	3		S	22	acre	1	Waukegan, Owner		0

Table H4 Illinois Department of Natural Resources Expanded Site Specific Action Plan

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	1.0.2	IDNR				Develop and implement habitat restoration and management plans for Illinois Beach State Park, including all wetlands, waterways, beach ridge, dune and swale systems, and T&E species habitat.	A8, C3, C4, C5, C6, E1, E7, G4	1	3		S	1548	acres	1	IDNR	-	0
		1.0.5	IDNR				Restore hydrologic connectivity of Dead River to Lake Michigan and remove those created to carry wastewater to the lake. Assumes that 4 hydrologic connections need to be restored or removed.	C3, C6, G4	3	3		S	4	ea	1	IDNR		0
		1.0.16	IDNR			DB55	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
	X	1.0.17	IDNR			DB56	Stabilize / regrade shoreline using bioenginnering practices and address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2		S-M	1100	lf	1	IDNR		0
	X	1.0.18	IDNR			DB58	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1		S-M	1	ea	1	IDNR		0
	X	1.0.19	IDNR			DB59	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1		S-M	1	ea	1	IDNR		0
	X	1.0.20	IDNR			DB60	Address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	1		S-M	1	ea	1	IDNR		0
		1.0.21	IDNR			DB206	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		1.0.22	IDNR			DB207	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		1.0.25	IDNR			DB234	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0
		1.0.26	IDNR			DB239	Inventory detention basin and identify resolutions to any noted functional problems.	-	3	1		S-M	1	ea	1	SMC		0

Table H5 Lake County Expanded Site Specific Action Plan

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	3a.0.6	Lake County				Depressional storage area #78, within the Thunderhawk Golf Club Forest Preserve, may be able to be expanded to provide additional storage if needed, and may also be retrofitted / restored to improve runoff quality from the golf course, provided that runoff can be directed into this area, treated, and then discharged to a receiving water body. Costs reflect restoration of this wet / hydric area.	B1, C1, C2, C3, E1, E2, E4, E9, G2, G4	2	3		S-L	4.5	acre	1	FPD		0
	X	3a.0.18	Lake County			DB45	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2		S-M	1200	lf	1	FPD		0
	X	3c.0.11	Lake County			DB46	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2		S-M	1000	lf	1	FPD		0
	X	3c.0.12	Lake County			DB47	Stabilize / regrade shoreline using bioenginnering practices.	E1, E2, E9	2	2		S-M	2000	lf	1	FPD		0
	X	3c.0.13	Lake County			DB50	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	E1, E2, E9	2	2		S-M	650	lf	1	FPD		0
X	X	3c.23.1	Lake County				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2		S	3600	lf	2	FPD		0

Table H5 Lake County Expanded Site Specific Action Plan (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	4.0.3	Lake County				Manage and restore the natural resources, including ADID wetland #1831, in the northeastern corner of Lyons Woods Forest Preserve. The southern portion of depressional storage area #28 is within the Forest Preserve boundary and may be used to relieve past IDOT-recorded flooding at Sheridan and York House Road. ADID wetland is approximately 46 acres (4000' by 500' wide) and the total area of Lyons Woods is 264 acres.	B1, C3, E1, E7, G2, G4	2	3		S-L	264	acres	1	FPD		0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		1.0.4	Waukegan, IDNR, Lake County				Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park.	C3, C5, F1, F6	1	3		S	A/R	-	-	Owner IDNR EPA	Waukegan	0
X		1.0.6	Beach Park, Waukegan				Preserve Category 1 open green infrastructure areas including a portion of depressional storage area #17 and the utility corridor that can serve as a green infrastructure connector between Illinois Beach State Park to Lyons Woods Forest Preserve.	A7, B1, C1, C2, C3, G2	1	3		L	30	acres	1	Owner/Utility	LCFPD IDNR	0
	X	1.0.11	Zion, Waukegan, IDNR				Manage the Lake Michigan shoreline and beaches to minimize beach erosion. Details reflect 28000 lf of shoreline at an average width of 150 feet.	C3, C4, C5, E1, E6	3	3		S	96	acres	1	Zion, Waukegan, IDNR		0
	X	1.0.12	Zion, Waukegan, IDNR				Manage the Lake Michigan shoreline and beaches to minimize E. coli contamination that leads to beach closures. Details reflect 28000 lf of shoreline at an average width of 150 feet.	C3, C4, C5, E1, E6	3	3		S	96	acres	1	LCHD	Zion, Waukegan, IDNR	0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	1.0.13	Zion, Beach Park, Waukegan, IDNR				*Install drainage swale improvements or other lot level / source control BMPs to capture and treat runoff from commercial and industrial land uses within Critical Subbasins #15, #74, and #76, identified as potential Pollution Hot Spot Critical Areas. Cost estimate reflects the installation of swales (10' wide) or other treatment measures along perimeter of these land uses, approximately 35,000 lf of treatment area.*	E1, E2, E7, E9, G1	1	3		S	8	acres	1	Waukegan, Zion	Utility	0
X	X	1.1.2	Waukegan, IDNR, Lake County				*Restore the natural connection and habitat quality of this reach to Lake Michigan by removing the lagoons through which the reach runs and disconnecting the reach from the Dead River to the north. Since these lagoons may be a component of a remedation or clean up plan, this should be considered a long term recommendation to be implemented when the contamination issues at Johns Manville have been adequately remediated. Details reflect major channel restoration.*	A1, A6, A8, C3, C5, C6, E7, G2, G4	1	3		S-L	2000	lf	2	Owner	IDNR EPA Waukegan	0
	X	1.1.4	Waukegan, Lake County				Address potential hazardous / toxic runoff from industrial uses to the east through filter strips and other filtration and infiltration techniques installed between the reach and these land uses, or by containing and remediating runoff on site through other means. Cost estimate reflects the installation of 2000 lf of 20' wide infiltration and filtration BMPs.	E1, E2, E7, E9, G1	2	3		S	0.9	acre	1	Owner EPA		0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		1.6.1	Beach Park, Lake County				Restore stream channel and improve instream habitat by installing pools and riffles and installing boulders, large rocks, and / or rootwads.	A1, A10, C3	3	3		S	2000	lf	1	FPD Owner	Beach Park, BPDD	0
X	X	1.6.2	Beach Park, Lake County				Restore native riparian buffer by controlling invasive species, planting native species, thinning forest and shrub canopy, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2		S	2000	lf	2	FPD Owner	Beach Park, BPDD	0
X		2.0.1	Zionion Beach Park				Category 1 and 2 green infrastructure areas along the western boundary of Illinois Beach State Park and bordering the Union Pacific rails to the west should be preserved as components of the green infrastructure / greenway system that includes Ophir Park, Carmel Park, and Illinois Beach State Park. These areas contain significant low lying depressional storage areas (#55, #56, and #57) that could be used for water quality improvement, wetland / hydric soil complexes, and steep slopes that are unsuitable for development.	A6, A7, B1, C1, C2, C3, G2, G4	1	3		L	61	acres	1	Owner, IDNR, Zion Park District		0
	X	2.0.2	Zion, Beach Park				*Convert the depressional storage complex of #55, #56, and #57 to improve water quality for Critical Subbasin #2, identified as a potential Pollutant Loading Hotspot. Assumes runoff can be directed into this area, treated, and discharged to the Illinois Beach State Park stream and wetland system. Estimated area to be converted is 7000lf by 400ft wide.*	B1, C1, C2, C3, E1, E2, G2, G4	1	3		L	64	acres	1	Owner, IDNR, Zion Park District		0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	2.0.4	Zion, Beach Park				*Reduce pollutant loading to Critical Subbasin #2, a potential pollutant loading hotspot, by improving swales and other surface stormwater drainage systems and installing stormwater filtration and infiltration BMPs to capture and treat runoff from parking lots, utilities, rooftops, storage areas, and other areas that may contribute pollutants to the stream. Cost estimate assumes 130,000 lf (approximately 30 acres) of 10 foot wide drainage swale improvements as a proxy for on-site source control BMPs.*	E1, E2, E7, E9, G1	1	3		S	30	acre	1	Beach Park, Zion		0
X		3a.0.1	Zion, Beach Park				Manage and restore the wooded ravine along reaches BL25, BL26, and BL27. Average 5000' x 250' wide.	A6, A7, A10	3	2		M	29	acre	1	Owner	Beach Park, Zion	0
	X	3a.0.2	Zion, Beach Park				Preserve and restore wetlands along drainage channel upstream of the McClory Bike Path and the complex northwest of Lewis and 29th St., wetland #4 east of Lewis Avenue, and wetland #3 in Hermon Park (56 acres total). Regional storage area #77 and the associated wetlands (9 acres) could be restored and / or used to provide storage for this SMU if needed when the upstream area develops. Implementation details reflect wetland / hydric soils preservation and restoration.	A6, B1, C2, C3, G2, G4	1	3		S-L	65	acre	1	Zion Park District, Owner	Beach Park, Zion	0
		3a.0.4	Zion, Beach Park				Preserve and restore T&E habitat within the area bounded by Lebanon St., the McClory Bike Path, and 31st St.	A1, A10, C3	3	2		S	5.6	acre	1	Zion Park District, IDNR		0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	3a.0.5	Zion, Beach Park				*Improve any swale and other surface stormwater drainage systems and/ or install source controls and lot level stormwater filtration and infiltration BMPs within the developed areas of the SMU. These practices may help reduce pollutant loading in potential pollution hotspot subasins S1, S3, S4, and S48. In order to generate cost and pollutant load reduction estimates, road swales are used as a proxy for individual site BMPs. Details reflect 252,000 lf (approximately 58 acre) of 10 foot wide drainage swale improvements on both side of all roads.*	E1, E2, E7, E9, G1	1	3		S	61	acre	1	Beach Park, Zion	Owner Developer	0
X		3a.25.1	Zion, Beach Park				*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	2000	lf	2	Owner	Beach Park, BPDD, Zion	0
X	X	3a.25.2	Zion, Beach Park				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	A6, A7, A10, B1, C3, E1	2	2		S	2000	lf	2	Owner		0
X		3a.25.3	Zion, Beach Park				Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	2	1		S	2000	lf	2	Owner		0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3a.25.5	Zion, Beach Park	224	376	HS143	Inspect hydraulic structure for possible erosion problems and stabilize using bioengineering practices if needed.	A1, A3, A5, A8, A11, C3, E1	3	1		S	1	ea	1	Owner	Beach Park, BPDD, Zion	0
X	X	3a.27st.1	Zion, Beach Park				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2		S	4000	lf	2	Zion Park District		0
	X	3b.0.1	Beach Park, Waukegan				Preserve and restore wetlands where these resource remain along drainage channel BL15, BL16, BL17, and along the daylit portions of the Wilson Avenue Tributary. Area is 10,000 lf by 300' wide.	A6, B1, C2, C3, G2, G4	1	3		S	69	acre	1	Beach Park Waukegan	Owner	0
X		3b.0.4	Beach Park, Waukegan				*Preserve greenway easements on Category 1 and 2 green infrastructure areas along BL16, which may help reduce pollution loading in potential pollution hotspot S57. Cost estimate assumes easements of 2000 lf by 100 ft wide (4.5 acres).*	B1, C1, C2, C3, G2, G4	1	3		L	4.5	acres	1	Owner	Beach Park Waukegan	0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	3b.0.6	Beach Park, Waukegan				*Depressional storage areas #32 and #43, currently undeveloped and containing current or former wetlands, could be enhanced to improve water quality of runoff from surrounding residential uses within this Critical Subbasin #57, identified as a potential pollutant loading hotspot. Depressional area #43 lies in an open Category 1 green infrastructure area that could be preserved for water quality improvement. Details reflect restoration and enhancement of both areas as wetlands.*	B1, C1, C2, C3, E1, E2, G2	1	3		L	12.5	acres	1	Owner		0
	X	3b.0.7	Beach Park, Waukegan				*Improve swales and other surface stormwater drainage systems and install source controls and lot level BMPs, including detention basin improvements, within the developed areas of potential pollutant loadin hotspots S57, S59, and S63. Details reflect 165,000 lf (approximately acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	E1, E2, E7, E9, G1	1	3		S	38	acres	1	Beach Park Waukegan		0
X		3b.15.1	Beach Park, Waukegan				Restore stream channel and improve instream habitat by enhancing pools and riffles.	A1, A10, C3	3	3		S	2800	lf	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.15.2	Beach Park, Waukegan				*Address High streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	2800	lf	2	Owner	Beach Park BPDD, Waukegan	0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X	X	3b.15.3	Beach Park, Waukegan				Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	A6, A10, B1, C3, E1	2	2		S	2800	lf	2	Owner		0
X		3b.15.4	Beach Park, Waukegan				Inspect footbridges and armored / concrete-lined banks for impacts on the stream corridor and remediated if necessary.	A1, A10, A11, C3	3	3		S	1	ea	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.15.5	Beach Park, Waukegan				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	2800	lf	2	Owner	Beach Park BPDD, Waukegan	0
X		3b.15.6	Beach Park, Waukegan				Inspect and, if necessary, repair the culvert under the McClory Bike Trail, which is partially collapsed.	A11	2	3		S	1	ea	1	LCDOT		0
X		3b.15.7	Beach Park, Waukegan	116	236		*Remove debris obstructing flow using American Fisheries Society guidelines.*	A10, A11, B4	1	2		S	1	ea	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.15.8	Beach Park, Waukegan	122	243		*Stabilize typical 4-6 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	A1, A3, A8, C3, E1	1	3		M	100	lf	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.15.9	Beach Park, Waukegan	129	254	HS93 PD118	*Stabilize erosion of the Beach Road steel culvert experiencing erosion around and underneath using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Beach Park Waukegan	Beach Park BPDD, Waukegan	0
X		3b.15.13	Beach Park, Waukegan	115	235	PD106	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	1	ea	1	Owner	Beach Park BPDD, Waukegan	0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3b.15.14	Beach Park, Waukegan	119	239	PD107	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	1	ea	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.15.15	Beach Park, Waukegan	119	240	PD108	*Stabilize erosion around clay drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.16.1	Beach Park, Waukegan				*Restore stream channel and improve instream habitat by enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.*	A1, A10, C3	1	3		S	3500	lf	1	Owner	Beach Park BPDD, Waukegan	0
X		3b.16.2	Beach Park, Waukegan				*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	A1, A3, A8, C3, E1	1	3		M	3500	lf	2	Owner	Beach Park BPDD, Waukegan	0
X	X	3b.16.3	Beach Park, Waukegan				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	3500	lf	2	Owner		0
X		3b.16.4	Beach Park, Waukegan				*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	A3, A5, A6, A7, A11, C3, D1, E1, E2, E5, E9	1	1		S	3500	lf	2	Owner		0
X		3b.15.16	Beach Park, Waukegan	123	244	PD110 & 111	*Stabilize erosion around two plastic drain pipe outfalls using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	2	ea	1	Owner	Beach Park BPDD	0
X		3b.15.17	Beach Park, Waukegan	127	250	PD115-116	*Stabilize erosion around concrete drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Beach Park Waukegan	Beach Park BPDD	0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
	X	3b.18.1	Beach Park, Waukegan				*BL18 flows through and near several publicly owned, open and partially open areas on or adjacent to the Waukegan Regional Airport property sourthwest of the Wadsworth Rd / Lewis Ave intersection. These areas include depressional storage area #34, which could be expanded and enhanced for stormwater storage and to capture and cleanse water runoff from airport property, which lies in Critical Subbasin #69, a potential pollutant loading hotspot.*	B1, C1, C2, C3, E1, E2, G2	1	3		L	7	acres	1	Waukegan Port District		0
X		3b.18.2	Beach Park, Waukegan				Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.	A1, A3, A8, C3, E1	1	3		M	700	lf	2	Waukegan Port District, Owner	Beach Park BPDD, Waukegan	0
		3b.18.3	Beach Park, Waukegan	154	292	HS111	The culvert draining Waukegan Airport is covered with wire fencing, presumably for security or to prevent animal invasion. However, investigate source and necessity, and remove if fencing impedes flow. It appears that strong flows exit the Airport property in this location.	A10, A11	3	1		S	1	ea	1	Waukegan Port District		0
X		3c.0.2	Beach Park, Zion				Manage and restore the wooded ravine along reaches BL07, BL08, BL09, BL10, BL11, BL19, BL20, BL21. Assumes 18,600 lf of stream by average 250' wide.	A6, A7, A10	1	2		S	107	acres	1	Owner	Beach Park, Zion	0
	X	3c.0.4	Beach Park, Zion				Preserve and restore wetlands along drainage channels BL21, BL22, BL23, BL24. Assumes 10,300 lf by 350' wide.	A6, B1, C2, C3, G2, G4	1	3		S	83	acres	1	Owner	Beach Park, Zion	0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.0.5	Beach Park, Zion				Preserve Category 1 green infrastructure area bounded by the McClory Bike Path, Clover, Wadsworth, and 34th St. that borders the stream channel to the north. Also preserve three separate areas through which the stream corridor runs: one along BL07 within the ravine, the second at the confluence of BL08, BL09, and BL19, and the third just upstream of this confluence along BL09.	A6, B1, C2, C3, G2, G4	1	3		S-L	11	acres	1	Owner	Beach Park, Zion	0
	X	3c.0.6	Beach Park, Zion, Waukegan				*Install filtration BMPs for commercial, industrial, and institutional uses along Sheridan Road, Wadsworth, and Lewis Avenue, which will help reduce pollutant loading in potential pollution hotspot subbasin #64. Details reflect 12,000 lf of road frontage along these uses to be treated with improved, 10' swales (approximately 2.75 acres.)*	E1, E2, E7, E9, G1	1	3		S	2.75	acres	1	Beach Park, Waukegan, Zion, Owner		0
	X	3c.0.7	Beach Park, Zion, Waukegan				*Install lot level filtration and infiltration BMPs within potential pollution hotspot subbasin #64. Details reflect 208,000 lf (approximately 48 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	E1, E2, E7, E9, G1	1	3		S	48	acres	1	Beach Park, Waukegan, Zion		0
X		3c.0.8	Beach Park, IDNR				Preserve the Category 1 open green infrastructure area that contains depressional storage area #45 along the west side of the Union Pacific rails.	B1, C2, G2	1	3		L	4.5	acres	1	Beach Park		0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.7.1	Beach Park, IDNR				*Stabilize High streambank erosion along approximately 25% of this reach not included in the previous stabilization project, some threatening homes and property, using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	500	lf	2	Owner, Beach Park		0
X	X	3c.7.2	Beach Park, IDNR				*Manage native riparian plant communities within this reach: control invasive species, plant native species, and manage vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	1800	lf	2	Bull Creek Stakeholder Assn.		0
X		3c.21.1	Beach Park, Zion				*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	A1, A3, A8, C3, E1	1	3		M	3500	lf	2	Owner	Beach Park, BPDD, Zion	0
X	X	3c.21.2	Beach Park, Zion				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	3500	lf	2	Owner	Beach Park, BPDD, Zion	0
X		3c.21.3	Beach Park, Zion				*Repair the discharge point / failed headwall approximately 200' upstream of the McClory Bike Path.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD, Zion	0
X		3c.21.4	Beach Park, Zion	184	331	PD155	*Stabilize channel erosion at outfall, and consider replacing rip rap control measure with bioengineering stabilization practices.*	A1, A3, A5, A8, A11, C3, E1	1	3		S-M	1	ea	1	Owner	Beach Park, BPDD, Zion	0
X		3c.21.5	Beach Park, Zion	185	332	PD156	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	1	ea	1	Owner	Beach Park, BPDD, Zion	0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X		3c.21.6	Beach Park, Zion	192	341	PD160	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	A1, A3, A5, A8, A11, C3, E1	1	1		S-M	1	ea	1	Owner	Beach Park, BPDD, Zion	0
X		4.0.2	Waukegan, Beach Park				Manage and restore the woodland ravine along reach BL05. Assumes 5000' by 500' area for cost estimation purposes.	A6, A7, A10	1	2		S	58	acre	1	Owner	Beach Park Waukegan	0
X		4.0.4	Waukegan, Beach Park				Preserve and restore the wetland complex within the open, Category 1 green infrastructure area along the eastern boundary of SMU 4 west of the Union Pacific rail line. This area creates a physical land connection between Lyons Woods and Illinois Beach State Park, and would also preserve regional storage area #17.	B1, C1, C2, C3, G2, G4	1	3		S-L	37	acres	1	Owner/Utility		0
X		4.05.1	Waukegan, Beach Park				*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation.*	A1, A3, A8, C3, E1	1	3		M	3000	lf	2	Owner	Beach Park, BPDD	0
X	X	4.05.2	Waukegan, Beach Park				*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	A6, A10, B1, C3, E1	1	2		S	3000	lf	2	Owner		0

Table H6 Expanded Site Specific Action Plan for Multiple Jurisdictions (continued)

Pollutant prevention	Pollutant reduction	ID# (SMU.reach.ID)	Jurisdiction	GPS Location	Photo	Structure ID	Recommendation Description (those addressing critical areas in italics)	Goal-Obj	Priority	Ease of Implementation	Status	Time frame	Quantity	Unit	# of sides	Implementation Lead	Implementation Support	Admin Effort
X	X	6.0.2	Waukegan, IDNR, Lake County				*Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park.This may help address potential pollutant loading hotspot S75*	C3, C5, F1, F6, G4	1	3		S-L	A/R	-	-	Waukegan, IDNR, EPA		0

appendix I - information and education resources

This appendix includes a general overall strategy for information, education, and public involvement to address watershed topics and issues, followed by a list of resources for conducting the education campaign.

SIX STEPS TO INFORMATION AND EDUCATION PROGRAM DEVELOPMENT

The USEPA *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* recommends the following six-step approach for developing an information and education program. The USEPA publication *Getting in Step: A Guide for Conducting Watershed Outreach Campaigns* describes each of these steps in detail.

1. Define driving forces, goals and objectives.
2. Identify and analyze the target audiences.
3. Create the messages for each audience, clearly articulating what actions they should take.
4. Package the message to various audiences.
5. Distribute the messages.
6. Evaluate the Information and Education program.

GUIDANCE FOR INFORMATION AND EDUCATION PLAN IMPLEMENTATION

The following are general ideas for implementing the Information and Education Plan. More detailed recommendations for addressing specific Dead River watershed issues are included in Table 5.16.

General Guidance

- Use words that the general public can understand and speak to their existing values and priorities.
- Keep messages simple and straightforward, with only two or three take-home points at a time, use graphics and photos to illustrate the message, and repeat it frequently.
- Emphasize the connections between the message, storms, the stream, Lake Michigan, land management, and the urban landscape and streets.
- Develop multiple messages: one broad message for the general public and a series of more specifically targeted messages for specific audiences along the creek (e.g., landowners, business owners, and municipalities.)
- 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 such as rain gardens, lawn care, and restoration and management of riparian buffers. Develop a similar "menu" of topics for each target audience.
- Coordinate the information and education strategy with partner organizations to combine efforts, achieve economies of scale, tap into each others' networks, share costs, and ensure a consistent message.
- 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 Kellogg Creek and Bull Creek being viewed as a drainage ditch rather than as a community asset to be preserved, 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.
- Be sure to inform your audience about actions they can take to help address watershed problems and issues.
- Post your message in public places such as libraries and village halls.

Direct Mailing and Outreach

- Materials targeted to landowners and businesses along the creek should be designed to help them understand riparian systems, streambanks, and buffers, and how to manage land and riparian areas appropriately.
- Individual quick-read "issue fact sheets" on watershed issues can be periodically sent to municipal officials as well as other leaders and decision-makers who have limited time for reading and absorbing important information.
- One-on-one outreach on watershed issues and improvement efforts, especially to municipal officials and other local decision makers.
- Survey (email, mail, telephone) of stakeholders to

assess current state of education.

- Design a set of BMP manuals for your various target audiences: residents, streamside landowners, business, municipalities, schools, and industries.
- Create and disseminate a guide for responsible stormwater management in the watershed, such as a pamphlet for landowners that describes simple, small-scale practices.

Media and Marketing Campaign

- If not already in place, install watershed road signs at stream crossings: "You are entering the Kellogg Creek Watershed. Please help protect our stream."
- 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.
- Create general watershed and water quality education materials such as a watershed slide show and enlist volunteers to present the program at community meetings and events.
- Distribute and post watershed map/poster/brochures that include pollution control strategies, watershed principles, and interesting facts about the watershed.
- Develop a traveling exhibit and hands-on educational workshops focused on restoration activities.
- Use paid advertising (direct mail, newspaper ads, cable or local access TV commercials) targeted to streamside landowners and residents.
- Send e-mail "alerts" to municipalities regarding water-related conferences, information, and strategies.
- 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 priority watershed issues and restoration objectives.
- Organize and fund a series of technical workshops targeted towards separate stakeholder groups, e.g., government officials, developers, professional consultants like engineers and landscape architects, lawn care companies, and private citizens, particularly riparian landowners. 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, Illinois Water Environment Association (IWEA), IEPA, American Public Works Association (APWA), the Illinois Society of Professional Engineers (ISPE), and others.
- General and technical workshops, open houses, and presentations targeting municipal leaders, engineers, public works officials, planners, and others to teach basics of water quality and watershed management.
- Hold stormwater open houses for professionals, engineers, consultants, and planners to share knowledge and techniques.

Manuals and Technical Resources

- Encourage watershed communities to pursue technical assistance to incorporate development guidelines and standards into comprehensive plans as well as zoning and subdivision code to encourage development in the watershed that is compatible with the goals and objectives of this plan.
- Identify funding and sources of project support and distribute a database of grantors, grant programs, and grant writing workshops to potential implementers in the watershed. Distribute list of grantors for watershed restoration projects.
- Provide annual grant writing workshops to target audiences.

Public Involvement, Stewardship, and Community Events

- Encourage development of sub-basin 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, 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 watershed improvement projects. Hold an annual award ceremony and 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 whereby an individual or group accepts responsibility for managing a specific stream reach.
- Arrange site visits and install interpretive signs at BMP installation sites.
- Establish a hotline or notification system to report fly dumping or illicit sanitary sewer connections.
- Engage the public in stream corridor restoration programs to help clean up the stream, restore and manage the riparian corridor, and control invasive species.
- Engage the public in wetland restoration programs to help control invasive species and plant wetland species.
- Establish or tap into an existing volunteer stream monitoring program such as RiverWatch.
- Hold stakeholder meetings to inform the public about watershed conditions and activities and as a forum for public discourse.

School Based Education

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

Demonstration Projects

- Restoration projects.
- Demonstration projects such as parking lot biofilters, residential rain gardens, stream restoration/stabilization. Capital projects are typically expensive, but they can provide both direct, physical improvement as well as public education.

INFORMATION AND EDUCATION MESSAGE FORMATS AND DELIVERY MECHANISMS

- Electronic media: radio public service announcements, TV advertisements, or video programs on the local access cable channel.
- Printed materials (newsletters, brochures, flyers, posters, displays, billboards) distributed through direct mail or posted in public spaces.
- Press releases, news articles, and advertisements in local papers.
- Watershed events and activities (tours, fairs and festivals, field trips, open houses, restoration outings, stream clean-ups, and storm drain stenciling)
- Presentations (workshops, conferences, group meetings, public hearings and meetings)
- Watershed interpretive and educational signs.

- Demonstration projects.
- Individual contact (door-to-door, telephone).
- Watershed organization website with links to related sites.
- Giveaways (bumper stickers, t-shirts, stickers, coffee mugs)

WATERSHED INFORMATION AND EDUCATION RESOURCES

The following resources include effective outreach messages, delivery techniques, watershed management planning, media relations, and strategies to assist with developing an outreach campaign. Some entries include EPA or other resource identification numbers for ordering purposes; others are downloadable and customizable for your watershed.

After the Storm Brochure. Provides a broad overview of stormwater pollution, including runoff from residential and commercial properties, farms, construction sites, automotive facilities, forestry operations, and others. May be customized. This brochure is also available in Spanish. EPA 833-B-03-002. The *After the Storm video* is now available on DVD. EPA 840-C-06-001.

Around the Home and On the Road. This 32-page publication is full of useful tips on pesticides, household chemicals, erosion, water conservation, and more. The guide is intended to educate people about their role in the Chesapeake Bay ecosystem, but it's also useful beyond the northeast coast. Copies are available from Alliance for the Chesapeake Bay, 6600 York Road, Suite 100, Baltimore, MD 21212. Phone: (410) 377-6270; www.acb-online.org.

Bookmark: "10 Things That You Can Do to Prevent Stormwater Runoff Pollution." This handy bookmark lists 10 simple things anyone can do to prevent stormwater pollution and is a good promotional item. EPA 841-H-03-003

Bridge Builder: A Guide for Watershed Partnerships (Facilitator's Handbook). The purpose of this handbook is to make the facilitation of watershed planning and management as easy as possible. Many exercises, transparencies, forms, checklists, and other sources of information and examples are included throughout the text. To obtain a copy of this handbook, contact Conservation Technology Information Center, 1220 Potter Drive, Room 170, West Lafayette, IN 47906-1383. Phone: (765) 494-9555. www.ctic.purdue.edu.

The Center for Watershed Protection at www.cmp.org provides numerous resources for watershed education and outreach including case studies, training opportunities, and model ordinances.

Chesapeake Bay Community Action Guide: A Step-by-Step Guide to Improving the Environment in Your Neighborhood. This guide, which is applicable beyond the Chesapeake Bay, includes information on storm drain stenciling, stream cleanups, re-forestation and tree care, and more. Contact Metropolitan Washington Council of Governments at (202) 962-3256 or visit www.mwcog.org.

The Clean Water Act: An Owner's Manual. This small booklet explains crucial sections of the Clean Water Act, points out how to get involved in regulatory decisions, and tells the stories of others who have done so. Contact River Network at (800) 423-6747 or www.rivernetwork.org.

Clean Water in Your Watershed: A Citizens Guide to Watershed Protection. Using Enviroscape watershed education models, children and adults learn by applying chemicals (drink mix) and loose soil (cocoa) throughout a typical community and then making it "rain" to immediately see the water pollution these activities could cause. Contact Enviroscape, c/o JT&A, Inc., 14524-F Lee Road, Chantilly, VA 20151. Phone: (703) 631-8810; learn@enviroscapes.com.

Cleaning Up Polluted Runoff with the Clean Water State Revolving Fund. This fact sheet provides an overview on financing runoff-related projects with the Clean Water State Revolving Fund (CWSRF). It explains how the SRFs work and provides some brief examples of the kinds of projects that have been funded by different states. EPA 832-F-03-004

Community Culture and the Environment: A Guide to Understanding a Sense of Place. Produced by EPA, this guide provides a process and set of tools for defining and understanding the social and cultural aspects of community-based environmental protection. Contact the National Service Center for Environmental Publications at (800) 490-9198 or e-mail ncepimal@one.net and ask for publication number EPA 942-B-01-003.

The Conservation Foundation (www.theconservationfoundation.org) is a local organization that provides education and outreach materials for watershed groups and other conservation organizations.

Conservation Partnerships Field Guide. This field guide to public-private partnering for natural resource conservation is designed to help both the novice and the experienced practitioner successfully use partnerships as equitable, effective, and efficient means of achieving results. It includes an overview of projects and partnerships. The field guide is available from the U.S. Fish and Wildlife Service, Office of Training and Education, 4401 North Fairfax Drive, Arlington, VA 22203, or call (703) 358-1711.

Culvert Action: How to Interest Your Local Media in Polluted Runoff Issues. This manual is intended to provide assistance to anyone seeking to educate the public about polluted runoff through newspapers, radio, and television. It's available from the Lindsay Museum, 1931 First Avenue, Walnut Creek, CA 94596. Phone: (510) 935-1978.

Designing an Effective Communication Program: A Blueprint for Success. This handbook will guide you through the crucial steps involved in designing an environmental communication program. From designing your program to increasing the effectiveness of communication materials, this guide has it all. It's available through the University of Michigan, School of Natural Resources and Environment, Ann Arbor, MI 48109, at (734) 764-1817.

Developing a Communications Plan: A Roadmap to Success. This guide provides a roadmap for developing a communications plan. Readers can learn valuable processes, such as prioritization exercises and feasibility screens, as well as how to manage the challenges of building an effective consumer education plan from the ground up. Available from the Huron River Watershed Council (HRWC), 1100 North Main Street, Suite 210, Ann Arbor, MI 48104. Phone: (313) 769-5123.

Directory of Funding Sources for Grassroots River and Watershed Conservation Groups 2001–2002. The directory profiles foundations, corporations, state and federal agencies, and nonprofits that support small, nonprofit watershed groups, as well as a few sources that support tribes. It includes contact information, grant sizes, and a brief description of each source's particular interests. Contact River Network at (800) 423-6747 or www.rivernetwort.org.

Door Hanger: "Stormwater Pollution Found in Your Area!" Provides a friendly reminder to keep trash, chemicals, and other pollutants out of storm drains. For use by stormwater inspectors and other local officials, in conjunction with illicit discharge elimination systems. May be customized. Go to epa.gov/nps/toolbox/products.htm to download the file. Printed copies are no longer available from EPA. EPA 833-F-03-002.

Environmental Partnerships: A Field Guide for Nonprofit Organizations and Community Interests. This guide introduces partnerships and explains what makes them successful and how to make them grow. It's available from the Management Institute for Environment and Business at (202) 833-6556, or call The Dryden Press at (800) 782-4479.

Funding Decentralized Wastewater Systems Using the Clean Water State Revolving Fund. This fact sheet describes options for using the Clean Water State Revolving Fund to finance installation, repair, and upgrading of septic systems. EPA 832-F-03-003

The *Getting in Step* outreach series includes a guidebook, video, workshops, training module, and stakeholder guide and is produced by the USEPA. The program website (www.epa.gov/owow/nps/toolbox/guide) hosts a variety of products and materials, some of which are downloadable and customizable. It includes *Getting in Step: Engaging and Involving Stakeholders in Your Watershed* a guidebook providing the tools needed to effectively engage

stakeholders to restore and maintain healthy watersheds through community support and cooperative action. Also see www.epa.gov/owow/watershed/outreach/documents.

Getting The Word Out in the Fight to Save the Earth. This book includes hundreds of practical and proven examples of how to effectively communicate your environmental message. It explains how any nonprofit group can expand and activate its membership, influence government officials, mobilize the news media, and shape public policy in the fight to save communities, regional ecosystems, and the earth. Available through the Johns Hopkins University Press, Baltimore, MD 21218.

Global Rivers Environmental Education Network (GREEN) at www.green.org/resources/ includes general and technical resources for watershed information and education programs.

The Green Room: Media Writing for Environmentalists. The Green Room will show you how to get media coverage, how to implement a media campaign, and the importance of the campaign. The site will take you through each step from drafting press releases and hosting media events to developing a long-term communications strategy. Visit www.green-room.org for more information.

Hands-on Social Marketing: A Step-by-Step Guide. This guide explains the concepts behind social marketing theory and provides handy case studies and other resources. Contact Sage Publications by e-mail at order@sagepub.com or visit www.socialmarketing.com.

How Do I Get Stormwater Permit Coverage for My Construction Site? A Construction Site Operator's Guide to EPA's Stormwater Permit Program. Provides construction companies with a brief overview of EPA's Construction General Permit (CGP) and its requirements. It is being sent to construction companies to inform them of the need to obtain permit coverage for sites disturbing one acre or more. The brochure contains a summary of the major provisions of the CGP, including areas of coverage, using EPA's new electronic notice of intent system for obtaining permit coverage, developing a stormwater pollution prevention plan, and more. Files are available to print using a professional printer. Printed copies are no longer available from EPA. EPA 833-F-04-002.

How to Create a Storm Water Pollution Prevention Campaign. This manual is for neighborhoods, community groups, governments, and others that want to protect and improve water quality. It was produced by the Environmental Health Coalition, which has created many community-based programs that have served as models throughout the country. For more information, contact Environmental Health Coalition, 1717 Kettner, Suite 100, San Diego, CA 92101, (619) 235-0281.

How to Save a River: A Handbook for Citizen Action. This handbook presents the wisdom gained from years of river protection campaigns across the United States. It covers the general principles of action, including getting organized, planning a campaign, building public support, and putting a plan into action. Contact River Network at (800) 423-6747 or www.rivernetwork.org.

The *Illinois Watershed Management Clearinghouse* at www.watershed.uiuc.edu provides assistance 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.

Innovative Use of Clean Water State Revolving Funds for Nonpoint Source Pollution. This fact sheet explains the creative approaches many states have taken to fund nonpoint source runoff projects using the Clean Water State Revolving Fund. Innovative uses include using linked deposit and pass-through loans. EPA 832-F-02-004.

Know Your Watershed: Watershed Management Starter Kit. Want to start a watershed management partnership for your local watershed? This complete kit includes five guides (*Getting to Know Your Watershed, Building Local Partnerships, Putting Together a Watershed Management Plan, Managing Conflict,* and *Leading and Communicating*), a 13-minute video (*Partnerships for Watersheds*), 10

companion brochures, and an application to the National Watershed Network. In other words, it includes everything you need to get started. It's available from Conservation Technology Information Center, (765) 494-9555 or www.ctic.purdue.edu/ Catalog/WatershedManagement.html.

The *Lake Notes Fact Sheets* series produced by CMAP (www.chicagoareaplanning.org) for the Illinois Environmental Protection Agency include topics such as Shoreline Buffer Strips, Shoreline Stabilization, Fertilizers and Pesticides, Home and Yard, and Stormwater Detention Ponds.

Leadership Identification Guidebook. Leadership is an important part of any successful conservation partnership. This guidebook provides methods for identifying community leaders and tells how to involve them in promoting the goals of the conservation partnership. It will also introduce you to the concept of group dynamics and teach you facilitation skills that will enable you to get the most out of your meetings. The guidebook is avail-able through the NACD Service Center, PO Box 855, League City, TX, 77574-0855, (800) 825-5547.

Maine Department of Environmental Protection's Nonpoint Source Awareness Campaign. Maine's Nonpoint Source Awareness Campaign started in 1995 as a collaborative effort between the Maine Department of Environmental Protection (DEP) and the State Planning Office to raise awareness about nonpoint source pollution prevention. Together these agencies produced the "8 Simple Steps" campaign and a series of radio and print messages. In 2000 the agencies began to develop more tailored materials and campaigns for their specific program needs. For more information, contact the Maine DEP, 1235 Central Drive, Presque Isle, ME 04769. Phone: (207) 764-0477; www.state.me.us/dep/blwq/docwatershed/npscamp.htm.

Make Your Home the Solution to Stormwater Pollution Brochure. This short brochure is targeted directly to homeowners and provides tips on a wide variety of simple things that homeowner's can do to prevent stormwater pollution. May be customized. EPA 833-B-03-003.

Making Waves: How to Put On a Water Festival. This publication is a great help in providing direction and ideas for organizing your own festival. Use Making Waves to plan an event in your school, county, or state. The water festival concept has been an enormously successful way to educate children and adults about water and water-related resources. This new version includes updated samples of fundraising letters, forms, news releases, and more. Also check out *Making More Waves: Ideas from Across the U.S. and Canada for Organizing Your Festival and Making a Bigger Splash: A Collection of Water Education and Festival Activities*. All are available through the Groundwater Foundation at (800) 858-4844.

Media Facts: A Guide to Competitive Media. Published by the Radio Advertising Bureau, this guide will help you understand and evaluate the strengths of various media formats. To download a copy, visit www.rab.com or call 1-800-252-RADIO.

Media Relations Guidebook. This guidebook provides tips to help you make effective use of the media in your area to promote watershed protection. It outlines the process of writing news releases and announcements. The guidebook is available through the NACD Service Center, P.O. Box 855, League City, TX, 77574-0855. Phone: (800) 825-5547.

The *National Pollutant Discharge Elimination System* web page, hosted by the USEPA, provides a wealth of information and guidance on public education and outreach. www.epa.gov/npdes/stormwater/menuofbmps/publicinvolvement

The National Watershed Library. The National Watershed Library lists many education and outreach tools for specific audiences like farmers, homeowners, and teachers. Visit www.ctic.purdue.edu for more information.

Nonpoint Source News-Notes. EPA's Nonpoint Source News-Notes is an occasional bulletin dealing with the condition of the water-related environment. To download the newsletter and search back issues, visit the Web site at www.epa.gov/owow/nps/toolbox.

Nonpoint Source Outreach Digital Toolbox. Provides information, tools, and a catalog of more than 700 outreach

materials that state and local agencies and organizations can use to launch their own nonpoint source pollution outreach campaign. Resources include the Getting in Step Outreach Series, a searchable catalog, logos, slogans, and mascots, surveys and evaluations, and others. See www.epa.gov/owow/nps/toolbox.

NPSINFO. NPSINFO is a forum for open discussion of nonpoint source pollution issues. It is sponsored by the U.S. Environmental Protection Agency's Office of Wetlands, Oceans, and Watersheds. Possible topics for discussion include agricultural nonpoint sources, urban runoff, technology, educational and funding alternatives, coastal nonpoint sources, forest management, best management practices, hydrological modification, and aquatic habitat modification. NPSINFO welcomes news articles, short abstracts, announcements, and conference notices, as well as questions, answers, and opinions. For more information, visit www.epa.gov/nps/changes. To subscribe, e-mail to join-npsinfo@lists.epa.gov. Leave the subject line and message body blank.

Ohio's Restoration Sponsor Program Integrates Point Source & Nonpoint Source Projects. This fact sheet summarizes how Ohio EPA has used the Clean Water State Revolving Fund to creatively fund runoff projects. EPA 832-F-02-001

Press Release Writing. The Press Release Writing Web site provides several articles and tips for organizations beginning to write PSAs. Visit www.press-release-writing.com for more information.

Project NEMO. NEMO uses geographic information system (GIS) technology to educate landowners and municipal officials about nonpoint source pollution and watershed protection. Contact University of Connecticut Cooperative Extension, Haddam, CT. Phone: (860) 345-4511; nemo.uconn.edu.

Protecting Water Quality from Urban Runoff. This fact sheet explains how urbanized areas affect water quality through increased runoff and pollutant loads and what homeowners can do to prevent stormwater pollution. Printed copies are no longer available from EPA. EPA 841-F-03-003.

Public Service Advertising Research Center. The Public Service Advertising Research Center is an online information library dedicated to public service advertising. The site provides a PSA bibliography, media profiles, an interactive broadcasters' café, case studies, and help sites. Visit www.psaresearch.com for more information.

Purdue University's "Know Your Watershed" website at www.ctic.purdue.edu/ is a national effort to encourage the formation of local, voluntary watershed partnerships and help assure that these partnerships successfully attain their goals. The website provides a variety of information for watershed partnerships.

Radio Marketing Guide and Fact Book for Advertisers, 2002–2003 Edition. Use this guide from the Radio Advertising Bureau to determine how radio can help you attain your outreach goals and market your cause more effectively. To download a copy, visit www.rab.com or call 1-800-252-RADIO.

RiverSmart. RiverSmart is a national public education campaign designed to show people how simple changes in their everyday activities can protect America's water resources. RiverSmart is a project of River Network, the nation's leader in supporting more than 4,000 local river and watershed groups nationwide that are working to save rivers. River Network Partner groups are placing RiverSmart television, radio, and newspaper ads in media outlets across the country. For more information, visit www.riversmart.com.

River Talk! Communicating a Watershed Message. River Talk! is a hands-on guide for people who want to be more efficient and effective in encouraging key sectors of their communities to become involved in designing river messages that resonate with target audiences. Contact River Network at (800) 423-6747 or www.rivernetwork.org.

The Role of Local Governments in Implementing the NPDES Stormwater Program for Construction Sites.

This new brochure provides local governments with a brief overview of the NPDES Stormwater Program on construction sites. Local governments can then provide this information to people in the construction industry who might need NPDES permit coverage. Stormwater permits require many operators of construction sites to implement steps to prevent sediment and other pollutants from washing off into nearby streams, rivers, lakes, and coastal waters. Files are available to print using a professional printer. Versions of both the Federal and State brochures are available. May be customized. Printed copies are no longer available from EPA. EPA 833-F-06-0022.

Social marketing Fostering Sustainable Behavior. This 175-page book on environmental marketing is a compilation of the strategies and methods that collectively form the basis of community-based social marketing— a proven breakthrough in the field of environmental education and outreach. It was written for those involved in designing, implementing, and evaluating public education programs with the goal of promoting sustainable behavior. For more information, visit www.cbsm.com.

Starting Up: A Handbook for New River and Watershed Organizations. This guide provides information for groups on how to get organized, including funding and procedural advice. Contact River Network at (800) 423-6747 or www.rivernetwork.org.

Stormwater and the Construction Industry Poster. Great for construction sites of all sizes! You can print this poster on 11x17 paper. Side one of this informative poster illustrates proper installation of common sediment and erosion control practices (best management practices). Side two describes the process for developing and implementing a stormwater pollution prevention plan and obtaining permit coverage. The complete 30x40 poster is also available. May be customized. EPA 833-H-03-001.

The *Stormwater Manager's Resource Center* www.. stormwatercenter.net has good information and includes a program resources page that provides a list of materials useful for watershed education. Topics include Watershed Education, Watershed Advocacy, Pollution Prevention at Home, and Pollution Prevention at Work.

Strategic Marketing for Nonprofit Organizations. This book forms a conceptual and practical foundation for marketing in nonprofit organizations. Its coverage encompasses the entire marketing process, providing valuable insights on strategic evaluations, positioning, market targeting, and more. For more information, visit http://vig.prehall.com.

Surf Your Watershed. Through this online service, you can locate your watershed and discover its condition and the partnerships working to protect it. Find information on population, area, land use, environmental issues, watershed groups, and water quality. You can also generate maps of your watershed at www.epa.gov/surf.

Think Blue San Diego. The City of San Diego believes the key to cleaner ocean waters is public education. That's why they created the "Think Blue" educational campaign. "Think Blue" educates residents, businesses, and industries about the causes of storm- water pollution and the pollution prevention behaviors everyone can adopt. For more information, visit www.thinkbluesd.org.

University of Wisconsin Extension and Wisconsin Priority Watershed Program. Resources include "how-to" guides on educational programming and the promotion of voluntary approaches to reducing non-point source pollution. Water Quality Fact Sheets topics include Polluted Urban Runoff, Erosion Control, and Pet Waste and Water Quality. See clean-water.uwex.edu/basins/basined.

The *USEPA Office of Water, Office of Wetlands Oceans, and Watersheds* website provides a variety of educational products including watershed-related pictures and clip art, activities for children, watershed education events, and links to watershed related web sites. See www.epa.gov/owow/.

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

Voices of the Watershed: A Guide to Urban Watershed Management Planning. Provides additional guidance on education and outreach strategies. Produced by the USEPA,

Lake County Stormwater Management Commission, Friends of the Chicago River, and IEPA.

Volunteer Monitor. The Volunteer Monitor is a national forum and newsletter for volunteer monitors. EPA established the list to encourage communication and information exchange among the nation's growing number of volunteer environmental monitoring programs. You'll receive news on coming conferences, workshops, special events, and new publications. This site is also a discussion forum and networking tool that volunteer monitors of all types use to ask and respond to questions about volunteer monitoring methods, data quality, data management issues, and more. Whether your group monitors wetlands, streams, or lakes, sign up and get into the loop. To subscribe, send an e-mail to join-volmonitor@lists.epa.gov. Leave the subject line and message body blank. Also see www.epa.gov/owow/monitoring/volunteer/vm_index.

The *Washington State Department of Ecology, Water Quality Program Showcase of Exceptional Education Products* at www.eyc.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.

Water Efficient Landscaping. This booklet describes the benefits of water-efficient, low-impact landscaping. It includes examples of successful projects, programs, and contacts. EPA 832-F-02-002.

Water Environment Web. This Web site provides a collection of Water Environment Federation resources and outside links related to watersheds. Included are publications, background information, coming events, and networking areas. www.wef.org/WaterNews.
Water Words That Work is a website (waterwordsthatwork.com) that presents ideas for communicating environmental issues effectively.

Watershed Academy Web. Through the Watershed Academy Web, EPA offers a variety of self-paced training modules that represent a basic and broad introduction to the watershed management field. Modules take 1⁄2 hour to 2 hours to complete. 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. Courses include Top Ten Watershed Lessons Learned, Introduction to the Clean Water Act, Wetland Functions and Values, and more. Completing a series of 15 of these modules earns a Watershed Academy Web Training Certificate. For more information, visit www.epa.gov/watertrain.

A Watershed Approach to Urban Runoff: Handbook for Decision Makers. This handbook outlines a process for understanding your watershed; explains the watershed management approach to assessing, planning, implementing, and evaluating; gives an overview of assessment and management tools; and provides detailed insights into structural and nonstructural best management practices and sample site plans. The guide can be obtained through the Conservation Technology Information Center at www.ctic.purdue.edu.

Watershed Protection: Catalog of Federal Funding Programs. The Catalog of Federal Funding Sources for Watershed Protection is now online as an easy-to-use, searchable Web site. The site provides information for watershed practitioners and others on 84 federal funding sources that may be available to help fund various watershed-related projects. The site updates EPA's original Catalog of Federal Funding Sources for Watershed Protection (EPA 841-B-99-003), which was previously published in 1999. For more information, visit www.epa.gov/watersedfunding.

Watershed Restoration: A Guide for Citizen Involvement in California. Some of the best science and technical tools available to citizens involved in coastal watershed management are available in this guide. Although it was developed for California, this well-constructed guide might spark ideas for use in other watersheds. Published

in December 1995, it can be obtained by contacting the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Coastal Oceans Office, 1315 East West Highway, Silver Spring, MD 20910. Phone: (301) 713-3338.

Watershed Stewards Project. This community-based watershed restoration program is committed to restoring salmon and other life-forms that depend on healthy watersheds for survival. Members join with top resource professionals, forming cooperative relationships between private industry, government agencies, and academic institutions, to build public awareness of the importance of watershed stewardship. For more information, check out the project's Web site at www.northcoast.com/~fishhelp.

Watershed Toolshed. The Ohio Watershed Network, a statewide information and education network in support of local watershed protection efforts, maintains an online Watershed Toolshed, which includes the module "Planning a Watershed Education Program." The module provides guidance to anyone interested in developing a watershed education program targeting specific audiences to help them make informed decisions to protect water quality. The Network also provides a listing of watershed groups in Ohio, the Ohio Watershed Academy, and other resources and references. Available online at ohiowatersheds.osu.edu/index.

Working with the Media: Communications Tips for Positive Media Relations. This web site, hosted by the Mississippi Department of Education's Office of Information and Safety, provides a list of helpful suggestions for organizations working with the media for outreach purposes: www.mde.k12.ms.us/ extrel/network/nettip.

appendix J - plan implementation cost estimate

Implementation of this plan will require the development of partnerships with local, state, and federal organizations for implementation, technical assistance, and funding. Tables J1 through J6 summarizess estimated financial assistance needed to implement the action recommendations. It includes areas / quantities for implementation, initial and annual unit costs, initial and annual total costs, parties responsible for action implementation, and anticipated staff administrative effort. Initial costs indicate cost for installation and/or establishment; annual costs indicate cost for ongoing management and maintenance. Table J7 presents the unit cost information used to estimate implementation costs for plan action recommendations.

Table J1 City of Zion Plan Implementation Cost Estimate

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
1.0.1	Zion	*Preserve Category 1 and 2 green infrastructure open space areas to connect the North and South units of Illinois Beach State Park, enhance recreational opportunities, and expand and restore important rare habitat. Decommission and remove the power plant and associated structures. Acreage count includes private / utility owned land within the area. It is assumed that restoration would address the potential pollutant loading hotspots identified as Critical Subbasins #15 and #74.*	382	acres	1	$0	$0	$0	$0
2.0.3	Zion	*Manage / minimize runoff impacts of commercial land uses along Sheridan Road, particularly at Sheridan and 33rd St and Sheridan and 27th, 28th, and 29th along the stream. Cost estimate assumes 8400 lf of Sheridan Road frontage treated with improved, 10' swales (approximately 2 acres) as a proxy for on-site source control BMPs.*	2	acre	1	$0	$0	$0	$0
2.0.6	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin; remove excess debris.	1100	lf	1	$125	$2	$137,500	$1,650
2.0.7	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin; remove excess debris. This is depressional area #54.	2000	lf	1	$125	$2	$250,000	$3,000
2.0.8	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads by naturalizing the basin; remove excess debris.	2100	lf	1	$125	$2	$262,500	$3,150
2.0.9	Zion	Address algae / nutrient loads by naturalizing the basin.	1	ea	1	$2,500	$250	$2,500	$250

Table J1 City of Zion Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
2.28.1	Zion	Restore stream channel and improve instream habitat by installing pools and riffles.	2700	lf	1	$0	$0	$0	$0
2.28.2	Zion	*Restore and manage the channel, native riparian buffers, and ravine woodland system, particularly the reach running through Ophir Park west of Sheridan Road, and Carmel Park east of Sheridan Road. Management practices include controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.*	2700	lf	2	$0	$0	$0	$0
2.28.3	Zion	*Stabilize and reduce downcutting of the incised channel through Ophir Park, and install a naturalized riparian buffer. Cost estimate assumes stabilization of streambanks with Moderate erosion problem.*	750	lf	2	$50	$2	$75,000	$2,250
2.28.4	Zion	Manage the culvert outflow at the upstream end of the reach for energy dissipation and pollutant removal, possibly with a settling basin or small constructed wetland.	1	ea	1	$0	$0	$0	$0
2.28.5	Zion	*Stabilize Moderate streambank erosion along the entire reach using bioengineering stabilization measures, which will help reduce the instream silt / sedimentation load within this reach.*	2700	lf	2	$50	$2	$270,000	$8,100
2.28.6	Zion	Remove debris, tires, and logs using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0
2.28.7	Zion	Remove debris obstructing flow using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0
2.28.8	Zion	Remove concrete debris and remove or repair failed headwall and outfall pipe.	1	ea	1	$0	$0	$0	$0
2.28.9	Zion	*Stabilize major erosion, bank slumping / blowout, and headwall failure at upstream end of the reach near the culvert. Use bioengineering stabilization measures if possible, and more structural measures if necessary. Cost estimate reflects stabilization of severe erosion problem.*	1	ea	1	$0	$0	$0	$0
2.28.10	Zion	*Stabilize 4 foot diameter plunge pool erosion below outfall. If feasible use bioengineering measures, though rip rap and structural measures may be necessary.*	1	ea	1	$0	$0	$0	$0
2.28.11	Zion	*Stabilize bank erosion caused by stormwater outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
2.28.12	Zion	Inspect and, if necessary, repair five culverts under trail, which may be crushed and/or failing.	5	ea	1	$0	$0	$0	$0

Table J1 City of Zion Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3a.0.3	Zion	Preserve approximately 21 acres of wetland and stream corridor open and partially open Category 1 green infrastructure areas and greenways within the headwaters of the 27th St tributary. Target areas are located (1) southwest of 25th St and Galilee, (2) south of Jethro and 26th Street, (3) west of 26th and Lewis, (4) southeast of 26th and Lewis, (5) northwest of 29th and Lewis.	21	acre	1	$0	$0	$0	$0
3a.0.7	Zion	Manage the golf course grounds and detention / water features in Shiloh Park, in the northeast corner of the SMU for water quality and habitat benefits, including installation of a 5 foot riparian buffer along shoreline / banks of water features.	2300	lf	1	$0	$0	$0	$0
3a.0.8	Zion	FPAI site 20-13 experiences local drainage problems due to runoff from the west. Retrofit David Park and the school property west of the problem area with detention or infiltration practices to reduce runoff rate and volume.	NA	NA	NA	NA	NA	NA	NA
3a.0.9	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a minimum 5 ft buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin.	350	lf	1	$125	$2	$43,750	$525
3a.0.10	Zion	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
3a.0.11	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation.	300	lf	1	$125	$2	$37,500	$450
3a.0.12	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	400	lf	1	$125	$2	$50,000	$600
3a.0.13	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; retrofit bottom concrete channel.	400	lf	1	$125	$2	$50,000	$600
3a.0.14	Zion	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; remove excess debris.	700	lf	1	$125	$2	$87,500	$1,050
3a.0.15	Zion	Stabilize / regrade shoreline using bioenginnering practices and native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads by naturalizing the basin; remove excess debris.	760	lf	1	$125	$2	$95,000	$1,140
3a.0.16	Zion	Stabilize / regrade shoreline and plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation.	800	lf	1	$125	$2	$100,000	$1,200

Table J1 City of Zion Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3a.0.17	Zion	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	1400	lf	1	$125	$2	$175,000	$2,100
3a.27.1	Zion	Restore and manage the native riparian buffer plant communities along this reach within Sharon Park by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer may be appropriate in the lower parts of the reach.	2000	lf	2	$0	$0	$0	$0
3a.27.2	Zion	Address High streambank erosion along entire reach using bioengineering stabilization measures, some of which may threaten buried sewer lines.	2000	lf	2	$100	$2	$400,000	$6,000
3a.27.3	Zion	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3a.27.4	Zion	*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream.*	100	lf	1	$100	$2	$10,000	$150
3a.27.5	Zion	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3a.27.6	Zion	*Stabilize significant erosion and exposure of manhole and sewer infrastructure using bioengineering stabilization measures and other hardscape solutions to ensure protection of the infrastructure elements. Length difficult to determine from photo; assume 100 lf for cost estimation purposes.*	100	lf	1	$0	$0	$0	$0
3a.27.7	Zion	*Stabilize erosion creating open channel at discharge point using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3a.27.8	Zion	*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 150 lf for cost estimation purposes.*	150	lf	1	$50	$2	$7,500	$225
3a.27.9	Zion	*Stabilize erosion at outfall that is creating an open channel using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3a.27.10	Zion	*Stabilize major erosion, headwall, and outfall pipe failure using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3a.27.11	Zion	*Stabilize minor channel erosion using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0

Table J1 City of Zion Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.22.1	Zion	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	1200	lf	2	$0	$0	$0	$0
3c.22.2	Zion	Remove debris obstructing flow using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0

Table J2 Village of Beach Park Plan Implementation Cost Estimate

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
1.0.3	Beach Park	Preserve and restore open and partially open green infrastructure bounded by North Ave, York House Road, Sheridan Road, and residential areas to the north (spanning SMUs #1, #3b, and #3c) for natural resource restoration and management and recreation. Preserving two corridors (19 acres) east of Sheridan Road would connect this piece to the larger Illinois Beach State Park system. The area also contains storage area #30 and potential storage area #27, which may help reduce flooding in the area of FPAI 20-02 along Coolidge Ave.	99	acres	1	$0	$0	$0	$0
1.0.8	Beach Park	Monitor IDOT-recorded flooding location at Sheridan and York House Road for further problems.	1	ea	1	$0	$0	$0	$0
1.0.9	Beach Park	Monitor IDOT-recorded flooding locations at Sheridan and Beach Road for further problems.	1	ea	1	$0	$0	$0	$0
1.0.14	Beach Park	Install filtration and infiltration BMPs for existing commercial properties along Sheridan Road. Cost estimate reflects 10' wide swale improvements (as a proxy for lot level / source control BMPs) along 1500 lf of Sheridan Road frontage.	0	acres	1	$0	$0	$0	$0
1.0.15	Beach Park	Improve any swale and other surface stormwater drainage systems within the developed areas of the western part of this SMU, which is mostly unsewered, and install stormwater filtration and infiltration BMPs. Details reflect 54,000 lf (approximately 12.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of roads within this part of the SMU.	13	acres	1	$0	$0	$0	$0
1.0.23	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
1.0.24	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
1.0.27	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
2.0.5	Beach Park	Monitor past IDOT-recorded flooding at Sheridan and Wadsworth for further problems and remediate if flooding continues.	1	ea	1	$0	$0	$0	$0
3a.25.4	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0
3a.26.1	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	2000	lf	2	$0	$0	$0	$0
3a.26.2	Beach Park	Restore stream channel and improve instream habitat by installing & enhancing pools and riffles.	2000	lf	1	$0	$0	$0	$0

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3a.26.3	Beach Park	*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt and sediment load.*	2000	lf	2	$50	$2	$200,000	$6,000
3a.26.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	2000	lf	2	$0	$0	$0	$0
3a.26.5	Beach Park	Remove chain link fence placed across stream channel.	1	ea	1	$0	$0	$0	$0
3a.26.6	Beach Park	*Remediate significant erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$50	$2	$5,000	$150
3a.26.7	Beach Park	Investigate and remediate collapsed pedestrian bridge in the stream channel.	1	ea	1	$0	$0	$0	$0
3b.0.2	Beach Park	Consider daylighting and restoring as much of the Wilson Avenue Tributary (not inventoried) as possible through the residential areas. Daylighting and restoration should address concerns about the tank cars and transite pipes that are reported to transmit the flow below ground in this location.	4000	lf	1	$0	$0	$0	$0
3b.0.3	Beach Park	Buffer the Wilson Avenue Tributary from encroachment by preserving open Category 2 green infrastructure areas.	3	acres	1	$0	$0	$0	$0
3b.0.5	Beach Park	Restore and manage the wetlands within the open and partially open Category 1 Green Infrastructure areas just north of Lyons Woods Forest Preserve; reconnect these wetlands to the Lyons Woods system.	7	acres	1	$0	$0	$0	$0
3b.0.8	Beach Park	FPAI site 20-04, in the Village of Beach Park, experiences sewer backup into homes due to an inadequate drainage system. Investigate whether the remedial measure, a large pipe and ditch installed as part of the Monarch Point development to the north, fixed the problem. If not, remedial action should be taken, which may include working with the open areas identified on the SMU map to relieve drainage issues.	9	acres	1	NA	NA	NA	NA
3b.0.9	Beach Park	FPAI site 20-05, in the Village of Beach Park, experiences road, home, and backyard flooding due to inadequate conveyance capacity of the open ditch and culvert, particularly the culvert under Yorkhouse Road. Remedial action may include retrofit / restoration of open green infrastructure areas to help absorb / store flood water.	14	acres	1	NA	NA	NA	NA
3b.0.10	Beach Park	The area where BL13, BL14, and BL15 come together is in need of a stream restoration plan to remediate the buildup of debris, concrete lined channels, underground culverts and railroad tank cars, yard waste in the stream channel, and other impacts from nearby residential areas.	400	lf	1	$0	$0	$0	$0

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3b.0.11	Beach Park	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	800	lf	1	$125	$2	$100,000	$1,200
3b.0.13	Beach Park	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	500	lf	1	$125	$2	$62,500	$750
3b.0.14	Beach Park	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	500	lf	1	$125	$2	$62,500	$750
3b.0.17	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
3b.0.18	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
3b.0.19	Beach Park	Plant banks with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	650	lf	1	$125	$2	$81,250	$975
3b.0.20	Beach Park	Convert to wet or wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	850	lf	1	$125	$2	$106,250	$1,275
3b.0.21	Beach Park	Plant banks and a surrounding buffer with native vegetation; remove excess debris.	1200	lf	1	$25	$2	$30,000	$1,800
3b.12.1	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.*	1900	lf	1	$0	$0	$0	$0
3b.12.2	Beach Park	*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	1900	lf	2	$100	$2	$380,000	$5,700
3b.12.3	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	1900	lf	2	$0	$0	$0	$0
3b.12.4	Beach Park	Investigate / inspect failed / broken concrete dam along west of Cheney / North Ave. for impact on stream, and remove impacting dam elements if found be have a negative impact.	1	ea	1	$0	$0	$0	$0
3b.12.5	Beach Park	*Stabilize typical 1-2 foot erosion on right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150
3b.12.6	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3b.12.7	Beach Park	*Stabilize significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150
3b.12.8	Beach Park	*Remove debris and sediment from culvert under Beach Road.*	1	ea	1	$0	$0	$0	$0
3b.12.9	Beach Park	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.12.10	Beach Park	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.13.1	Beach Park	Manage and restore the wooded ravine along reach BL13. Assumes an area 2500 lf by 150 ft in width for cost estimating purposes.	9	acre	1	$0	$0	$0	$0
3b.13.2	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and removing numerous debris jams according to the American Fisheries Society guidelines.*	3000	lf	1	$0	$0	$0	$0
3b.13.3	Beach Park	*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	3000	lf	2	$100	$2	$600,000	$9,000
3b.13.4	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	3000	lf	2	$0	$0	$0	$0
3b.13.5	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	3000	lf	2	$0	$0	$0	$0
3b.13.6	Beach Park	Inspect footbridges and armored / concrete-lined banks and remediate if found to be negatively impacting the stream.	1	ea	1	$0	$0	$0	$0
3b.13.7	Beach Park	*Restore channel reach near Wilson Avenue by installing pool and riffle structures and stabilizing streambanks.*	200	lf	1	$0	$0	$0	$0
3b.13.8	Beach Park	Remove concrete debris dumping / fill just upstream of Beach Rd culvert from property / operation at Tewes and Beach.	1	ea	1	$0	$0	$0	$0
3b.13.9	Beach Park	*Remediate significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3b.13.10	Beach Park	*Inspect and assess fencing across channel and rock wall armoring and remove if found to impair the conveyance of water.*	1	ea	1	$0	$0	$0	$0
3b.13.11	Beach Park	*Remove concrete from channel and restore stream channel by stabilizing streambanks and installing habitat features such as pools and riffles and rootwads. Assumes 150 lf of stream channel needs attention for cost estimation purposes.*	150	lf	1	$0	$0	$0	$0
3b.13.12	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3b.13.13	Beach Park	*Remove debris and sediment from culvert under Beach Road.*	1	ea	1	$0	$0	$0	$0
3b.13.14	Beach Park	*Address failed concrete wall armoring and major erosion behind the armoring by removing the concrete and using bioengineering stabilization measures. Assumes 100lf of stream channel needs attention for cost estimation purposes.*	100	lf	1	$0	$0	$0	$0
3b.13.15	Beach Park	*Repair or replace broken concrete and corrugated metal pipe culvert and remove debris obstructing flow.*	1	ea	1	$0	$0	$0	$0
3b.13.16	Beach Park	*Stabilize erosion at and below outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.13.17	Beach Park	*Repair failed clay outfall pipe and address erosion around outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.14.1	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	500	lf	2	$0	$0	$0	$0
3b.14.2	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	500	lf	2	$0	$0	$0	$0
3b.14.3	Beach Park	*Conduct major channel restoration by removing debris and restoring a natural channel to this concrete-lined drainage ditch.*	50	lf	1	$0	$0	$0	$0
3b.15.10	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.15.11	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3b.15.12	Beach Park	*Remove debris at the outfall discharge points.*	1	ea	1	$0	$0	$0	$0
3b.17.1	Beach Park	Restore stream channel and improve instream habitat by enhancing pools and riffles.	2400	lf	1	$0	$0	$0	$0
3b.17.2	Beach Park	Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.	2400	lf	2	$50	$2	$240,000	$7,200
3b.17.3	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	2400	lf	2	$0	$0	$0	$0
3b.17.4	Beach Park	Inspect footbridges and armored / concrete-lined banks along this reach for impacts on the stream corridor and remediate if necessary.	1	ea	1	$0	$0	$0	$0
3b.17.5	Beach Park	Remove broken concrete slab streambank armoring and restore channel to natural channel condition. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	50	lf	1	$0	$0	$0	$0
3b.17.6	Beach Park	Restore a minimum 5 foot wide, deep-rooted native plant buffer to the stream edge within the golf course.	600	lf	2	$0	$0	$0	$0
3b.17.7	Beach Park	Remove debris at outfall.	1	ea	1	$0	$0	$0	$0
3b.17.8	Beach Park	Stabilize significant erosion and bank slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	50	lf	1	$100	$2	$5,000	$75
3b.17.9	Beach Park	Remove debris blocking culvert and repair, remediate, and/or stabilize the exposed culvert.	1	ea	1	$0	$0	$0	$0
3b.17.10	Beach Park	Stabilize erosion undermining the culvert, preferably using bioengineering stabilization measures but also using more structural measures if necessary.	1	ea	1	$0	$0	$0	$0
3c.0.9	Beach Park	FPAI site 20-02, in the Village of Beach Park, experiences flooding due to inadequate outlets and poor drainage. There is a backyard drainage ditch between Beach and Howard, Sheridan and Geraghty (depressional storage #49) and extending along Coolidge Rd to the north (depressional storage #50) that are likely part of the cause of flooding. Investigate whether the new storm sewer along Coolidge Avenue has eliminated flooding in this location. If flooding persists, additionial solutions may include improvement of drainage overland flow paths and installation of additional storm sewer capacity to alleviate the problem.	NA	NA	NA	NA	NA	NA	NA

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.0.10	Beach Park	Monitor past IDOT-recorded flooding locations at Sheridan and Wadsworth, Sheridan and Talmadge / Michigan, and Sheridan and Beach Rd. to determine whether flooding is still occuring at these sites. If so, develop and implement flood mitigation strategies.	1	ea	1	$0	$0	$0	$0
3c.0.14	Beach Park	Stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	650	lf	1	$125	$2	$81,250	$975
3c.0.15	Beach Park	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin.	600	lf	1	$125	$2	$75,000	$900
3c.0.16	Beach Park	Retrofit as wet / wetland basin; stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	300	lf	1	$125	$2	$37,500	$450
3c.0.18	Beach Park	Plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	375	lf	1	$125	$2	$46,875	$563
3c.7.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	1800	lf	2	$0	$0	$0	$0
3c.7.4	Beach Park	Assess side slope seeps for restoration potential. Restore if possible.	2	acre	1	$0	$0	$0	$0
3c.7.5	Beach Park	Remove massive debris jam approximately 300' downstream of Sheridan Road and stabilize channel.	1	ea	1	$0	$0	$0	$0
3c.8.1	Beach Park	*Address High streambank erosion along entire reach, some threatening homes and property, using bioengineering stabilization measures.*	2000	lf	2	$100	$2	$400,000	$6,000
3c.8.2	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	2000	lf	2	$0	$0	$0	$0
3c.8.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	2000	lf	2	$0	$0	$0	$0

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.8.4	Beach Park	*Repair broken cement outfall pipe and stabilize surrounding erosion using bioengineering stabilization measures. Location is approximately 300' upstream of Sheridan Rd.*	1	ea	1	$0	$0	$0	$0
3c.8.5	Beach Park	*Stabilize streambank erosion across from the sewer / manhole stabilization project along the reach near the Garaghty / California intersection. Length of problem is unknown; assume 50 lf and 1 side of stream for cost estimation purposes.*	50	lf	1	$50	$2	$2,500	$75
3c.8.6	Beach Park	*Stabilize minor channel erosion and downcutting of channel outfall using bioengineering stabilization measures and energy dissipation measures.*	1	ea	1	$0	$0	$0	$0
3c.8.7	Beach Park	*Stabilize major erosion behind headwall and below outfall preferably using bioengineering stabilization measures but may also require more structural measures.*	1	ea	1	$0	$0	$0	$0
3c.8.8	Beach Park	*Stabilize moderate channel erosion and downcutting using bioengineering stabilization measures and, if necessary, check dams.*	1	ea	1	$0	$0	$0	$0
3c.8.9	Beach Park	*Address major erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	50	lf	1	$100	$2	$5,000	$75
3c.8.10	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3c.8.11	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3c.8.12	Beach Park	*Monitor sewer manhole, which rises 6 feet above stream elevation, for leakage and infiltration problems.*	1	ea	1	$0	$0	$0	$0
3c.8.13	Beach Park	*Stabilize major erosion and slumping of ravine bank using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3c.8.14	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3c.9.1	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.*	2500	lf	1	$0	$0	$0	$0
3c.9.2	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	2500	lf	2	$100	$2	$500,000	$7,500

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.9.3	Beach Park	*Restore the native riparian buffer (manage native riparian plant communities within this reach: control invasive species, plant native species, thin shrub layer to allow more understory growth, and manage vegetation such as through prescribed burning.)*	2500	lf	2	$0	$0	$0	$0
3c.9.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	2500	lf	2	$0	$0	$0	$0
3c.9.5	Beach Park	*Stabilize major erosion with slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	50	lf	1	$100	$2	$5,000	$75
3c.9.6	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3c.9.7	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3c.9.8	Beach Park	*Remove debris around plastic outfall pipe.*	1	ea	1	$0	$0	$0	$0
3c.9.9	Beach Park	*Stabilize major erosion on the left bank using bioengineering stabilization measures.*	100	lf	1	$0	$0	$0	$0
3c.9.10	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3c.9.11	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3c.9.12	Beach Park	*Stabilize major erosion and slumping of the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150
3c.10.1	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation within this reach.*	800	lf	2	$100	$2	$160,000	$2,400
3c.10.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	800	lf	2	$0	$0	$0	$0
3c.10.3	Beach Park	*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.10.4	Beach Park	*Stabilize erosion around capped outfall pipe using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3c.11.1	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	2500	lf	2	$100	$2	$500,000	$7,500
3c.11.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	2500	lf	2	$0	$0	$0	$0
3c.11.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	2500	lf	2	$0	$0	$0	$0
3c.11.4	Beach Park	Remove debris obstructing culverts.	1	ea	1	$0	$0	$0	$0
3c.11.5	Beach Park	Remove debris from outfall channel and assess armoring for impact on stream; if negative impact is found, remove armoring and stabilize with bioengineering approach.	1	ea	1	$0	$0	$0	$0
3c.11.6	Beach Park	*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150
3c.11.7	Beach Park	*Repair / remediate erosion below outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3c.11.8	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0
3c.11.9	Beach Park	*Stabilize major erosion occurring behind armoring on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150
3c.11.10	Beach Park	*Assess wood armoring / retention wall for stability and feasibility of bioengineered approach to bank stabilization. Assumes 100lf of stream channel, both sides for cost estimation purposes.*	100	lf	2	$0	$0	$0	$0
3c.19.1	Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	1900	lf	2	$50	$2	$190,000	$5,700
3c.19.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	1900	lf	2	$0	$0	$0	$0

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.19.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	1900	lf	2	$0	$0	$0	$0
3c.19.4	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0
3c.19.5	Beach Park	*Stabilize significant erosion and slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150
3c.19.6	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams or other grade stabilization measures if necessary.*	1	ea	1	$0	$0	$0	$0
3c.19.7	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	1	ea	1	$0	$0	$0	$0
3c.20.1	Beach Park	Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.	3600	lf	1	$0	$0	$0	$0
3c.20.2	Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	3600	lf	2	$50	$2	$360,000	$10,800
3c.20.3	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	3600	lf	2	$0	$0	$0	$0
3c.20.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	3600	lf	2	$0	$0	$0	$0
3c.20.5	Beach Park	*Stabilize significant erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$50	$2	$5,000	$150
3c.20.6	Beach Park	*Stabilize significan erosion and attempted stabilization debris around culvert using bioengineering stabilization measures*	1	ea	1	$0	$0	$0	$0
3c.20.7	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0
3c.20.8	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	1	ea	1	$0	$0	$0	$0

Table J2 Village of Beach Park Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.20.9	Beach Park	*Stabilize erosion around culvert using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3c.20.10	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3c.20.11	Beach Park	Repair or remediate cracked concrete armoring at outfall.	10	lf	1	$0	$0	$0	$0
3c.24.1	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	2000	lf	2	$0	$0	$0	$0
3c.24.2	Beach Park	Remove debris including tires.	1	ea	1	$0	$0	$0	$0
4.0.1	Beach Park	Preserve and restore the ravine within the open Category 1 green infrastructure area between Ganster Road and Sheridan Road, just east of Lyons Woods Forest Preserve.	10	acres	1	$0	$0	$0	$0
4.0.6	Beach Park	Expand / enlarge detention basins #28, #75, and #76 to reduce IDOT-recorded flooding locations along Sheridan Road north of Blanchard.	1	ea	1	$0	$0	$0	$0
4.0.9	Beach Park	Inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrients by naturalizing the basin; remove excess debris.	650	lf	1	$125	$2	$81,250	$975
4.05.3	Beach Park	Remove debris / bricks in channel.	1	ea	1	$0	$0	$0	$0
4.05.4	Beach Park	*Stabilize bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	50	lf	1	$50	$2	$2,500	$75

Table J3 City of Waukegan Plan Implementation Cost Estimate

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
1.0.7	Waukegan	Preserve and restore the green infrastructure areas in the southwest corner of the SMU, east of the Union Pacific rails and west of industrial land uses (Midwest Generation, North Shore Sanitary District, and Outboard Marine Corporation). This area has been identified by the City of Waukegan for restoration as the 'Waukegan Moorlands'.	52	acres	1	$0	$0	$0	$0
1.0.10	Waukegan	Investigate the wetlands adjacent to the Johns Manville lagoons for restoration and remediation potential and as a possible water quality improvement facility for water runoff from nearby industrial sites. Cost reflects standard wetland restoration and management rather than clean up and remediation.	35	acres	1	$0	$0	$0	$0
1.1.1	Waukegan	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	2000	lf	2	$0	$0	$0	$0
1.1.3	Waukegan	*Restore stream channel and instream habitat by reducing / remediating channelization, possibly through a remeandering and other restoration projects such as installing boulders, large rocks, and / or rootwads.*	2000	lf	1	$0	$0	$0	$0
1.1.5	Waukegan	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	1	ea	1	$0	$0	$0	$0
1.1.6	Waukegan	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	1	ea	1	$0	$0	$0	$0
3b.0.12	Waukegan	Address algae / nutrient loads by naturalizing the basin.		lf	1	$2,500	$250	$0	$0
3b.0.15	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
3b.0.16	Waukegan	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	400	lf	1	$125	$2	$50,000	$600
3b.16.5	Waukegan	*Stabilize the eroding, 4 foot deep cut channel within the turf grass landscape at the upstream end of BL16, just downstream of the Beach Rd. culvert.*	300	lf	2	$100	$2	$60,000	$900
3b.16.6	Waukegan	*Repair or replace the steel Beach Road culvert that is eroding around the edges and beneath, possibly due in part to the additional plastic drain pipe.*	1	ea	1	$0	$0	$0	$0
3c.0.3	Waukegan	For Waukegan Airport property, implement the spill prevention and response plan and reduce the use of salt and/or deicers. Install filtration and infiltration BMPs to capture and treat runoff from airport landscapes, particularly impervious surfaces such as runways and fueling areas, before being discharged to the stream system of Bull Creek.	A/R	-	-	-	-	-	-

Table J3 City of Waukegan Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.0.17	Waukegan	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	1300	lf	1	$125	$2	$162,500	$1,950
4.0.5	Waukegan	Improve swale and other surface stormwater drainage systems within the developed areas of the SMU, particularly those residential areas off Miraflores and Montesano, with lot level stormwater filtration and infiltration BMPs. Details reflect 28,000 lf (approximately 6.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	7	acres	1	$0	$0	$0	$0
4.0.7	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
4.0.8	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
4.05.5	Waukegan	*Stabilize and strengthen the incised discharge channel.*	1	ea	1	$0	$0	$0	$0
5.0.1	Waukegan	Preserve the ravine within the 7-acre open Category 1 green infrastructure area between Circle Court and the Amstutz Expressway.	7	acre	1	$0	$0	$0	$0
5.0.2	Waukegan	Preserve and restore wetland complexes where these resource remain, including those along the entire length of reach BL04 and those adjacent to Lake County Gardens (depressional storage areas #22 and #23). Wetland / depressional area #23, bordered by Pine, Lorraine, Wilson, and the McClory Bike Trail, contains some elements of a decent quality wetland indicative of good restoration potential. Two additional potential restoration areas are the small park between Butrick and Yeoman and the upstream drainage corridor north of and paralleling Rice St.	65	acre	1	$0	$0	$0	$0
5.0.3	Waukegan	Preserve the wetlands / stream corridor within Category 1 and 2 open green infrastructure areas between Rice and MacArthur, west of Lewis Avenue, and the area between Pine, Wilson, and the McClory bike path.	34	acre	1	$0	$0	$0	$0
5.0.4	Waukegan	*Install filtration BMPs for commercial and institutional uses along Greenwood Avenue and at the York House Rd / Lewis Ave intersection to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S43, and S73. Details reflect 10,000 lf (approximately 2.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontage.*	3	acres	1	$0	$0	$0	$0
5.0.5	Waukegan	*Install lot level filtration and infiltration BMPs, to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S39, S43, and S73. Details reflect 228,000 lf (approximately 52 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	52	acres	1	$0	$0	$0	$0

Table J3 City of Waukegan Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
5.0.6	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	1500	lf	1	$125	$2	$187,500	$2,250
5.0.7	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin; remove excess debris.	900	lf	1	$125	$2	$112,500	$1,350
5.0.8	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	600	lf	1	$125	$2	$75,000	$900
5.0.9	Waukegan	Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation.	900	lf	1	$125	$2	$112,500	$1,350
5.0.10	Waukegan	*Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and address turbidity / sedimentation by naturalizing the basin. This may reduce pollutant loading within potential pollutant loading hotspot S39.*	750	lf	1	$125	$2	$93,750	$1,125
5.0.11	Waukegan	*Inventory detention basin and identify resolutions to any noted functional problems.his may reduce pollutant loading within potential pollutant loading hotspot S14.*	1	ea	1	$0	$0	$0	$0
5.2.1	Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. Restoration and management of Bowen Park and the residential areas along Miraflores is important to enhance the habitat quality of this reach.	4000	lf	2	$0	$0	$0	$0
5.2.2	Waukegan	Reduce impacts of surrounding golf course and park property such as landscape waste dumping, turf grass stream edges. Filter and infiltrate runoff from parking lots, such as those within Bowen Park, with BMPs. Details reflect installation of lot level BMPs.	2000	lf	2	$0	$0	$0	$0
5.2.3	Waukegan	Reduce impacts of residential homes along Miraflores: cease yard waste dumping, replace mown turf grass to the edge of the stream with a minimum 10 foot native vegetation buffer, infiltrate runoff discharge from roof or footing drains with rain gardens or rain barrels, and naturalize the stream channel by replacing poured concrete and rip rap with bioengineering stabilization measures.	2000	lf	2	$0	$0	$0	$0
5.2.4	Waukegan	Gully erosion occurring in the ravines of Bowen Park should be remediated through ravine woodland restoration and management along reach BL02. Assumes 4000 lf of stream reach by 500' width. Costs reflect woodland restoration; load reduction reflects Moderate erosion stabilization.	46	acre	1	$0	$0	$0	$0

Table J3 City of Waukegan Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
5.2.5	Waukegan	Stabilize erosion around the Sheridan Road culvert and replace the broken stormsewer that is discharging to the opposite streambank.	1	ea	1	$0	$0	$0	$0
5.2.6	Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0
5.2.7	Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	1	ea	1	$0	$0	$0	$0
5.2.8	Waukegan	Stabilize typical 2-4 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.	100	lf	1	$50	$2	$5,000	$150
5.2.9	Waukegan	Stabilize minor erosion of open discharge channel using bioengineering stabilization measures.	1	ea	1	$0	$0	$0	$0
5.2.10	Waukegan	Stabilize significant erosion below outfall using bioengineering stabilization measures.	1	ea	1	$0	$0	$0	$0
5.2.11	Waukegan	Stabilize minor channel erosion below concrete lined channel outfall. Consider removing concrete and stabilizing channel with more habitat-appropriate measures.	1	ea	1	$0	$0	$0	$0
5.2.12	Waukegan	Install energy dissipation measures to address the eroding plunge pool created by discharge from the elevated outfall.	1	ea	1	$0	$0	$0	$0
5.3.1	Waukegan	*Restore a 5 foot wide native riparian buffer and replace turf grass lawn edges to native riparian plant communities as is feasible within the golf course.*	3000	lf	2	$0	$0	$0	$0
5.3.2	Waukegan	Glen Flora Country Club: replace or remediate online detention, armored dams and wiers with more habitat appropriate structures that allow fish passage.	3	ea	1	$0	$0	$0	$0
5.3.3	Waukegan	*Stabilize erosion undercutting the concrete-lined channel outfall / dam; if feasible, remove concrete and replace with bioengineered channel stabilization measure.*	20	lf	1	$0	$0	$0	$0
5.4.1	Waukegan	Restore stream channel and improve instream habitat by reducing channelization, such as through a remeandering project.	7000	lf	1	$0	$0	$0	$0
5.4.2	Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.	7000	lf	2	$0	$0	$0	$0

Table J3 City of Waukegan Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
5.4.3	Waukegan	Implement the mitigation planfor FPAI site 20-06, in the City of Waukegan, Lake County Gardens subdivision. There also may be opportunities to increase the detention and/or drainage capacity of the drainage system in this area, particularly within the community park to the north. However, improvement of the wetlands to increase their storage capacity may also be an option.	145	acres	1	NA	NA	NA	NA
5.4.4	Waukegan	Restore the upper end of this reach, a fairly undefined channel that is choked with cattails, through invasive species removal and management.	2200	lf	1	$0	$0	$0	$0
6.0.1	Waukegan	*Manage and restore the wooded ravine, wetland, and depressional area #3 that lies between the Amstutz and Sheridan Road for storage. Load reduction details reflect impact of restored wetland.*	14	acre	1	$0	$0	$0	$0
6.0.3	Waukegan	Open and partially open Category 1 green infrastructure areas between the waste water treatment plant and the Union Pacific tracks should be restored and integrated into the planned Waukegan Moorlands area to the north. Details reflect natural area restoration.	28	acre	1	$0	$0	$0	$0
6.0.4	Waukegan	*Install filtration BMPs for commercial, industrial, and institutional uses in the eastern and southwestern portions of the SMU to help improve water quality in potential pollutant loading hotspot S10, S11, and S75. Details reflect approximately 15,000 lf (approximately 3.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontages of these land uses.*	4	acre	1	$0	$0	$0	$0
6.0.5	Waukegan	*This SMU is primarily sewerd but undetained. Install source controls and lot level filtration and infiltration BMPs, including detention basin improvements, which may help address pollutant loading in potential pollutant loading hotspot S10, S11, and S75. Details reflect 96,000 lf (approximately 22 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	22	acre	1	$0	$0	$0	$0

Table J4 Illinois Department of Natural Resources Plan Implementation Cost Estimate

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
1.0.2	IDNR	Develop and implement habitat restoration and management plans for Illinois Beach State Park, including all wetlands, waterways, beach ridge, dune and swale systems, and T&E species habitat.	1548	acres	1	$0	$0	$0	$0
1.0.5	IDNR	Restore hydrologic connectivity of Dead River to Lake Michigan and remove those created to carry wastewater to the lake. Assumes that 4 hydrologic connections need to be restored or removed.	4	ea	1	NA	NA	NA	NA
1.0.16	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
1.0.17	IDNR	Stabilize / regrade shoreline using bioenginnering practices and address algae / nutrient loads by naturalizing the basin.	1100	lf	1	$125	$2	$137,500	$1,094
1.0.18	IDNR	Address algae / nutrient loads by naturalizing the basin.	1	ea	1	$2,500	$250	$2,500	$250
1.0.19	IDNR	Address algae / nutrient loads by naturalizing the basin.	1	ea	1	$2,500	$250	$2,500	$250
1.0.20	IDNR	Address algae / nutrient loads by naturalizing the basin.	1	ea	1	$2,500	$250	$2,500	$250
1.0.21	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
1.0.22	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
1.0.25	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0
1.0.26	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	1	ea	1	$0	$0	$0	$0

Table J5 Lake County Plan Implementation Cost Estimate

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3a.0.6	Lake County	Depressional storage area #78, within the Thunderhawk Golf Club Forest Preserve, may be able to be expanded to provide additional storage if needed, and may also be retrofitted / restored to improve runoff quality from the golf course, provided that runoff can be directed into this area, treated, and then discharged to a receiving water body. Costs reflect restoration of this wet / hydric area.	5	acre	1	$0	$0	$0	$0
3a.0.18	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	1200	lf	1	$125	$2	$150,000	$1,800
3c.0.11	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	1000	lf	1	$125	$2	$125,000	$1,500
3c.0.12	Lake County	Stabilize / regrade shoreline using bioenginnering practices.	2000	lf	1	$125	$2	$250,000	$3,000
3c.0.13	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	650	lf	1	$125	$2	$81,250	$975
3c.23.1	Lake County	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	3600	lf	2	$0	$0	$0	$0
4.0.3	Lake County	Manage and restore the natural resources, including ADID wetland #1831, in the northeastern corner of Lyons Woods Forest Preserve. The southern portion of depressional storage area #28 is within the Forest Preserve boundary and may be used to relieve past IDOT-recorded flooding at Sheridan and York House Road. ADID wetland is approximately 46 acres (4000' by 500' wide) and the total area of Lyons Woods is 264 acres.	264	acres	1	$0	$0	$0	$0

Table J6 Multiple Jurisdictions Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
1.0.4	Waukegan, IDNR, Lake County	Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park.	A/R	-	-	-	-	-	-
1.0.6	Beach Park, Waukegan	Preserve Category 1 open green infrastructure areas including a portion of depressional storage area #17 and the utility corridor that can serve as a green infrastructure connector between Illinois Beach State Park to Lyons Woods Forest Preserve.	30	acres	1	$0	$0	$0	$0
1.0.11	Zion, Waukegan, IDNR	Manage the Lake Michigan shoreline and beaches to minimize beach erosion. Details reflect 28000 lf of shoreline at an average width of 150 feet.	96	acres	1	$0	$0	$0	$0
1.0.12	Zion, Waukegan, IDNR	Manage the Lake Michigan shoreline and beaches to minimize E. coli contamination that leads to beach closures. Details reflect 28000 lf of shoreline at an average width of 150 feet.	96	acres	1	$0	$0	$0	$0
1.0.13	Zion, Beach Park, Waukegan, IDNR	*Install drainage swale improvements or other lot level / source control BMPs to capture and treat runoff from commercial and industrial land uses within Critical Subbasins #15, #74, and #76, identified as potential Pollution Hot Spot Critical Areas. Cost estimate reflects the installation of swales (10' wide) or other treatment measures along perimeter of these land uses, approximately 35,000 lf of treatment area.*	8	acres	1	$0	$0	$0	$0
1.1.2	Waukegan, IDNR, Lake County	*Restore the natural connection and habitat quality of this reach to Lake Michigan by removing the lagoons through which the reach runs and disconnecting the reach from the Dead River to the north. Since these lagoons may be a component of a remedation or clean up plan, this should be considered a long term recommendation to be implemented when the contamination issues at Johns Manville have been adequately remediated. Details reflect major channel restoration.*	2000	lf	2	$0	$0	$0	$0
1.1.4	Waukegan, Lake County	Address potential hazardous / toxic runoff from industrial uses to the east through filter strips and other filtration and infiltration techniques installed between the reach and these land uses, or by containing and remediating runoff on site through other means. Cost estimate reflects the installation of 2000 lf of 20' wide infiltration and filtration BMPs.	0	acre	1	$0	$0	$0	$0
1.6.1	Beach Park, Lake County	Restore stream channel and improve instream habitat by installing pools and riffles and installing boulders, large rocks, and / or rootwads.	2000	lf	1	$0	$0	$0	$0
1.6.2	Beach Park, Lake County	Restore native riparian buffer by controlling invasive species, planting native species, thinning forest and shrub canopy, and managing vegetation such as through prescribed burning.	2000	lf	2	$0	$0	$0	$0

Table J6 Multiple Jurisdictions Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
2.0.1	Zionion Beach Park	Category 1 and 2 green infrastructure areas along the western boundary of Illinois Beach State Park and bordering the Union Pacific rails to the west should be preserved as components of the green infrastructure / greenway system that includes Ophir Park, Carmel Park, and Illinois Beach State Park. These areas contain significant low lying depressional storage areas (#55, #56, and #57) that could be used for water quality improvement, wetland / hydric soil complexes, and steep slopes that are unsuitable for development.	61	acres	1	$0	$0	$0	$0
2.0.2	Zion, Beach Park	*Convert the depressional storage complex of #55, #56, and #57 to improve water quality for Critical Subbasin #2, identified as a potential Pollutant Loading Hotspot. Assumes runoff can be directed into this area, treated, and discharged to the Illinois Beach State Park stream and wetland system. Estimated area to be converted is 7000lf by 400ft wide.*	64	acres	1	$0	$0	$0	$0
2.0.4	Zion, Beach Park	*Reduce pollutant loading to Critical Subbasin #2, a potential pollutant loading hotspot, by improving swales and other surface stormwater drainage systems and installing stormwater filtration and infiltration BMPs to capture and treat runoff from parking lots, utilities, rooftops, storage areas, and other areas that may contribute pollutants to the stream. Cost estimate assumes 130,000 lf (approximately 30 acres) of 10 foot wide drainage swale improvements as a proxy for on-site source control BMPs.*	30	acre	1	$0	$0	$0	$0
3a.0.1	Zion, Beach Park	Manage and restore the wooded ravine along reaches BL25, BL26, and BL27. Average 5000' x 250' wide.	29	acre	1	$0	$0	$0	$0
3a.0.2	Zion, Beach Park	Preserve and restore wetlands along drainage channel upstream of the McClory Bike Path and the complex northwest of Lewis and 29th St., wetland #4 east of Lewis Avenue, and wetland #3 in Hermon Park (56 acres total). Regional storage area #77 and the associated wetlands (9 acres) could be restored and / or used to provide storage for this SMU if needed when the upstream area develops. Implementation details reflect wetland / hydric soils preservation and restoration.	65	acre	1	$0	$0	$0	$0
3a.0.4	Zion, Beach Park	Preserve and restore T&E habitat within the area bounded by Lebanon St., the McClory Bike Path, and 31st St.	6	acre	1	$0	$0	$0	$0
3a.0.5	Zion, Beach Park	*Improve any swale and other surface stormwater drainage systems and/or install source controls and lot level stormwater filtration and infiltration BMPs within the developed areas of the SMU. These practices may help reduce pollutant loading in potential pollution hotspot subasins S1, S3, S4, and S48. In order to generate cost and pollutant load reduction estimates, road swales are used as a proxy for individual site BMPs. Details reflect 252,000 lf (approximately 58 acre) of 10 foot wide drainage swale improvements on both side of all roads.*	61	acre	1	$0	$0	$0	$0

Table J6 Multiple Jurisdictions Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3a.25.1	Zion, Beach Park	*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	2000	lf	2	$50	$2	$200,000	$6,000
3a.25.2	Zion, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	2000	lf	2	$0	$0	$0	$0
3a.25.3	Zion, Beach Park	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	2000	lf	2	$0	$0	$0	$0
3a.25.5	Zion, Beach Park	Inspect hydraulic structure for possible erosion problems and stabilize using bioengineering practices if needed.	1	ea	1	$0	$0	$0	$0
3a.27st.1	Zion, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	4000	lf	2	$0	$0	$0	$0
3b.0.1	Beach Park, Waukegan	Preserve and restore wetlands where these resource remain along drainage channel BL15, BL16, BL17, and along the daylit portions of the Wilson Avenue Tributary. Area is 10,000 lf by 300' wide.	69	acre	1	$0	$0	$0	$0
3b.0.4	Beach Park, Waukegan	*Preserve greenway easements on Category 1 and 2 green infrastructure areas along BL16, which may help reduce pollution loading in potential pollution hotspot S57. Cost estimate assumes easements of 2000 lf by 100 ft wide (4.5 acres).*	5	acres	1	$0	$0	$0	$0
3b.0.6	Beach Park, Waukegan	*Depressional storage areas #32 and #43, currently undeveloped and containing current or former wetlands, could be enhanced to improve water quality of runoff from surrounding residential uses within this Critical Subbasin #57, identified as a potential pollutant loading hotspot. Depressional area #43 lies in an open Category 1 green infrastructure area that could be preserved for water quality improvement. Details reflect restoration and enhancement of both areas as wetlands.*	13	acres	1	$0	$0	$0	$0
3b.0.7	Beach Park, Waukegan	*Improve swales and other surface stormwater drainage systems and install source controls and lot level BMPs, including detention basin improvements, within the developed areas of potential pollutant loadin hotspots S57, S59, and S63. Details reflect 165,000 lf (approximately acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	38	acres	1	$0	$0	$0	$0

Table J6 Multiple Jurisdictions Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3b.15.1	Beach Park, Waukegan	Restore stream channel and improve instream habitat by enhancing pools and riffles.	2800	lf	1	$0	$0	$0	$0
3b.15.2	Beach Park, Waukegan	*Address High streambank erosion along entire reach using bioengineering stabilization measures.*	2800	lf	2	$100	$2	$560,000	$8,400
3b.15.3	Beach Park, Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	2800	lf	2	$0	$0	$0	$0
3b.15.4	Beach Park, Waukegan	Inspect footbridges and armored / concrete-lined banks for impacts on the stream corridor and remediated if necessary.	1	ea	1	$0	$0	$0	$0
3b.15.5	Beach Park, Waukegan	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	2800	lf	2	$0	$0	$0	$0
3b.15.6	Beach Park, Waukegan	Inspect and, if necessary, repair the culvert under the McClory Bike Trail, which is partially collapsed.	1	ea	1	$0	$0	$0	$0
3b.15.7	Beach Park, Waukegan	*Remove debris obstructing flow using American Fisheries Society guidelines.*	1	ea	1	$0	$0	$0	$0
3b.15.8	Beach Park, Waukegan	*Stabilize typical 4-6 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100	lf	1	$100	$2	$10,000	$150
3b.15.9	Beach Park, Waukegan	*Stabilize erosion of the Beach Road steel culvert experiencing erosion around and underneath using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.15.13	Beach Park, Waukegan	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.15.14	Beach Park, Waukegan	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.15.15	Beach Park, Waukegan	*Stabilize erosion around clay drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.16.1	Beach Park, Waukegan	*Restore stream channel and improve instream habitat by enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.*	3500	lf	1	$0	$0	$0	$0

Table J6 Multiple Jurisdictions Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3b.16.2	Beach Park, Waukegan	*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	3500	lf	2	$50	$2	$350,000	$10,500
3b.16.3	Beach Park, Waukegan	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	3500	lf	2	$0	$0	$0	$0
3b.16.4	Beach Park, Waukegan	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	3500	lf	2	$0	$0	$0	$0
3b.15.16	Beach Park, Waukegan	*Stabilize erosion around two plastic drain pipe outfalls using bioengineering stabilization measures.*	2	ea	1	$0	$0	$0	$0
3b.15.17	Beach Park, Waukegan	*Stabilize erosion around concrete drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
3b.18.1	Beach Park, Waukegan	*BL18 flows through and near several publicly owned, open and partially open areas on or adjacent to the Waukegan Regional Airport property sourthwest of the Wadsworth Rd / Lewis Ave intersection. These areas include depressional storage area #34, which could be expanded and enhanced for stormwater storage and to capture and cleanse water runoff from airport property, which lies in Critical Subbasin #69, a potential pollutant loading hotspot.*	7	acres	1	$0	$0	$0	$0
3b.18.2	Beach Park, Waukegan	Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.	700	lf	2	$50	$2	$70,000	$2,100
3b.18.3	Beach Park, Waukegan	The culvert draining Waukegan Airport is covered with wire fencing, presumably for security or to prevent animal invasion. However, investigate source and necessity, and remove if fencing impedes flow. It appears that strong flows exit the Airport property in this location.	1	ea	1	$0	$0	$0	$0
3c.0.2	Beach Park, Zion	Manage and restore the wooded ravine along reaches BL07, BL08, BL09, BL10, BL11, BL19, BL20, BL21. Assumes 18,600 lf of stream by average 250' wide.	107	acres	1	$0	$0	$0	$0
3c.0.4	Beach Park, Zion	Preserve and restore wetlands along drainage channels BL21, BL22, BL23, BL24. Assumes 10,300 lf by 350' wide.	83	acres	1	$0	$0	$0	$0

Table J6 Multiple Jurisdictions Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.0.5	Beach Park, Zion	Preserve Category 1 green infrastructure area bounded by the McClory Bike Path, Clover, Wadsworth, and 34th St. that borders the stream channel to the north. Also preserve three separate areas through which the stream corridor runs: one along BL07 within the ravine, the second at the confluence of BL08, BL09, and BL19, and the third just upstream of this confluence along BL09.	11	acres	1	$0	$0	$0	$0
3c.0.6	Beach Park, Zion, Waukegan	*Install filtration BMPs for commercial, industrial, and institutional uses along Sheridan Road, Wadsworth, and Lewis Avenue, which will help reduce pollutant loading in potential pollution hotspot subbasin #64. Details reflect 12,000 lf of road frontage along these uses to be treated with improved, 10' swales (approximately 2.75 acres.)*	3	acres	1	$0	$0	$0	$0
3c.0.7	Beach Park, Zion, Waukegan	*Install lot level filtration and infiltration BMPs within potential pollution hotspot subbasin #64. Details reflect 208,000 lf (approximately 48 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	48	acres	1	$0	$0	$0	$0
3c.0.8	Beach Park, IDNR	Preserve the Category 1 open green infrastructure area that contains depressional storage area #45 along the west side of the Union Pacific rails.	5	acres	1	$0	$0	$0	$0
3c.7.1	Beach Park, IDNR	*Stabilize High streambank erosion along approximately 25% of this reach not included in the previous stabilization project, some threatening homes and property, using bioengineering stabilization measures.*	500	lf	2	$100	$2	$100,000	$1,500
3c.7.2	Beach Park, IDNR	*Manage native riparian plant communities within this reach: control invasive species, plant native species, and manage vegetation such as through prescribed burning.*	1800	lf	2	$0	$0	$0	$0
3c.21.1	Beach Park, Zion	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	3500	lf	2	$50	$2	$350,000	$10,500
3c.21.2	Beach Park, Zion	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	3500	lf	2	$0	$0	$0	$0
3c.21.3	Beach Park, Zion	*Repair the discharge point / failed headwall approximately 200' upstream of the McClory Bike Path.*	1	ea	1	$0	$0	$0	$0
3c.21.4	Beach Park, Zion	*Stabilize channel erosion at outfall, and consider replacing rip rap control measure with bioengineering stabilization practices.*	1	ea	1	$0	$0	$0	$0
3c.21.5	Beach Park, Zion	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0

Table J6 Multiple Jurisdictions Plan Implementation Cost Estimate (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Quantity	Unit	# of sides	Initial Unit Cost ($)	Annual Unit Cost ($)	Estimated Total Initial Cost ($)	Estimated Total Annual Cost ($)
3c.21.6	Beach Park, Zion	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	1	ea	1	$0	$0	$0	$0
4.0.2	Waukegan, Beach Park	Manage and restore the woodland ravine along reach BL05. Assumes 5000' by 500' area for cost estimation purposes.	58	acre	1	$0	$0	$0	$0
4.0.4	Waukegan, Beach Park	Preserve and restore the wetland complex within the open, Category 1 green infrastructure area along the eastern boundary of SMU 4 west of the Union Pacific rail line. This area creates a physical land connection between Lyons Woods and Illinois Beach State Park, and would also preserve regional storage area #17.	37	acres	1	$0	$0	$0	$0
4.05.1	Waukegan, Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation.*	3000	lf	2	$50	$2	$300,000	$9,000
4.05.2	Waukegan, Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	3000	lf	2	$0	$0	$0	$0
6.0.2	Waukegan, IDNR, Lake County	*Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park.This may help address potential pollutant loading hotspot S75*	A/R	-	-	-	-	-	-

Table J7 Unit Cost information for Dead River Watershed Management Plan

Category	Action Recommendations	Details	Initial Cost	Annual Cost	Unit	Admin / Tech Support	Comment
Natural Resource Restoration and Management	Wooded bank burn management		$10	$1.50	lf	M	
	Initial clearing and herbiciding (2-year cycle)						
	Assume 30 feet on each side of stream						
	Annual fire ~ 30 ft buffer (0.0007 ac/ft)						
	Woodland management		$8,000	$1,700.00	acre	M	
	Initial clearing and herbiciding (2-year cycle)						
	Annual burning						
	Wetland Management and Restoration		$5,000	$200.00	acre	M	
	Invasive species control						
	Natural Area Management and Restoration		$7,500	$1,700.00	acre	M	
	Clearing and burning						
	Lake / Pond / Shoreline Management and Restoration		$2,500	$500	acre	M	
Native Riparian Buffers	Establish, restore, and manage native riparian buffer		$25	$1.50	lf	L	
	Initial clearing and herbiciding (2-year cycle)						
	Seeding and plugging						
	Annual fire ~ 30 ft buffer (0.0007 ac/ft)						
	Riparian buffer management		$7	$1.50	lf	L	

Table J7 Unit Cost information for Kellogg Creek and Dead River Watershed Management Plan (continued)

Category	Action Recommendations	Details	Initial Cost	Annual Cost	Unit	Admin / Tech Support	Comment
Category	Action Recommendations	Details	Initial Cost	Annual Cost	Unit	Admin / Tech Support	Comment
Natural Resource Restoration and Management	Wooded bank burn management		$10	$1.50	lf	M	
	Initial clearing and herbiciding (2-year cycle)						
	Assume 30 feet on each side of stream						
	Annual fire ~ 30 ft buffer (0.0007 ac/ft)						
	Woodland management		$8,000	$1,700.00	acre	M	
	Initial clearing and herbiciding (2-year cycle)						
	Annual burning						
	Wetland Management and Restoration		$5,000	$200.00	acre	M	
	Invasive species control						
	Natural Area Management and Restoration		$7,500	$1,700.00	acre	M	
	Clearing and burning						
	Lake / Pond / Shoreline Management and Restoration		$2,500	$500	acre	M	
Native Riparian Buffers	Establish, restore, and manage native riparian buffer		$25	$1.50	lf	L	
	Initial clearing and herbiciding (2-year cycle)						
	Seeding and plugging						
	Annual fire ~ 30 ft buffer (0.0007 ac/ft)						
	Riparian buffer management		$7	$1.50	lf	L	
	Native buffer (5' width) within lawns / golf courses along shoreline		$1	$0.10	lf	L	

Table J7 Unit Cost information for Kellogg Creek and Dead River Watershed Management Plan (continued)

Category	Action Recommendations	Details	Initial Cost	Annual Cost	Unit	Admin / Tech Support	Comment
Streambank Stabilization	Minor regrading (assumes 2' high bank)		$40	$1.50	lf	H	
	Regrading, seed, blanket						
	Annual fire ~ 30 ft buffer (0.0007 ac/ft)						
	Detention Basin Retrofits					H	
	Create wet / wetland basin		NA	NA	ft cu		
	Stabilize / regrade shoreline		$100	$1.50	lf		
	Plant banks / buffer with native vegetation		$25	$1.50	lf		
	Inlet / outlet remediation		NA	NA	ea		
	Algae control		$2,500	$250.00	ea		
	Turbidity control		NA	NA	ft cu		
	Debris removal		NA	NA	ea		
Green Infrastructure Protection	Protect Green Infrastructure Parcels		$10,000	$500	acre	M	
	purchase / easement						
	Conversion of depressional areas to storage and water quality enhancement		$3,500	$500	acre	H	
Discharge Point Remediation	Point Discharge Erosion / Stabilization		$3,000	$500	ea	M	
	Assumes 20lf of severe streambank erosion						
	Point Discharge Repair (major headwall or pipe failure)		$6,000	$500	ea	H	
	Plastic Drain Remediation (redirection, BMP installation, flow attenuation)		$1,000	$150	ea	L	

Table J7 Unit Cost information for Kellogg Creek and Dead River Watershed Management Plan (continued)

Category	Action Recommendations	Details	Initial Cost	Annual Cost	Unit	Admin / Tech Support	Comment
Culvert Remediation	Culvert Repair / Stabilization		$5,000	$0	ea	H	
Debris & Sediment Removal	Sediment / debris removal from culvert / outfall (annual cost reflects single inspection per year)		$450	$50	ea	M	
	Sediment removal from channel		$20	$0	lf	M	
	Debris removal / clean up (annual monitoring)		$1,500	$50	ea	L	
Monitoring	Annual monitoring / inspection, single stream point		$125	$75	ea	L	
	Annual monitoring inspection, reach		$750	$600	ea	L	
	Inspect / inventory detention basin		$350	$0	ea	L	
Administrative / Planning						M	

appendix J - implementation plan cost estimate

appendix K - watershed pollutant loading and plan implementation pollutant loading estimates

This appendix includes a variety of tables containing information pertaining to watershed pollutant loading and reduction estimates. Table K1 presents non-point source pollutant loading estimates by subbasin for 12 common pollutants. Tabel K2 presents pollutant loading assumptions by land use category, and Table K3 presents the assumed land use category used for estimating pollutant loading for the land use categories provided by each municipality. The relative contribution of each of the 12 pollutants presented in Table K1 is displayed on the maps in Appendix M.

Tables K4 through K9 present the estimated pollutant load / impairment reductions expected for implementing the recommendations in the action plan of Chapter 5. Pollutant and impairment reduction projections are best estimates and/or ranges of impairment reduction that can be achieved for recommended actions for the quantities (e.g., acres, linear feet of stream) indicated. Impairment reduction estimates, whether indicated as quantities, as ranges of percentages, or as an estimated ability to meet reduction targets, are based on a variety of studies examining the potential effectiveness of different actions and best management practices. Results from the various studies are included in Tables K10 to K18.

Impairment reduction targets are indicated in Tables K4 through K9 in two ways and are based on professional opinion of feasibility. First, Impairment Reduction Targets indicate the potential reduction of the indicated impairment based on full (100%) implementation of the recommended action. For example, if all of the recommended actions intended to address sediment / Total Suspended Solids were to be fully implemented, then 75% of the sediment / Total Suspended Solids impairment, or problem, can reasonably be expected to be addressed. In other words, even under the best conditions, the entire sediment / Total Suspended Solids problem could not be addressed because it is likely that there will always be some erosion and runoff of sediment from the urban landscape into the stream. Nonetheless, a 75% reduction in Total Suspended Solids / sediment loading would be a successful achievement for watershed improvement.

Area Improvement Targets indicate the area that can reasonably be expected to be addressed by each of the recommended actions. For example, many of the wetland restoration recommendations have an Area Improvement Target of 75%, indicating that 75% of the wetland can reasonably be expected to be restored to a healthy condition. For wetlands, an improvement of 100% is considered unattainable given the hydrologic and stormwater issues of the watershed.

Impairment Reduction Projections are best estimates and/or ranges of impairment reduction that can be achieved for recommended actions for the quantities (e.g., acres, linear feet of stream) indicated. Impairment reduction estimates, whether indicated as quantities, as ranges of percentages, or as an estimated ability to meet reduction targets, are based on a variety of studies examining the potential effectiveness of different actions and best management practices. improve watershed resources. Where actual figures in pounds per year (lbs/yr) are shown for Total Suspended Solids / sediment and for phosphorous, these figures represent expected load reductions for these two constituents. Figures are estimated based on research of the practices and the recommended area to be treated. Where a range of percentages is shown, this range indicates the broadest possible range of effectiveness based on research. Properly installed and implemented practices can be expected to reduce the impairment by a percentage within the range indicated. Where a 1, 2, or 3 is indicated, these numbers represent the potential ability to meet reduction target using a three-point scale where 1 represents 0-33% effective, 2 represents 34-66% effective, and 3 represents 67-100% effective. These rankings are based on both research and professional opinion of the planning team.

appendix K - watershed pollutant loading and plan implementation pollutant loading reduction estimates

Table K.1. Dead River Subwatershed Pollutant Loading

Subbasin	Acres	TSS	TP	COD	BOD	TDS	TN	TKN	DP	Cad	Lead	Cop	Zn
		(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac
1	137	1.06	945	367	29.90	2208	7.76	7.63	0.23	0.01	0.97	0.20	1.45
2	534	0.70	576	231	22.04	1332	5.68	4.56	0.19	0.00	0.55	0.12	0.87
3	36	0.82	688	266	21.97	1611	5.71	5.68	0.18	0.01	0.69	0.15	1.06
4	171	0.83	666	244	24.03	1278	6.02	5.22	0.22	0.00	0.58	0.12	0.97
5	12	0.28	218	91	4.86	742	1.33	2.03	0.04	0.00	0.24	0.05	0.31
6	114	0.62	447	174	16.08	1012	4.24	3.76	0.15	0.00	0.43	0.09	0.73
7	132	0.51	394	128	12.66	674	4.35	2.96	0.16	0.00	0.25	0.06	0.48
8	246	0.56	435	115	14.94	716	4.40	2.25	0.26	0.01	0.52	0.08	0.51
9	45	0.86	554	228	23.63	1172	6.30	5.00	0.22	0.00	0.55	0.11	1.11
10	252	0.92	804	273	27.39	1613	7.44	5.40	0.31	0.01	0.90	0.16	1.12
11	84	1.00	767	311	29.09	1728	7.63	6.44	0.25	0.01	0.78	0.16	1.35
12	39	0.13	23	16	0.47	249	0.22	0.47	0.03	0.00	0.01	0.00	0.03
13	167	1.04	882	331	32.60	1811	8.39	6.63	0.30	0.01	0.86	0.17	1.32
14	130	0.79	656	243	23.12	1455	6.22	4.92	0.23	0.01	0.73	0.14	1.01
15	87	0.83	696	171	24.21	960	7.09	3.21	0.42	0.01	0.85	0.12	0.79
16	228	0.59	463	175	16.58	1047	4.33	3.60	0.16	0.00	0.46	0.09	0.69
17	90	0.44	340	96	11.21	629	3.21	1.94	0.19	0.01	0.38	0.06	0.39
18	21	0.62	466	106	17.08	615	5.17	1.94	0.33	0.01	0.59	0.08	0.52
19	5	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
20	193	0.34	210	54	7.49	400	2.31	1.08	0.16	0.00	0.25	0.03	0.24
21	123	0.14	32	20	0.67	271	0.27	0.54	0.03	0.00	0.02	0.00	0.05
22	21	0.37	274	114	8.46	776	2.31	2.52	0.07	0.00	0.29	0.06	0.46
23	140	0.20	86	48	5.23	387	1.35	0.81	0.07	0.00	0.06	0.01	0.12
24	114	0.27	123	60	6.59	394	1.79	1.21	0.08	0.00	0.10	0.02	0.24
25	249	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
26	82	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
27	92	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
28	205	0.68	531	127	18.83	746	5.64	2.37	0.35	0.01	0.67	0.09	0.61
29	50	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
30	112	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
31	415	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
32	136	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
33	186	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
34	153	0.60	446	163	15.68	951	4.63	3.52	0.18	0.00	0.45	0.09	0.71
35	7	0.20	74	37	2.58	344	0.77	0.90	0.05	0.00	0.06	0.01	0.14
36	97	0.70	503	197	18.97	1087	4.94	4.30	0.17	0.00	0.48	0.10	0.86
37	138	0.28	136	61	3.72	573	1.19	1.43	0.06	0.00	0.13	0.03	0.20
38	174	0.60	425	139	17.78	778	4.98	2.64	0.25	0.01	0.48	0.08	0.62
39	96	0.75	627	212	25.49	953	6.01	4.19	0.25	0.00	0.41	0.09	0.68
40	15	1.04	1221	468	28.19	3212	7.32	9.91	0.12	0.01	1.44	0.30	1.73

Table K.1. Dead River Subwatershed Pollutant Loading (continued)

Subbasin	Acres	TSS	TP	COD	BOD	TDS	TN	TKN	DP	Cad	Lead	Cop	Zn
		(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac	(lb/yr)/ac
41	141	0.66	447	154	18.10	854	5.06	3.20	0.24	0.01	0.49	0.09	0.73
42	97	0.78	518	212	20.78	1157	5.55	4.57	0.20	0.00	0.51	0.11	0.99
43	121	0.80	614	257	29.66	1330	7.49	4.66	0.26	0.00	0.58	0.12	0.98
44	34	0.70	503	145	19.97	734	5.68	2.90	0.30	0.01	0.56	0.09	0.70
45	19	0.75	474	174	20.20	907	5.59	3.74	0.24	0.01	0.50	0.09	0.87
46	156	0.49	380	148	11.66	995	3.20	3.17	0.12	0.00	0.42	0.08	0.60
47	11	0.33	245	84	8.32	496	2.01	1.83	0.10	0.00	0.16	0.04	0.26
48	63	0.91	705	282	26.26	1579	6.82	5.97	0.22	0.01	0.71	0.15	1.21
49	201	0.51	343	127	13.58	663	3.56	2.79	0.15	0.00	0.26	0.06	0.52
50	98	0.56	346	141	15.43	741	4.04	3.04	0.16	0.00	0.31	0.06	0.64
51	280	0.70	505	205	18.82	1156	5.01	4.47	0.16	0.00	0.52	0.11	0.93
52	99	0.57	410	164	15.61	900	4.19	3.58	0.14	0.00	0.40	0.08	0.74
53	131	0.59	364	151	16.04	801	4.49	3.26	0.16	0.00	0.33	0.07	0.70
54	50	0.62	505	188	17.91	1017	4.56	4.04	0.16	0.00	0.46	0.10	0.76
55	31	0.53	421	176	15.57	1050	4.12	3.62	0.12	0.00	0.45	0.09	0.72
56	439	0.50	428	166	13.61	1068	3.84	3.47	0.12	0.00	0.45	0.09	0.64
57	168	0.87	817	283	26.57	1530	6.43	5.92	0.23	0.01	0.68	0.15	0.98
58	174	0.37	236	102	10.44	598	2.77	2.08	0.10	0.00	0.22	0.05	0.42
59	100	1.00	784	297	28.21	1611	7.32	6.29	0.26	0.01	0.72	0.15	1.23
60	215	0.83	547	204	23.65	943	6.21	4.43	0.25	0.00	0.43	0.09	0.91
61	108	0.65	574	228	18.77	1398	5.15	4.75	0.14	0.00	0.59	0.12	0.89
62	39	0.68	308	129	16.18	613	4.93	3.02	0.20	0.00	0.23	0.05	0.69
63	69	0.99	827	318	28.07	1802	7.25	6.74	0.23	0.01	0.82	0.17	1.32
64	192	0.84	644	264	24.57	1509	6.59	5.41	0.21	0.01	0.65	0.14	1.12
65	197	0.67	436	162	17.71	850	4.89	3.56	0.20	0.00	0.38	0.08	0.73
66	355	0.64	416	170	17.41	935	4.69	3.65	0.17	0.00	0.42	0.09	0.79
67	106	0.43	320	96	10.30	481	3.88	2.30	0.15	0.00	0.20	0.04	0.38
68	123	0.15	36	22	1.25	259	0.43	0.58	0.04	0.00	0.02	0.01	0.07
69	209	1.08	1303	508	29.40	3496	7.55	10.78	0.10	0.01	1.54	0.32	1.86
70	97	0.25	128	55	4.33	437	1.21	1.29	0.06	0.00	0.12	0.02	0.21
71	91	0.80	534	221	21.43	1209	5.73	4.85	0.19	0.00	0.55	0.11	1.05
72	263	0.70	529	211	18.71	1236	4.92	4.47	0.17	0.00	0.52	0.11	0.89
73	38	0.91	647	245	30.16	1257	8.04	4.57	0.33	0.01	0.68	0.12	1.07
74	59	0.81	638	157	25.51	837	7.44	2.64	0.44	0.01	0.79	0.11	0.73
75	232	1.05	942	291	34.28	1759	9.40	5.17	0.45	0.01	1.12	0.19	1.15
76	204	0.92	799	209	26.57	1233	7.80	3.99	0.43	0.01	1.00	0.15	0.95
77	60	0.13	20	15	0.40	241	0.20	0.44	0.03	0.00	0.01	0.00	0.03
Total	7896	44.8	33583	12356	1210	73580	328	258	13.2	0.33	34.0	6.6	51.1

Table K.2. Pollutant Loading Assumptions by Land Use Category

	TSS		TP		COD		BOD		TDS		TN
	Sewered	Unsewered	Sewered	Unsewered	Sewered	Unsewered	Sewered	Unsewered	Sewered	Unsewered	Sewered
	(lbs/Ac/Yr)		(lbs/Ac/Yr)		(lbs/Ac/Yr)		(lbs/Ac/Yr)		(lbs/Ac/Yr)		(lbs/Ac/Yr)
Commercial	1180	1040	1.3	1.2	589	520	85	75	2830	2500	21
Industrial	1240	1080	1.5	1.3	260	230	50	40	1290	1130	14
Institutional	1320	790	1.4	0.8	320	190	52	31	623	374	11
Transportation	2260	1330	1.8	1.1	881	518	50	30	6060	3565	13
Multi-Family	1320	1050	1.4	1.1	320	260	52	42	623	498	11
Residential	309	154	0.81	0.4	140	71	22	11	436	218	6
Agricultural	307	307	0.36	0.36	55	55	6	6	178.4	178.4	4.8
Vacant	100	40	0.22	0.088	64	26	2	0.9	1210	483	1
Open Space	61	20	0.39	0.13	46	15	1	0.4	724	241	1
*Use Unsewered values for all residential parcels											

	TKN		DP		Cad		Lead		Cop		Zn	
Unsewered	Sewered	Unsewered	Sewered	Unsewered	Sewered	Unsewered	Sewered	Unsewered	Sewered	Unsewered	Sewered	Unsewered
	(lbs/Ac/Yr)		(lbs/Ac/Yr)		(lbs/Ac/Yr)		(lbs/Ac/Yr)		(lbs/Ac/Yr)		(lbs/Ac/Yr)	
18	6.9	6.1	0.69	0.61	0.008	0.0071	1.03	0.909	0.2	0.18	1.6	1.4
12	4	4	0.86	0.75	0.025	0.022	1.58	1.39	0.21	0.18	1.3	1.2
6.5	6.4	3.8	0.61	0.36	0.0037	0.0022	0.367	0.22	0.1	0.061	0.57	0.34
7.7	18	11	0.2	0.1	0.021	0.012	2.67	1.57	0.56	0.33	3.2	1.9
8.6	6.4	5.1	0.61	0.48	0.0037	0.003	0.367	0.294	0.1	0.081	0.57	0.46
3.1	3.2	1.6	0.26	0.13	0.002	0.001	0.234	0.117	0.048	0.024	0.9	0.45
4.8	1.82	1.82	0.17	0.17	0.0003	0.0003	0.005	0.005	0.0088	0.0088	0.138	0.138
0.5	2.2	0.88	0.1	0.05	0.0003	0.0001	0.027	0.011	0.01	0.004	0.1	0.06
0.2	1.3	0.44	0.08	0.03	0.0002	0.0001	0.016	0.0054	0.01	0.002	0.08	0.03

Table K.3. Land Use Categories Used for Pollution Loading Estimates

WI landuse types	Assumed Type
Agriculture	Agriculture
Forest/ grassland	Open Space
Multi-family Residential	Residential
Open Water	Open Space
Public and Private Open Space	Open Space
Retail/ Commercial	Commercial
Single Family Residential	Residential
Transportation	Transportation
Wetlands	Open Space
IL Landuse Types	**Assumed Type**
Agricultural	Agricultural
Forest and Grassland	Open Space
Government and Institutional	Institutional
Industrial	Industrial
Multi Famliy	Residential
Office	Commercial
Public and Private Open Space	Open Space
Retail/ Commercial	Commercial
Single Family	Residential
Transportation	Transportation
Utility and Waste Facilities	Industrial
Water	Open Space
Wetlands	Open Space

Table K.4. City of Zion Plan Implementation Pollutant Load Reduction Estimates

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
1.0.1	Zion	*Preserve Category 1 and 2 green infrastructure open space areas to connect the North and South units of Illinois Beach State Park, enhance recreational opportunities, and expand and restore important rare habitat. Decommission and remove the power plant and associated structures. Acreage count includes private / utility owned land within the area. It is assumed that restoration would address the potential pollutant loading hotspots identified as Critical Subbasins #15 and #74.*	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.0.3	Zion	*Manage / minimize runoff impacts of commercial land uses along Sheridan Road, particularly at Sheridan and 33rd St and Sheridan and 27th, 28th, and 29th along the stream. Cost estimate assumes 8400 lf of Sheridan Road frontage treated with improved, 10' swales (approximately 2 acres) as a proxy for on-site source control BMPs.*	100%	4,620	5	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
2.0.6	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/ or debris buildup; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin; remove excess debris.	100%	883	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
2.0.7	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin; remove excess debris. This is depressional area #54.	100%	1,606	3	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
2.0.8	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads by naturalizing the basin; remove excess debris.	100%	1,686	3	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
2.0.9	Zion	Address algae / nutrient loads by naturalizing the basin.	100%	1	3	3	NA	1	1	NA	NA	1	1	NA	NA	NA	NA
2.28.1	Zion	Restore stream channel and improve instream habitat by installing pools and riffles.	25%	1	1	1	1	NA	3	NA	NA	NA	NA	1	NA	NA	NA
2.28.2	Zion	*Restore and manage the channel, native riparian buffers, and ravine woodland system, particularly the reach running through Ophir Park west of Sheridan Road, and Carmel Park east of Sheridan Road. Management practices include controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.*	100%	4,336	7	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2

Table K.4. City of Zion Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
2.28.3	Zion	*Stabilize and reduce downcutting of the incised channel through Ophir Park, and install a naturalized riparian buffer. Cost estimate assumes stabilization of streambanks with Moderate erosion problem.*	100%	29,700	14	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
2.28.4	Zion	Manage the culvert outflow at the upstream end of the reach for energy dissipation and pollutant removal, possibly with a settling basin or small constructed wetland.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
2.28.5	Zion	*Stabilize Moderate streambank erosion along the entire reach using bioengineering stabilization measures, which will help reduce the instream silt / sedimentation load within this reach.*	100%	106,920	49	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
2.28.6	Zion	Remove debris, tires, and logs using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
2.28.7	Zion	Remove debris obstructing flow using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
2.28.8	Zion	Remove concrete debris and remove or repair failed headwall and outfall pipe.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
2.28.9	Zion	*Stabilize major erosion, bank slumping / blowout, and headwall failure at upstream end of the reach near the culvert. Use bioengineering stabilization measures if possible, and more structural measures if necessary. Cost estimate reflects stabilization of severe erosion problem.*	100%	130	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
2.28.10	Zion	*Stabilize 4 foot diameter plunge pool erosion below outfall. If feasible use bioengineering measures, though rip rap and structural measures may be necessary.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
2.28.11	Zion	*Stabilize bank erosion caused by stormwater outfall using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
2.28.12	Zion	Inspect and, if necessary, repair five culverts under trail, which may be crushed and/or failing.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.0.3	Zion	Preserve approximately 21 acres of wetland and stream corridor open and partially open Category 1 green infrastructure areas and greenways within the headwaters of the 27th St tributary. Target areas are located (1) southwest of 25th St and Galilee, (2) south of Jethro and 26th Street, (3) west of 26th and Lewis, (4) southeast of 26th and Lewis, (5) northwest of 29th and Lewis.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table K.4. City of Zion Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3a.0.7	Zion	Manage the golf course grounds and detention / water features in Shiloh Park, in the northeast corner of the SMU for water quality and habitat benefits, including installation of a 5 foot riparian buffer along shoreline / banks of water features.	100%	1,847	3	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3a.0.8	Zion	FPAI site 20-13 experiences local drainage problems due to runoff from the west. Retrofit David Park and the school property west of the problem area with detention or infiltration practices to reduce runoff rate and volume.	100%	2	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	3	1	NA
3a.0.9	Zion	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a minimum 5 ft buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin.	100%	281	0	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3a.0.10	Zion	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3a.0.11	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation.	100%	241	0	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3a.0.12	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	100%	321	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3a.0.13	Zion	Retrofit as wet / wetland basin; plant banks and a minimum 5 ft surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; retrofit bottom concrete channel.	100%	321	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3a.0.14	Zion	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; remove excess debris.	100%	562	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3a.0.15	Zion	Stabilize / regrade shoreline using bioenginnering practices and native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrient loads by naturalizing the basin; remove excess debris.	100%	610	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3a.0.16	Zion	Stabilize / regrade shoreline and plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation.	100%	642	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3a.0.17	Zion	Plant banks and a minimum 5 ft surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	100%	1,124	2	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA

Table K.4. City of Zion Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3a.27.1	Zion	Restore and manage the native riparian buffer plant communities along this reach within Sharon Park by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer may be appropriate in the lower parts of the reach.	100%	3,212	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3a.27.2	Zion	Address High streambank erosion along entire reach using bioengineering stabilization measures, some of which may threaten buried sewer lines.	100%	518,400	216	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.27.3	Zion	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3a.27.4	Zion	*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.27.5	Zion	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3a.27.6	Zion	*Stabilize significant erosion and exposure of manhole and sewer infrastructure using bioengineering stabilization measures and other hardscape solutions to ensure protection of the infrastructure elements. Length difficult to determine from photo; assume 100 lf for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.27.7	Zion	*Stabilize erosion creating open channel at discharge point using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.27.8	Zion	*Remediate significant erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 150 lf for cost estimation purposes.*	100%	19,440	8	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.27.9	Zion	*Stabilize erosion at outfall that is creating an open channel using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.27.10	Zion	*Stabilize major erosion, headwall, and outfall pipe failure using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.27.11	Zion	*Stabilize minor channel erosion using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.4. City of Zion Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.22.1	Zion	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	100%	1,927	3	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.22.2	Zion	Remove debris obstructing flow using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
1.0.3	Beach Park	Preserve and restore open and partially open green infrastructure bounded by North Ave, York House Road, Sheridan Road, and residential areas to the north (spanning SMUs #1, #3b, and #3c) for natural resource restoration and management and recreation. Preserving two corridors (19 acres) east of Sheridan Road would connect this piece to the larger Illinois Beach State Park system. The area also contains storage area #30 and potential storage area #27, which may help reduce flooding in the area of FPAI 20-02 along Coolidge Ave.	100%	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
1.0.8	Beach Park	Monitor IDOT-recorded flooding location at Sheridan and York House Road for further problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
1.0.9	Beach Park	Monitor IDOT-recorded flooding locations at Sheridan and Beach Road for further problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
1.0.14	Beach Park	Install filtration and infiltration BMPs for existing commercial properties along Sheridan Road. Cost estimate reflects 10' wide swale improvements (as a proxy for lot level / source control BMPs) along 1500 lf of Sheridan Road frontage.	100%	0	0	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
1.0.15	Beach Park	Improve any swale and other surface stormwater drainage systems within the developed areas of the western part of this SMU, which is mostly unsewered, and install stormwater filtration and infiltration BMPs. Details reflect 54,000 lf (approximately 12.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of roads within this part of the SMU.	75%	57,915	61	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
1.0.23	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
1.0.24	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
1.0.27	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
2.0.5	Beach Park	Monitor past IDOT-recorded flooding at Sheridan and Wadsworth for further problems and remediate if flooding continues.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3a.25.4	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3a.26.1	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	100%	3,212	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3a.26.2	Beach Park	Restore stream channel and improve instream habitat by installing & enhancing pools and riffles.	25%	1	1	1	1	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3a.26.3	Beach Park	*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt and sediment load.*	100%	79,200	36	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.26.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	2,200	5,280	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3a.26.5	Beach Park	Remove chain link fence placed across stream channel.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3a.26.6	Beach Park	*Remediate significant erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.26.7	Beach Park	Investigate and remediate collapsed pedestrian bridge in the stream channel.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	1	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3b.0.2	Beach Park	Consider daylighting and restoring as much of the Wilson Avenue Tributary (not inventoried) as possible through the residential areas. Daylighting and restoration should address concerns about the tank cars and transite pipes that are reported to transmit the flow below ground in this location.	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.0.3	Beach Park	Buffer the Wilson Avenue Tributary from encroachment by preserving open Category 2 green infrastructure areas.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	2	NA	NA	3
3b.0.5	Beach Park	Restore and manage the wetlands within the open and partially open Category 1 Green Infrastructure areas just north of Lyons Woods Forest Preserve; reconnect these wetlands to the Lyons Woods system.	75%	1,379	3	63% BOD	90% HC; 36-69% TM	NA	1	NA	3	NA	NA	NA	1	3	NA
3b.0.8	Beach Park	FPAI site 20-04, in the Village of Beach Park, experiences sewer backup into homes due to an inadequate drainage system. Investigate whether the remedial measure, a large pipe and ditch installed as part of the Monarch Point development to the north, fixed the problem. If not, remedial action should be taken, which may include working with the open areas identified on the SMU map to relieve drainage issues.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	1

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3b.0.9	Beach Park	FPAI site 20-05, in the Village of Beach Park, experiences road, home, and backyard flooding due to inadequate conveyance capacity of the open ditch and culvert, particularly the culvert under Yorkhouse Road. Remedial action may include retrofit / restoration of open green infrastructure areas to help absorb / store flood water.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	1
3b.0.10	Beach Park	The area where BL13, BL14, and BL15 come together is in need of a stream restoration plan to remediate the buildup of debris, concrete lined channels, underground culverts and railroad tank cars, yard waste in the stream channel, and other impacts from nearby residential areas.	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.0.11	Beach Park	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address turbidity / sedimentation by naturalizing the basin.	100%	642	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3b.0.13	Beach Park	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	100%	402	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3b.0.14	Beach Park	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	100%	402	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3b.0.17	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3b.0.18	Beach Park	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3b.0.19	Beach Park	Plant banks with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; remove excess debris.	100%	522	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3b.0.20	Beach Park	Convert to wet or wetland basin; plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	100%	683	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3b.0.21	Beach Park	Plant banks and a surrounding buffer with native vegetation; remove excess debris.	100%	964	2	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3b.12.1	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.*	25%	1	1	1	1	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.12.2	Beach Park	*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	100%	492,480	205	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3b.12.3	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	3,051	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3b.12.4	Beach Park	Investigate / inspect failed / broken concrete dam along west of Cheney / North Ave. for impact on stream, and remove impacting dam elements if found be have a negative impact.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3b.12.5	Beach Park	*Stabilize typical 1-2 foot erosion on right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	540	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.12.6	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3b.12.7	Beach Park	*Stabilize significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.12.8	Beach Park	*Remove debris and sediment from culvert under Beach Road.*	100%	1	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	NA	NA
3b.12.9	Beach Park	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.12.10	Beach Park	*Remediate erosion of open point discharge channel draining to the creek using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.13.1	Beach Park	Manage and restore the wooded ravine along reach BL13. Assumes an area 2500 lf by 150 ft in width for cost estimating purposes.	75%	1,674	4	63% BOD	90% HC; 36-69% TM	NA	3	1	3	3	2	1	1	1	1
3b.13.2	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and removing numerous debris jams according to the American Fisheries Society guidelines.*	25%	1	1	1	1	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.13.3	Beach Park	*Address High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	100%	777,600	324	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3b.13.4	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	4,818	8	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3b.13.5	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	3,300	11,880	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3b.13.6	Beach Park	Inspect footbridges and armored / concrete-lined banks and remediate if found to be negatively impacting the stream.	75%	197	0	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1
3b.13.7	Beach Park	*Restore channel reach near Wilson Avenue by installing pool and riffle structures and stabilizing streambanks.*	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.13.8	Beach Park	Remove concrete debris dumping / fill just upstream of Beach Rd culvert from property / operation at Tewes and Beach.	100%	NA	NA	NA	1	NA	NA	NA	NA	NA	1	1	NA	NA	1
3b.13.9	Beach Park	*Remediate significant erosion and slumping of right bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.13.10	Beach Park	*Inspect and assess fencing across channel and rock wall armoring and remove if found to impair the conveyance of water.*	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3b.13.11	Beach Park	*Remove concrete from channel and restore stream channel by stabilizing streambanks and installing habitat features such as pools and riffles and rootwads. Assumes 150 lf of stream channel needs attention for cost estimation purposes.*	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.13.12	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3b.13.13	Beach Park	*Remove debris and sediment from culvert under Beach Road.*	100%	1	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	NA	NA
3b.13.14	Beach Park	*Address failed concrete wall armoring and major erosion behind the armoring by removing the concrete and using bioengineering stabilization measures. Assumes 100lf of stream channel needs attention for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.13.15	Beach Park	*Repair or replace broken concrete and corrugated metal pipe culvert and remove debris obstructing flow.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3b.13.16	Beach Park	*Stabilize erosion at and below outfall using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.13.17	Beach Park	*Repair failed clay outfall pipe and address erosion around outfall using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.14.1	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	803	1	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3b.14.2	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	550	330	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3b.14.3	Beach Park	*Conduct major channel restoration by removing debris and restoring a natural channel to this concrete-lined drainage ditch.*	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.15.10	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.11	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.12	Beach Park	*Remove debris at the outfall discharge points.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3b.17.1	Beach Park	Restore stream channel and improve instream habitat by enhancing pools and riffles.	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.17.2	Beach Park	Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.	100%	95,040	43	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.17.3	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	100%	3,854	6	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3b.17.4	Beach Park	Inspect footbridges and armored / concrete-lined banks along this reach for impacts on the stream corridor and remediate if necessary.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3b.17.5	Beach Park	Remove broken concrete slab streambank armoring and restore channel to natural channel condition. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.17.6	Beach Park	Restore a minimum 5 foot wide, deep-rooted native plant buffer to the stream edge within the golf course.	100%	964	2	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3b.17.7	Beach Park	Remove debris at outfall.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3b.17.8	Beach Park	Stabilize significant erosion and bank slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.	100%	6,480	3	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.17.9	Beach Park	Remove debris blocking culvert and repair, remediate, and/or stabilize the exposed culvert.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.17.10	Beach Park	Stabilize erosion undermining the culvert, preferably using bioengineering stabilization measures but also using more structural measures if necessary.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.0.9	Beach Park	FPAI site 20-02, in the Village of Beach Park, experiences flooding due to inadequate outlets and poor drainage. There is a backyard drainage ditch between Beach and Howard, Sheridan and Geraghty (depressional storage #49) and extending along Coolidge Rd to the north (depressional storage #50) that are likely part of the cause of flooding. Investigate whether the new storm sewer along Coolidge Avenue has eliminated flooding in this location. If flooding persists, additionial solutions may include improvement of drainage overland flow paths and installation of additional storm sewer capacity to alleviate the problem.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3c.0.10	Beach Park	Monitor past IDOT-recorded flooding locations at Sheridan and Wadsworth, Sheridan and Talmadge / Michigan, and Sheridan and Beach Rd. to determine whether flooding is still occuring at these sites. If so, develop and implement flood mitigation strategies.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3c.0.14	Beach Park	Stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	100%	522	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.0.15	Beach Park	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and turbidity / sedimentation by naturalizing the basin.	100%	482	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3c.0.16	Beach Park	Retrofit as wet / wetland basin; stabilize / regrade shoreline and plant banks and a surrounding buffer with native vegetation.	100%	241	0	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3c.0.18	Beach Park	Plant banks and a surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup.	100%	301	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3c.7.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	1,980	4,277	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3c.7.4	Beach Park	Assess side slope seeps for restoration potential. Restore if possible.	75%	NA	NA	NA	NA	NA	1	NA	3	2	1	1	NA	NA	NA
3c.7.5	Beach Park	Remove massive debris jam approximately 300' downstream of Sheridan Road and stabilize channel.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.8.1	Beach Park	*Address High streambank erosion along entire reach, some threatening homes and property, using bioengineering stabilization measures.*	100%	518,400	216	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.8.2	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	100%	3,212	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.8.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	2,200	5,280	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3c.8.4	Beach Park	*Repair broken cement outfall pipe and stabilize surrounding erosion using bioengineering stabilization measures. Location is approximately 300' upstream of Sheridan Rd.*	100%	130	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.8.5	Beach Park	*Stabilize streambank erosion across from the sewer / manhole stabilization project along the reach near the Garaghty / California intersection. Length of problem is unknown; assume 50 lf and 1 side of stream for cost estimation purposes.*	100%	990	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.8.6	Beach Park	*Stabilize minor channel erosion and downcutting of channel outfall using bioengineering stabilization measures and energy dissipation measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.8.7	Beach Park	*Stabilize major erosion behind headwall and below outfall preferably using bioengineering stabilization measures but may also require more structural measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.8.8	Beach Park	*Stabilize moderate channel erosion and downcutting using bioengineering stabilization measures and, if necessary, check dams.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.8.9	Beach Park	*Address major erosion and slumping on left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	100%	6,480	3	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.8.10	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.8.11	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.8.12	Beach Park	*Monitor sewer manhole, which rises 6 feet above stream elevation, for leakage and infiltration problems.*	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3c.8.13	Beach Park	*Stabilize major erosion and slumping of ravine bank using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.8.14	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.9.1	Beach Park	*Restore stream channel and improve instream habitat by installing and enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.*	25%	1	1	1	1	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3c.9.2	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	100%	648,000	270	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.9.3	Beach Park	*Restore the native riparian buffer (manage native riparian plant communities within this reach: control invasive species, plant native species, thin shrub layer to allow more understory growth, and manage vegetation such as through prescribed burning.)*	100%	4,015	7	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.9.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	2,750	8,250	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3c.9.5	Beach Park	*Stabilize major erosion with slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	100%	6,480	3	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.9.6	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.9.7	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.9.8	Beach Park	*Remove debris around plastic outfall pipe.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.9.9	Beach Park	*Stabilize major erosion on the left bank using bioengineering stabilization measures.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.9.10	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.9.11	Beach Park	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.9.12	Beach Park	*Stabilize major erosion and slumping of the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.10.1	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation within this reach.*	100%	207,360	86	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.10.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	1,285	2	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.10.3	Beach Park	*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.10.4	Beach Park	*Stabilize erosion around capped outfall pipe using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.11.1	Beach Park	*Stabilize High streambank erosion along entire reach using bioengineering stabilization measures.*	100%	648,000	270	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.11.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	4,015	7	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.11.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	2,750	8,250	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3c.11.4	Beach Park	Remove debris obstructing culverts.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.11.5	Beach Park	Remove debris from outfall channel and assess armoring for impact on stream; if negative impact is found, remove armoring and stabilize with bioengineering approach.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.11.6	Beach Park	*Stabilize major erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.11.7	Beach Park	*Repair / remediate erosion below outfall using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.11.8	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.11.9	Beach Park	*Stabilize major erosion occurring behind armoring on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.11.10	Beach Park	*Assess wood armoring / retention wall for stability and feasibility of bioengineered approach to bank stabilization. Assumes 100lf of stream channel, both sides for cost estimation purposes.*	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3c.19.1	Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	100%	75,240	34	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.19.2	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	3,051	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.19.3	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	2,090	4,765	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3c.19.4	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.19.5	Beach Park	*Stabilize significant erosion and slumping on the left bank using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.19.6	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams or other grade stabilization measures if necessary.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.19.7	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.20.1	Beach Park	Restore stream channel and improve instream habitat by installing and enhancing pools and riffles.	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3c.20.2	Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	100%	142,560	65	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.20.3	Beach Park	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	5,782	10	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.20.4	Beach Park	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	3,960	17,107	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3c.20.5	Beach Park	*Stabilize significant erosion and slumping using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.20.6	Beach Park	*Stabilize significan erosion and attempted stabilization debris around culvert using bioengineering stabilization measures*	100%	130	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.20.7	Beach Park	Remove debris obstructing flow using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
3c.20.8	Beach Park	*Stabilize channel erosion and downcutting of discharge channel using bioengineering stabilization measures and check dams if necessary.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.20.9	Beach Park	*Stabilize erosion around culvert using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.20.10	Beach Park	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.20.11	Beach Park	Repair or remediate cracked concrete armoring at outfall.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3c.24.1	Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	100%	3,212	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.24.2	Beach Park	Remove debris including tires.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
4.0.1	Beach Park	Preserve and restore the ravine within the open Category 1 green infrastructure area between Ganster Road and Sheridan Road, just east of Lyons Woods Forest Preserve.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table K.5. Village of Beach Park Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
4.0.6	Beach Park	Expand / enlarge detention basins #28, #75, and #76 to reduce IDOT-recorded flooding locations along Sheridan Road north of Blanchard.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
4.0.9	Beach Park	Inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address algae / nutrients by naturalizing the basin; remove excess debris.	100%	522	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
4.05.3	Beach Park	Remove debris / bricks in channel.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
4.05.4	Beach Park	*Stabilize bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 50 lf and 1 side of stream for cost estimation purposes.*	100%	990	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K6. City of Waukegan Plan Implementation Pollutant Load Reduction Estimates

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
1.0.7	Waukegan	Preserve and restore the green infrastructure areas in the southwest corner of the SMU, east of the Union Pacific rails and west of industrial land uses (Midwest Generation, North Shore Sanitary District, and Outboard Marine Corporation). This area has been identified by the City of Waukegan for restoration as the 'Waukegan Moorlands'.	100%	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
1.0.10	Waukegan	Investigate the wetlands adjacent to the Johns Manville lagoons for restoration and remediation potential and as a possible water quality improvement facility for water runoff from nearby industrial sites. Cost reflects standard wetland restoration and management rather than clean up and remediation.	75%	6,895	14	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1
1.1.1	Waukegan	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	3,212	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
1.1.3	Waukegan	*Restore stream channel and instream habitat by reducing / remediating channelization, possibly through a remeandering and other restoration projects such as installing boulders, large rocks, and / or rootwads.*	25%	1	1	1	1	NA	3	NA	NA	NA	NA	1	NA	NA	NA
1.1.5	Waukegan	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	100%	NA	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	NA	NA
1.1.6	Waukegan	Inspect and remediate culvert, which is nearly full of water in the inventory photo and may be sediment filled.	100%	NA	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	NA	NA
3b.0.12	Waukegan	Address algae / nutrient loads by naturalizing the basin.	100%	0	3	3	NA	1	1	NA	NA	1	1	NA	NA	NA	NA
3b.0.15	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3b.0.16	Waukegan	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	100%	321	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3b.16.5	Waukegan	*Stabilize the eroding, 4 foot deep cut channel within the turf grass landscape at the upstream end of BL16, just downstream of the Beach Rd. culvert.*	100%	77,760	32	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.16.6	Waukegan	*Repair or replace the steel Beach Road culvert that is eroding around the edges and beneath, possibly due in part to the additional plastic drain pipe.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K6. City of Waukegan Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.0.3	Waukegan	For Waukegan Airport property, implement the spill prevention and response plan and reduce the use of salt and/or deicers. Install filtration and infiltration BMPs to capture and treat runoff from airport landscapes, particularly impervious surfaces such as runways and fueling areas, before being discharged to the stream system of Bull Creek.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3c.0.17	Waukegan	Retrofit as wet / wetland basin; plant banks and a surrounding buffer with native vegetation.	100%	1,044	2	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
4.0.5	Waukegan	Improve swale and other surface stormwater drainage systems within the developed areas of the SMU, particularly those residential areas off Miraflores and Montesano, with lot level stormwater filtration and infiltration BMPs. Details reflect 28,000 lf (approximately 6.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.	75%	30,030	32	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
4.0.7	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
4.0.8	Waukegan	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
4.05.5	Waukegan	*Stabilize and strengthen the incised discharge channel.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
5.0.1	Waukegan	Preserve the ravine within the 7-acre open Category 1 green infrastructure area between Circle Court and the Amstutz Expressway.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	NA
5.0.2	Waukegan	Preserve and restore wetland complexes where these resource remain, including those along the entire length of reach BL04 and those adjacent to Lake County Gardens (depressional storage areas #22 and #23). Wetland / depressional area #23, bordered by Pine, Lorraine, Wilson, and the McClory Bike Trail, contains some elements of a decent quality wetland indicative of good restoration potential. Two additional potential restoration areas are the small park between Butrick and Yeoman and the upstream drainage corridor north of and paralleling Rice St.	75%	12,804	27	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1
5.0.3	Waukegan	Preserve the wetlands / stream corridor within Category 1 and 2 open green infrastructure areas between Rice and MacArthur, west of Lewis Avenue, and the area between Pine, Wilson, and the McClory bike path.	100%	NA	NA	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	NA	NA

Table K6. City of Waukegan Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
5.0.4	Waukegan	*Install filtration BMPs for commercial and institutional uses along Greenwood Avenue and at the York House Rd / Lewis Ave intersection to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S43, and S73. Details reflect 10,000 lf (approximately 2.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontage.*	100%	5,500	6	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
5.0.5	Waukegan	*Install lot level filtration and infiltration BMPs, to help reduce pollutant loading in potential pollution hotspot subbasins S13, S14, S39, S43, and S73. Details reflect 228,000 lf (approximately 52 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	100%	125,400	137	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
5.0.6	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	100%	1,205	2	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
5.0.7	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation; inspect and remediate inlet / outlet problems by removing clogging and/or debris buildup; address turbidity / sedimentation by naturalizing the basin; remove excess debris.	100%	723	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
5.0.8	Waukegan	Stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation.	100%	482	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
5.0.9	Waukegan	Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and surrounding buffer with native vegetation.	100%	723	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
5.0.10	Waukegan	*Retrofit as wet / wetland basin; stabilize / regrade shoreline using bioenginnering practices and plant banks and a surrounding buffer with native vegetation; address algae / nutrient loads and address turbidity / sedimentation by naturalizing the basin. This may reduce pollutant loading within potential pollutant loading hotspot S39.*	100%	602	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
5.0.11	Waukegan	*Inventory detention basin and identify resolutions to any noted functional problems.his may reduce pollutant loading within potential pollutant loading hotspot S14.*	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]

Table K6. City of Waukegan Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
5.2.1	Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. Restoration and management of Bowen Park and the residential areas along Miraflores is important to enhance the habitat quality of this reach.	100%	6,424	11	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
5.2.2	Waukegan	Reduce impacts of surrounding golf course and park property such as landscape waste dumping, turf grass stream edges. Filter and infiltrate runoff from parking lots, such as those within Bowen Park, with BMPs. Details reflect installation of lot level BMPs.	100%	2,200	5,280	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
5.2.3	Waukegan	Reduce impacts of residential homes along Miraflores: cease yard waste dumping, replace mown turf grass to the edge of the stream with a minimum 10 foot native vegetation buffer, infiltrate runoff discharge from roof or footing drains with rain gardens or rain barrels, and naturalize the stream channel by replacing poured concrete and rip rap with bioengineering stabilization measures.	100%	2,200	5,280	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
5.2.4	Waukegan	Gully erosion occurring in the ravines of Bowen Park should be remediated through ravine woodland restoration and management along reach BL02. Assumes 4000 lf of stream reach by 500' width. Costs reflect woodland restoration; load reduction reflects Moderate erosion stabilization.	100%	911	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
5.2.5	Waukegan	Stabilize erosion around the Sheridan Road culvert and replace the broken stormsewer that is discharging to the opposite streambank.	100%	130	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
5.2.6	Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
5.2.7	Waukegan	Remove debris obstructing flow using American Fisheries Society guidelines.	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA
5.2.8	Waukegan	Stabilize typical 2-4 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.	100%	1,980	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
5.2.9	Waukegan	Stabilize minor erosion of open discharge channel using bioengineering stabilization measures.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K6. City of Waukegan Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
5.2.10	Waukegan	Stabilize significant erosion below outfall using bioengineering stabilization measures.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
5.2.11	Waukegan	Stabilize minor channel erosion below concrete lined channel outfall. Consider removing concrete and stabilizing channel with more habitat-appropriate measures.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
5.2.12	Waukegan	Install energy dissipation measures to address the eroding plunge pool created by discharge from the elevated outfall.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
5.3.1	Waukegan	*Restore a 5 foot wide native riparian buffer and replace turf grass lawn edges to native riparian plant communities as is feasible within the golf course.*	100%	4,818	8	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
5.3.2	Waukegan	Glen Flora Country Club: replace or remediate online detention, armored dams and wiers with more habitat appropriate structures that allow fish passage.	100%	NA	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	NA	NA	NA
5.3.3	Waukegan	*Stabilize erosion undercutting the concrete-lined channel outfall / dam; if feasible, remove concrete and replace with bioengineered channel stabilization measure.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
5.4.1	Waukegan	Restore stream channel and improve instream habitat by reducing channelization, such as through a remeandering project.	25%	1	1	1	1	NA	3	NA	NA	NA	NA	1	NA	NA	NA
5.4.2	Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, and managing vegetation such as through prescribed burning.	100%	11,242	19	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
5.4.3	Waukegan	Implement the mitigation planfor FPAI site 20-06, in the City of Waukegan, Lake County Gardens subdivision. There also may be opportunities to increase the detention and/or drainage capacity of the drainage system in this area, particularly within the community park to the north. However, improvement of the wetlands to increase their storage capacity may also be an option.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	1
5.4.4	Waukegan	Restore the upper end of this reach, a fairly undefined channel that is choked with cattails, through invasive species removal and management.	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
6.0.1	Waukegan	*Manage and restore the wooded ravine, wetland, and depressional area #3 that lies between the Amstutz and Sheridan Road for storage. Load reduction details reflect impact of restored wetland.*	75%	2,758	6	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1

Table K6. City of Waukegan Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
6.0.3	Waukegan	Open and partially open Category 1 green infrastructure areas between the waste water treatment plant and the Union Pacific tracks should be restored and integrated into the planned Waukegan Moorlands area to the north. Details reflect natural area restoration.	75%	5,516	12	63% BOD	90% HC; 36-69% TM	NA	3	NA	NA	1	NA	NA	NA	NA	NA
6.0.4	Waukegan	*Install filtration BMPs for commercial, industrial, and institutional uses in the eastern and southwestern portions of the SMU to help improve water quality in potential pollutant loading hotspot S10, S11, and S75. Details reflect approximately 15,000 lf (approximately 3.5 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on along the road frontages of these land uses.*	100%	2	0	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
6.0.5	Waukegan	*This SMU is primarily sewerd but undetained. Install source controls and lot level filtration and infiltration BMPs, including detention basin improvements, which may help address pollutant loading in potential pollutant loading hotspot S10, S11, and S75. Details reflect 96,000 lf (approximately 22 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	75%	102,960	108	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA

Table K7 Illinois Department of Natural Resources Plan Implementation Pollutant Load Reduction Estimates

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
1.0.2	IDNR	Develop and implement habitat restoration and management plans for Illinois Beach State Park, including all wetlands, waterways, beach ridge, dune and swale systems, and T&E species habitat.	75%	304,937	639	63% BOD	90% HC; 36-69% TM	NA	3	1	3	3	1	1	NA	NA	NA
1.0.5	IDNR	Restore hydrologic connectivity of Dead River to Lake Michigan and remove those created to carry wastewater to the lake. Assumes that 4 hydrologic connections need to be restored or removed.	75%	NA	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	NA	NA	NA
1.0.16	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
1.0.17	IDNR	Stabilize / regrade shoreline using bioenginnering practices and address algae / nutrient loads by naturalizing the basin.	100%	883	606	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
1.0.18	IDNR	Address algae / nutrient loads by naturalizing the basin.	100%	1	3	3	NA	1	1	NA	NA	1	1	NA	NA	NA	NA
1.0.19	IDNR	Address algae / nutrient loads by naturalizing the basin.	100%	1	3	3	NA	1	1	NA	NA	1	1	NA	NA	NA	NA
1.0.20	IDNR	Address algae / nutrient loads by naturalizing the basin.	100%	1	3	3	NA	1	1	NA	NA	1	1	NA	NA	NA	NA
1.0.21	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
1.0.22	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
1.0.25	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
1.0.26	IDNR	Inventory detention basin and identify resolutions to any noted functional problems.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]

Table K8. Lake County Implementation Pollutant Load Reduction Estimates

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3a.0.6	Lake County	Depressional storage area #78, within the Thunderhawk Golf Club Forest Preserve, may be able to be expanded to provide additional storage if needed, and may also be retrofitted / restored to improve runoff quality from the golf course, provided that runoff can be directed into this area, treated, and then discharged to a receiving water body. Costs reflect restoration of this wet / hydric area.	75%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3	NA
3a.0.18	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	100%	964	2	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3c.0.11	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	100%	803	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3c.0.12	Lake County	Stabilize / regrade shoreline using bioenginnering practices.	100%	1,606	3	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3c.0.13	Lake County	Stabilize / regrade shoreline using bioenginnering practices; address algae / nutrient loads by naturalizing the basin.	100%	522	1	30-50%BOD	62-75% HC; 14-71%TM	1	1	NA	NA	1	1	NA	NA	NA	NA
3c.23.1	Lake County	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	100%	5,782	10	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
4.0.3	Lake County	Manage and restore the natural resources, including ADID wetland #1831, in the northeastern corner of Lyons Woods Forest Preserve. The southern portion of depressional storage area #28 is within the Forest Preserve boundary and may be used to relieve past IDOT-recorded flooding at Sheridan and York House Road. ADID wetland is approximately 46 acres (4000' by 500' wide) and the total area of Lyons Woods is 264 acres.	75%	52,005	109	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1

Table K9 Multiple Jurisdictionis Plan Implementation Pollutant Load Reduction Estimates

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
1.0.4	Waukegan, IDNR, Lake County	Remediate, cap, or otherwise contain contaminated areas, materials, waste piles, waste ponds, etc. to prevent contaminants from becoming mobilized (via air or water) and entering water resources or sensitive natural areas in Illinois Beach State Park.	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^	NA^
1.0.6	Beach Park, Waukegan	Preserve Category 1 open green infrastructure areas including a portion of depressional storage area #17 and the utility corridor that can serve as a green infrastructure connector between Illinois Beach State Park to Lyons Woods Forest Preserve.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3	NA
1.0.11	Zion, Waukegan, IDNR	Manage the Lake Michigan shoreline and beaches to minimize beach erosion. Details reflect 28000 lf of shoreline at an average width of 150 feet.	75%	NA	NA	NA	NA	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.0.12	Zion, Waukegan, IDNR	Manage the Lake Michigan shoreline and beaches to minimize E. coli contamination that leads to beach closures. Details reflect 28000 lf of shoreline at an average width of 150 feet.	75%	NA	NA	NA	NA	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.0.13	Zion, Beach Park, Waukegan, IDNR	*Install drainage swale improvements or other lot level / source control BMPs to capture and treat runoff from commercial and industrial land uses within Critical Subbasins #15, #74, and #76, identified as potential Pollution Hot Spot Critical Areas. Cost estimate reflects the installation of swales (10' wide) or other treatment measures along perimeter of these land uses, approximately 35,000 lf of treatment area.*	100%	19,250	21	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
1.1.2	Waukegan, IDNR, Lake County	*Restore the natural connection and habitat quality of this reach to Lake Michigan by removing the lagoons through which the reach runs and disconnecting the reach from the Dead River to the north. Since these lagoons may be a component of a remedation or clean up plan, this should be considered a long term recommendation to be implemented when the contamination issues at Johns Manville have been adequately remediated. Details reflect major channel restoration.*	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
1.1.4	Waukegan, Lake County	Address potential hazardous / toxic runoff from industrial uses to the east through filter strips and other filtration and infiltration techniques installed between the reach and these land uses, or by containing and remediating runoff on site through other means. Cost estimate reflects the installation of 2000 lf of 20' wide infiltration and filtration BMPs.	100%	1,100	1	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
1.6.1	Beach Park, Lake County	Restore stream channel and improve instream habitat by installing pools and riffles and installing boulders, large rocks, and / or rootwads.	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA

Table K9 Multiple Jurisdictionis Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
1.6.2	Beach Park, Lake County	Restore native riparian buffer by controlling invasive species, planting native species, thinning forest and shrub canopy, and managing vegetation such as through prescribed burning.	100%	3,212	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
2.0.1	Zionion Beach Park	Category 1 and 2 green infrastructure areas along the western boundary of Illinois Beach State Park and bordering the Union Pacific rails to the west should be preserved as components of the green infrastructure / greenway system that includes Ophir Park, Carmel Park, and Illinois Beach State Park. These areas contain significant low lying depressional storage areas (#55, #56, and #57) that could be used for water quality improvement, wetland / hydric soil complexes, and steep slopes that are unsuitable for development.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.0.2	Zion, Beach Park	*Convert the depressional storage complex of #55, #56, and #57 to improve water quality for Critical Subbasin #2, identified as a potential Pollutant Loading Hotspot. Assumes runoff can be directed into this area, treated, and discharged to the Illinois Beach State Park stream and wetland system. Estimated area to be converted is 7000lf by 400ft wide.*	75%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3	NA
2.0.4	Zion, Beach Park	*Reduce pollutant loading to Critical Subbasin #2, a potential pollutant loading hotspot, by improving swales and other surface stormwater drainage systems and installing stormwater filtration and infiltration BMPs to capture and treat runoff from parking lots, utilities, rooftops, storage areas, and other areas that may contribute pollutants to the stream. Cost estimate assumes 130,000 lf (approximately 30 acres) of 10 foot wide drainage swale improvements as a proxy for on-site source control BMPs.*	75%	139,425	146	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
3a.0.1	Zion, Beach Park	Manage and restore the wooded ravine along reaches BL25, BL26, and BL27. Average 5000' x 250' wide.	75%	5,713	12	63% BOD	90% HC; 36-69% TM	NA	3	1	3	3	2	1	1	1	1
3a.0.2	Zion, Beach Park	Preserve and restore wetlands along drainage channel upstream of the McClory Bike Path and the complex northwest of Lewis and 29th St., wetland #4 east of Lewis Avenue, and wetland #3 in Hermon Park (56 acres total). Regional storage area #77 and the associated wetlands (9 acres) could be restored and / or used to provide storage for this SMU if needed when the upstream area develops. Implementation details reflect wetland / hydric soils preservation and restoration.	75%	12,804	27	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1
3a.0.4	Zion, Beach Park	Preserve and restore T&E habitat within the area bounded by Lebanon St., the McClory Bike Path, and 31st St.	75%	1,103	2	63% BOD	90% HC; 36-69% TM	NA	3	1	3	3	1	1	NA	NA	NA

Table K9 Multiple Jurisdictionis Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3a.0.5	Zion, Beach Park	*Improve any swale and other surface stormwater drainage systems and/ or install source controls and lot level stormwater filtration and infiltration BMPs within the developed areas of the SMU. These practices may help reduce pollutant loading in potential pollution hotspot subasins S1, S3, S4, and S48. In order to generate cost and pollutant load reduction estimates, road swales are used as a proxy for individual site BMPs. Details reflect 252,000 lf (approximately 58 acre) of 10 foot wide drainage swale improvements on both side of all roads.*	100%	6,600	7	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
3a.25.1	Zion, Beach Park	*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	100%	79,200	36	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3a.25.2	Zion, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning. A wider, partially forested buffer is appropriate in the lower parts of the reach.	100%	3,212	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3a.25.3	Zion, Beach Park	Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.	100%	2,200	5,280	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3a.25.5	Zion, Beach Park	Inspect hydraulic structure for possible erosion problems and stabilize using bioengineering practices if needed.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3a.27st.1	Zion, Beach Park	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	100%	6,424	11	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3b.0.1	Beach Park, Waukegan	Preserve and restore wetlands where these resource remain along drainage channel BL15, BL16, BL17, and along the daylit portions of the Wilson Avenue Tributary. Area is 10,000 lf by 300' wide.	75%	13,592	29	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1
3b.0.4	Beach Park, Waukegan	*Preserve greenway easements on Category 1 and 2 green infrastructure areas along BL16, which may help reduce pollution loading in potential pollution hotspot S57. Cost estimate assumes easements of 2000 lf by 100 ft wide (4.5 acres).*	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table K9 Multiple Jurisdictionis Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3b.0.6	Beach Park, Waukegan	*Depressional storage areas #32 and #43, currently undeveloped and containing current or former wetlands, could be enhanced to improve water quality of runoff from surrounding residential uses within this Critical Subbasin #57, identified as a potential pollutant loading hotspot. Depressional area #43 lies in an open Category 1 green infrastructure area that could be preserved for water quality improvement. Details reflect restoration and enhancement of both areas as wetlands.*	75%	2,462	5	63% BOD	90% HC; 36-69% TM	NA	1	NA	3	NA	NA	NA	1	3	NA
3b.0.7	Beach Park, Waukegan	*Improve swales and other surface stormwater drainage systems and install source controls and lot level BMPs, including detention basin improvements, within the developed areas of potential pollutant loadin hotspots S57, S59, and S63. Details reflect 165,000 lf (approximately acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	75%	176,963	186	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
3b.15.1	Beach Park, Waukegan	Restore stream channel and improve instream habitat by enhancing pools and riffles.	25%	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.15.2	Beach Park, Waukegan	*Address High streambank erosion along entire reach using bioengineering stabilization measures.*	100%	725,760	302	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.3	Beach Park, Waukegan	Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.	100%	4,497	8	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3b.15.4	Beach Park, Waukegan	Inspect footbridges and armored / concrete-lined banks for impacts on the stream corridor and remediated if necessary.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3b.15.5	Beach Park, Waukegan	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	3,080	10,349	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3b.15.6	Beach Park, Waukegan	Inspect and, if necessary, repair the culvert under the McClory Bike Trail, which is partially collapsed.	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.7	Beach Park, Waukegan	*Remove debris obstructing flow using American Fisheries Society guidelines.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	1	1	NA	NA	NA	1	NA	NA	NA

Table K9 Multiple Jurisdictionis Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3b.15.8	Beach Park, Waukegan	*Stabilize typical 4-6 foot bank erosion using bioengineering stabilization measures. Length difficult to determine from photo; assume 100 lf and 1 side of stream for cost estimation purposes.*	100%	12,960	5	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.9	Beach Park, Waukegan	*Stabilize erosion of the Beach Road steel culvert experiencing erosion around and underneath using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.13	Beach Park, Waukegan	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.14	Beach Park, Waukegan	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.15	Beach Park, Waukegan	*Stabilize erosion around clay drain pipe outfall using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.16.1	Beach Park, Waukegan	*Restore stream channel and improve instream habitat by enhancing pools and riffles and installing boulders, large rocks, and / or rootwads.*	25%	1	1	1	1	NA	3	NA	NA	NA	NA	1	NA	NA	NA
3b.16.2	Beach Park, Waukegan	*Address Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the instream silt / sedimentation load.*	100%	138,600	63	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.16.3	Beach Park, Waukegan	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	5,621	9	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3b.16.4	Beach Park, Waukegan	*Install residential lot level stormwater BMPs, such as rain barrels or rain gardens, to reduce runoff discharge from roof or footing drains.*	100%	3,850	16,170	30-90% BOD	62-90% HC; 14-100% TM	1	NA	NA	NA	NA	1	1	1	NA	1
3b.15.16	Beach Park, Waukegan	*Stabilize erosion around two plastic drain pipe outfalls using bioengineering stabilization measures.*	100%	108	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.15.17	Beach Park, Waukegan	*Stabilize erosion around concrete drain pipe outfall using bioengineering stabilization measures.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K9 Multiple Jurisdictionis Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3b.18.1	Beach Park, Waukegan	*southwest of the Wadsworth Rd / Lewis Ave intersection. These areas include depressional storage area #34, which could be expanded and enhanced for stormwater storage and to capture and cleanse water runoff from airport property, which lies in Critical Subbasin #69, a potential pollutant loading hotspot.*	75%	1,379	3	63% BOD	90% HC; 36-69% TM	NA	NA	NA	NA	NA	NA	NA	1	3	NA
3b.18.2	Beach Park, Waukegan	Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.	100%	27,720	13	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3b.18.3	Beach Park, Waukegan	The culvert draining Waukegan Airport is covered with wire fencing, presumably for security or to prevent animal invasion. However, investigate source and necessity, and remove if fencing impedes flow. It appears that strong flows exit the Airport property in this location.	100%	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]	NA[1]
3c.0.2	Beach Park, Zion	Manage and restore the wooded ravine along reaches BL07, BL08, BL09, BL10, BL11, BL19, BL20, BL21. Assumes 18,600 lf of stream by average 250' wide.	75%	21,078	44	63% BOD	90% HC; 36-69% TM	NA	3	1	3	3	2	1	1	1	1
3c.0.4	Beach Park, Zion	Preserve and restore wetlands along drainage channels BL21, BL22, BL23, BL24. Assumes 10,300 lf by 350' wide.	75%	16,350	34	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1
3c.0.5	Beach Park, Zion	Preserve Category 1 green infrastructure area bounded by the McClory Bike Path, Clover, Wadsworth, and 34th St. that borders the stream channel to the north. Also preserve three separate areas through which the stream corridor runs: one along BL07 within the ravine, the second at the confluence of BL08, BL09, and BL19, and the third just upstream of this confluence along BL09.	75%	2,167	5	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1
3c.0.6	Beach Park, Zion, Waukegan	*Install filtration BMPs for commercial, industrial, and institutional uses along Sheridan Road, Wadsworth, and Lewis Avenue, which will help reduce pollutant loading in potential pollution hotspot subbasin #64. Details reflect 12,000 lf of road frontage along these uses to be treated with improved, 10' swales (approximately 2.75 acres.)*	100%	6,600	7	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
3c.0.7	Beach Park, Zion, Waukegan	*Install lot level filtration and infiltration BMPs within potential pollution hotspot subbasin #64. Details reflect 208,000 lf (approximately 48 acre) of 10 foot wide drainage swale improvements / lot level / source control BMPs on each side of all roads.*	75%	223,080	234	30-90% BOD	62-90% HC; 14-100% TM	1	NA	2	NA	NA	NA	NA	2	NA	NA
3c.0.8	Beach Park, IDNR	Preserve the Category 1 open green infrastructure area that contains depressional storage area #45 along the west side of the Union Pacific rails.	100%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table K9 Multiple Jurisdictionis Plan Implementation Pollutant Load Reduction Estimates (continued)

ID# (SMU.reach.ID)	Jurisdiction	Recommendation Description (those addressing critical areas in italics)	Area Improvement Target (percent)	Water Quality: TSS / sediment (lb/yr)	Water Quality: Nutrients (Phosphorous lb/yr)	Water Quality: Low dissolved oxygen	Water Quality: Aquatic life toxicity	Water Quality: Fecal coliform	Habitat Degradation: Lack of habitat characteristics	Habitat Degradation: Hydrologic disturbance / flow alterations	Habitat Degradation: Wetland loss / degradation	Habitat Degradation: Exotic & invasive species	Habitat Degradation: Loss / degradation of buffer	Habitat Degradation: Streamside alterations	Flood Flows: Runoff rate and volume	Flood Flows: Loss of storage	Flood Damage: Floodplain encroachment
Impairment Reduction Target				100%	100%	50%	25%	50%	25%	50%	90%	25%	75%	75%	75%	90%	100%
3c.7.1	Beach Park, IDNR	*Stabilize High streambank erosion along approximately 25% of this reach not included in the previous stabilization project, some threatening homes and property, using bioengineering stabilization measures.*	100%	129,600	54	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.7.2	Beach Park, IDNR	*Manage native riparian plant communities within this reach: control invasive species, plant native species, and manage vegetation such as through prescribed burning.*	100%	2,891	5	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.21.1	Beach Park, Zion	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures.*	100%	138,600	63	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.21.2	Beach Park, Zion	*Restore and manage the native riparian buffer plant communities along this reach by controlling invasive species, planting native species, thinning forest and shrub vegetation to allow more ground vegetation, and managing vegetation such as through prescribed burning.*	100%	5,621	9	30-50%BOD	62-75% HC; 14-71%TM	NA	3	NA	NA	3	3	2	1	NA	2
3c.21.3	Beach Park, Zion	*Repair the discharge point / failed headwall approximately 200' upstream of the McClory Bike Path.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.21.4	Beach Park, Zion	*Stabilize channel erosion at outfall, and consider replacing rip rap control measure with bioengineering stabilization practices.*	100%	2,592	1	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.21.5	Beach Park, Zion	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
3c.21.6	Beach Park, Zion	*Stabilize erosion around plastic drain pipe outfall using bioengineering stabilization measures.*	100%	54	0	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA
4.0.2	Waukegan, Beach Park	Manage and restore the woodland ravine along reach BL05. Assumes 5000' by 500' area for cost estimation purposes.	75%	11,425	24	63% BOD	90% HC; 36-69% TM	NA	3	1	3	3	2	1	1	1	1
4.0.4	Waukegan, Beach Park	Preserve and restore the wetland complex within the open, Category 1 green infrastructure area along the eastern boundary of SMU 4 west of the Union Pacific rail line. This area creates a physical land connection between Lyons Woods and Illinois Beach State Park, and would also preserve regional storage area #17.	75%	7,289	15	63% BOD	90% HC; 36-69% TM	NA	1	1	3	1	2	1	1	3	1
4.05.1	Waukegan, Beach Park	*Stabilize Moderate streambank erosion along entire reach using bioengineering stabilization measures, which may help reduce the silt / sediment accumulation.*	100%	118,800	54	30-50%BOD	62-75% HC; 14-71%TM	NA	NA	NA	NA	NA	1	2	NA	NA	NA

Table K.10. TSS Load Reduction Estimates (CDF 2006)

Watershed Restoration Strategy Effectiveness							
	TSS						
Recommendation	Effectiveness	Unit	Load	Reduction	Source for effectiveness	Source for Load	Notes
Stream/Shoreline stabilization							
Severe	90%	Lbs/ft/yr	144	129.6	IEPA worksheet	IEPA worksheet, 4' bank, LRR=0.4	Assumes Loam soils
Moderate	90%	Lbs/ft/yr	22	19.8	IEPA worksheet	IEPA worksheet, 3' bank, LRR=0.08	Assumes Loam soils
Low	90%	Lbs/ft/yr	6	5.4	IEPA worksheet	IEPA worksheet, 2' bank, LRR=0.03	Assumes Loam soils
Protect & restore wetlands/woodlands	85%	Lbs/ac/yr	309	262.7	Land use change avoidance	LCSMC unit area loads, sewered res	Effectiveness based on comparison between open space and residential
Native Buffer	73%	Lbs/ft/yr	1.1	0.803	IEPA worksheet for Filter Strip	LCSMC unit area loads, unsewered res	Assumes 300 foot tribtary area/ft of buffer
Swale naturalization / source control / lot level BMPs	50%	Lbs/ft/yr	1.1	0.55	Best guess	LCSMC unit area loads, unsewered res	Assumes 300 foot lawn and 15 foot road tributary area/ft of swale, reduction relative to turf swale; assumes 20 sf of swale area per 1 linear ft of swale
Retrofit curb & gutter	65%	Lbs/ft/yr	2.2	1.43	IEPA, worksheet for swale	LCSMC unit area loads, sewered res	Assumes 300 foot lawn and 15 foot road tributary area/ft of swale, sewered res land use

Table K.11. P Load Reduction Estimates (CDF 2007)

Watershed Restoration Strategy Effectiveness							
	P						
Recommendation	Effectiveness	Unit	Load	Reduction	Source for effectiveness	Source for Load	Notes
Stream/Shoreline stabilization							
Severe	90%	Lbs/ft/yr	0.06	0.054	IEPA worksheet	IEPA worksheet, 4' bank, LRR=0.4	Assumes Loam soils
Moderate	90%	Lbs/ft/yr	0.01	0.009	IEPA worksheet	IEPA worksheet, 3' bank, LRR=0.08	Assumes Loam soils
Low	90%	Lbs/ft/yr	0.002	0.0018	IEPA worksheet	IEPA worksheet, 2' bank, LRR=0.03	Assumes Loam soils
Protect & restore wetlands/woodlands	68%	Lbs/ac/yr	0.81	0.5508	Land use change avoidance	LCSMC unit area loads, sewered res	Effectiveness based on comparison between open space and residential loading rates
Native Buffer	45%	Lbs/ft/yr	0.003	0.00135	IEPA worksheet for Filter Strip	LCSMC unit area loads, unsewered res	Assumes 300 foot tribtary area/ft of buffer
Swale naturalization / source control / lot level BMPs	20%	Lbs/ft/yr	0.003	0.0006	Best guess - assumes TP removal effectiveness is 40% of TSS removal effectiveness	LCSMC unit area loads, unsewered res	Assumes 300 foot lawn and 15 foot road tributary area/ft of swale, reduction relative to turf swale; assumes 20 sf of swale area per 1 linear ft of swale
Retrofit curb & gutter	25%	Lbs/ft/yr	0.006	0.0015	IEPA, worksheet for swale	LCSMC unit area loads, sewered res	Assumes 300 foot lawn and 15 foot road tributary area/ft of swale, sewered res land use

Table K.12. Effectiveness of BMPs Recommended for Fish Lake Drain (NIPC)

	BMP Objective						
BEST MANAGEMENT PRACTICE	Runoff	Runoff Volume Control	Physical Habitat Preservation	Sediment Pollution Control	Nutrient Control	BOD	Other
	Rate					Control	Pollutant Control*
	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	2	3	1	3	3	3	3
Devices							
Porous	2	2	1	3	3	3	3
Pavement							
Wet Detention	3	1	2	3	2	3	2
Wetland	3	1	2	3	2	3	2
Detention							
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	1	1	2	2	1	1	1
Protection							
Storage Area Cover	1	1	1	2	2	1	2-3
Street	1	1	1	1-2	1	1-2	1-2
Sweeping							
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
Key							
3 = Fully achieves objective; 2 = partially achieves objective; 1 = minimally achieves 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: Price and Dreher, “Model Best Management Practice Selection Methodology and Lake County Decision Making Framework”, Northeastern Illinois Planning Commission, July 1994.							

Table K.13. BMP Effectiveness (CDF Flint Creek)

	BMP Objective (Removal / Reduction in Percent)				
	Annual TSS Removal	Annual TP Removal	Annual BOD Removal	2-Yr Rate Reduction	Annual Runoff Volume Reduction
BMP					
Impervious Area Recuction	14% for I1&I2=25&20	9% for I1&I2=25&20	14% for I1&I2=25&20	18% for I1&I2=25&20	13% for I1&I2=25&20
Impervious Area Disconnection	See Filter Strips and Swales	See Filter Strips and Swales	See Filter Strips and Swales	See Filter Strips and Swales	See Filter Strips and Swales
Filter Strips (a)	90% for R=0.5 72% for R=5	64% for R=0.5 37% for R=5	64% for R=0.5 37% for R=5	negligible	40% for R=0.5 18% for R=5
Swales	70%	30%	30%	10%	15%
Infiltration Devices	94% for P=1.0”	83% for P=1.0”	83% for P=1.0”	2% for P=1.5”; 35% for P=2.0”; 100% for P=3.0	76% for P=1.0”
Wet Detention (b)	92%	72%	72%	90-98% for I>20%	Negligible
Wetland Detention (b)	90%	63%	63%	90-98% for I>20%	Negligible
Dry Detention (b,c)	70% for I=10	27% for I=10	27% for I=10	90-98% for I>20%	Negligible
Settling Basins (d)	88% for I=25; 75% for I-75	62% for I=25; 41% for I-75	69% for I=25; 43% for I-75	51% for I=25; 0% for I-80	Negligible
Sand Filters (e)	75-90%	30-45%	30-50%	0	0
Water Quality Inlets	39%	13%	13%	0	0
Weekly Street Sweeping	16%	6%	6%	0	0
Key:			(a) R is ration of impervious area to filter strip area		
I=percent Imperviousness = 100/(1+1/R)			(b) Removal rates for Lake County detention design		
R=Ration of treated impervious area to pervious area = 1/(100/I-1)			© Dry detention may not be feasible for high impervious %		
P=design Precipitation event (inches)			(d) Removal rates for Lake County divert and detain requirement		
			(e) Austin Texas reported removal rates		

Table K.14. Pollutant Removal Efficiencies for Selected Groups of BMPs (Center for Watershed Protection)

Median Stormwater Pollutant Removal Rate (Percent)							
Best Management	No. of	Total Suspended Solids	Total	Soluble P[3]	Total N[4]	Nitrate	Carbon[5]
Practice	Studies[1]		P[2]				
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 o							
Source: Center for Watershed Protection							

Table K.15. Pollutant Removal Efficiencies for BMPs (Center for Watershed Protection)

Median Stormwater Pollutant Removal Rate (Percent)						
Best Management Practice	Bacteria [E]	Hydro-	Cadmium	Copper	Lead	Zinc
		Carbons [F]				
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, T						

Table K.16. Pollutant Removal Efficiencies for BMPs (IEPA)

	Pollutant Removal Rate (Percent)				
Best Management Practice	BOD	COD	TSS	Lead	Copper
Vegetated Filter Strips	50	40	73	45	
Grass Swales	30	25	65	70	50
Infiltration Devices	83		94		
Extended Wet Detention	72		86	40	
Wetland Detention	63	50	77	65	
Dry Detention	27	20	57	50	
Settling Basin	56		81		
Sand Filters	40		82		
WQ Inlets	13	5	37	15	
Weekly Street Sweeping	6		16		
Infiltration Basin		65	75	65	
Infiltration Trench		65	75	65	
Porous Pavement		80	90	1	
Concrete Grid Pavement		90	90	90	

Table K.17. Pollutant Removal Efficiencies for BMPs (IEPA) (continued)

	Pollutant Removal Rate (Percent)				
Best Management Practice	BOD	COD	TSS	Lead	Copper
Sand Filter/Infiltration Basin		55	80	60	
WQ Inlet w/ Sand Filter		55	80	80	
Oil/Grit Separator		5	15	15	
Wet Pond		40	60	75	
Source: IEPA Nonpoint Source Unit, Pollutant Load Reduction Spreadsheets					

Table K.18. Sediment

Pollutant	Potential Removal Rate*
Sediment	75%
Total nitrogen	40%
Total phosphorus	50%
Trace metals	60–70%
Hydrocarbons	75%
*Riparian buffer potential removal rate based on combined 25-foot grass strip in outer zone and 75 foot forested buffer in middle and streamside zone.	
Source: Schueler, T.R. Comparative Pollutant Removal Capability of Urban BMPs: a Reanalysis. *Watershed Protection Techniques Technical Note 95: 2(4), 1995.*	

appendix L - plan implementation funding sources

POTENTIAL FUNDING SOURCES FOR WATERSHED RESTORATION ACTIVITIES

The following list of potential funding sources is compiled from a variety of sources and is accurate as of 2007. Funding and program availability are contingent upon federal, state, and local budgets and appropriations for the budget year in which funding is being sought. Contact the program representative for updates or changes to program details.

The *Catalog of Federal Domestic Assistance (CFDA)* is the single best place to search all federal funding sources. The catalog should be available at local libraries and can also be accessed on the CFDA website on-line at: http://www.cfda.gov. The website lists all federal funding programs available, including those for conservation. Federal agency websites will provide more detailed information about federal programs and provide information on other opportunities for assistance. All organizations applying for federal funding must have a Data Universal Numbering System (DUNS) identification number.

There are a number of *Federal Tax Incentives for Conservation* for owners of environmentally sensitive land that has been donated for conservation purposes, or has been placed in a conservation easement, or simply managed for conservation. Individuals, organizations, and others are all eligible. Information can be found at www.gpoaccess.gov/cfr, www.irs.gov/, www.ailt.org/irs.htm, and http://www/irs.gov/pub/irs-drop/n-04-41.pdf. You can also contact the Illinois EPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois, 62794-9276. Phone: 217-782-3397.

U.S. Environmental Protection Agency (USEPA) issues federal environmental regulations, enforces federal environmental law, and manages a number of grant programs.

- Clean Water Act Section 319 Grants provide funding for implementing corrective and preventative best management practices on a watershed scale, for the demonstration of innovative BMPs on a sub-watershed scale, and the development of information and education non point source pollution control programs. Administered by Illinois EPA.
  Eligibility: State and local governments, nonprofits, individuals, businesses.
  Assistance: Federal cost share at 60 percent maximum.
  Website: http://www.epa.state.il.us/water/financial-assistance/non-point.html.
  Contact: Illinois EPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois, 62794-9276. Phone: 217-782-3397.

- Clean Water State Revolving Loan Funds (SRF), initially designed for wastewater treatment plant upgrades, supports watershed and non-point source control measures. These can include projects such as agricultural and urban runoff control, wet weather flow control including stormwater and sewer overflows, buffers, wetland protection, habitat restoration, and community-based comprehensive watershed management. Currently IEPA targets SRF funding to point source pollution control, i.e., upgrading wastewater infrastructure, but there has been discussion of setting aside some SRF funds for non-point source control programs.
  Eligibility: State and local governments, nonprofits, individuals, businesses.
  Assistance: Funds projects at 100 percent at a national average interest rate of 2.2 percent, subject to change.
  Website: http://www.epa.gov/owmitnet/cwfinance/cwsrf/.
  Contact: Illinois EPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois, 62794-9276. Phone: 217-782-3397.

- Five Star Restoration Challenge Grants bring together citizen groups, corporations, youth groups and students, landowners, and government agencies to undertake projects that restore streambanks and wetlands. Projects must include a strong wetland or riparian restoration component, and should also include

education, outreach, and community stewardship. Jointly administered by the National Fish and Wildlife Foundation, the National Association of Counties, and the Wildlife Habitat Council, and mainly funded by USEPA.
Eligibility: Requires at least five or more partnering organizations.
Assistance: $5,000 to $20,000 with a 1 to 1 match requirement.
Website: http://www/nfwf.org/programs/5-star-rfp.htm, http://www.epa.gov/owow/wetlands/restore/5star/.
Contact: USEPA Wetlands Division, Room 6105 (4502 T), 1200 Pennsylvania Avenue, NW, Washington, DC. Email: price.myra@epa.gov.

- Water Quality Cooperative Agreements assist public or nonprofit organizations in developing, implementing, and demonstrating innovative that reduce wastewater related pollution. Primarily meant to fund exemplary projects, e.g., new BMPs, that increase and transfer knowledge. Not to be used for land acquisition and development.
  Eligibility: States, public agencies, and nonprofit organizations.
  Assistance: $10,000 to $500,000 with no local match requirement, although match offers are considered during evaluation.
  Website: http://www.epa.gov/owm/wqca/2004.htm
  Contact: USEPA Region 5, 77 W. Jackson Blvd. Chicago, IL 60604. Phone: 312-353-4378.

- Wetland Program Development Grants support strengthening state comprehensive wetland programs, developing a comprehensive wetland monitoring and assessment program, improving the effectiveness of compensatory mitigation, and refining the protection of vulnerable wetlands and aquatic resources.
  Eligibility: States, local governments, public agencies, and interstate agencies.
  Assistance: $50,000 to $420,000 grants with 25 percent local match requirement.
  Website: http://www.epa.gov/owow/wetlands/grantguidelines/.
  Contact: US EPA Region 5, 77 West Jackson Blvd., Chicago, IL, 60604. Phone: 312-886-0241 Email: garra.catherine@epa.gov.

- Assessment and Watershed Protection Program Grants help to develop innovative approaches to watershed protection, make a contribution to the body of restoration and management techniques, and transfer knowledge. Application of established techniques may be funded if doing so would contribute to the general understanding of an environmental problem.
  Eligibility: States, local governments, public agencies, nonprofit organizations, individuals.
  Assistance: $5,000 to $80,000 with no local match requirement, although match offers are considered during evaluation as 10 percent of the ranking.
  Website: http://www.epa.gov/owow/funding.html.
  Contact: USEPA Office of Wetlands, Oceans, and Watersheds, 1200 Pennsylvania Avenue, N.W., Washington, D.C. 20460. Phone: 202-566-1211, 202-566-1206.

- Targeted Watersheds Grants Program (formerly Watershed Initiative) funds projects that demonstrate innovative approaches to watershed restoration with an emphasis on inter-organizational collaboration, market-based techniques, and demonstrable environmental improvement. Does not support activities directly required under the Clean Water Act.
  Eligibility: Any public entity, but must be nominated by the state.
  Assistance: $600,000 to $900,000 with 25 percent local match required.
  Website: http://www.epa.gov/owow/watershed/initiative/.
  Contact: USEPA Region 5, 77 W. Jackson Blvd. Chicago, IL 60604. Phone: 312-886-7742. Email: thomas.paul@epa.gov.

- State Wetlands Protection Grants support development of new wetland protection, management, and restoration programs or refine existing programs. Grants can finance monitoring, assessment, and river corridor restoration.

Eligibility: State governments, local governments, and special districts.
Assistance: Federal–local cost share at 75 percent federal funding.
Website: http://www.epa.gov/region5/business/fs-swpg.htm.
Contact: USEPA Region 5, Water Division, 77 W. Jackson Blvd. Chicago, IL 60604. Phone: 312-886-0241.

- The Illinois Clean Lakes Program grant program supports lake owners' interest and commitment to long-term, comprehensive lake management. Detailed diagnostic/ feasibility studies scientifically document the causes, sources and magnitude of lake impairment (Phase I). Data generated from these monitoring studies are used to recommend lake protection/ restoration practices for future implementation (Phase II).
  Eligibility: Lake owners, local units of government, private not-for-profit (501C3) groups.
  Assistance: up to $75,000 for Phase 1, 40% match required; up to $300,000 for Phase II study costs with 50 percent local match required. Available for publicly-owned lakes larger than 6 acres with public access.
  Website: http://www.epa.state.il.us/water/conservation-2000/iclp.html.
  Contact: IEPA Bureau of Water – Surface Water Section, Des Plaines Monitoring and Assessment Unit, 9511 West Harrison, Des Plaines, IL 60016. Phone: 847-294-4000. Contact Wally Matsunaga. State contact: 217-782-3362.

- The Lake Education Assistance Program supports educational programs on inland lakes and lake watersheds.
  Eligibility: local governments, educational organizations, and private not-for-profit groups.
  Assistance: Maximum funding of $500 is reimbursed after completion.
  Website: http://www.epa.state.il.us/water/conservation-2000/leap/index.html.
  Contact: 217-782-3362.

- The Volunteer Lake Management Program (VLMP), administered by the Illinois EPA, serves as an educational program for Illinois citizens to learn about lake ecosystems and utilizes the time and talents of citizen volunteers to gather fundamental information on inland lakes.
  Eligibility: Lake owners.
  Assistance: technical assistance only.
  Website: http://www/epa.state.il.us/water/conservation-2000/vlmp.html.
  Contact: Holly Hudson, Chicago Metropolitan Agency for Planning, 233 South Wacker, Suite 800, Sears Tower, Chicago, IL 60606. email: hlhudson@cmap.org.

- The USEPA Guidebook for Financial Tools is used for identifying conservation funding source options
  Eligibility: anyone can access the guidebook.
  Assistance: informational only.
  Website: http://www.epa.gov/efinpage or http://cfpub.epa.gov/fedfund/
  Contact: see website.

- USEPA Catalog of Funding Sources for Watershed Protection is useful for identifying programs that will protect both urban and rural watersheds
  Eligibility: anyone can access the guidebook.
  Assistance: informational only.
  Website: http://www.epa.gov/owow/funding.html, http://www.epa.gov/owow/watershed/ or http://wwwepa.gov/owow/funding/html, http://www.epa.gov/owow/watershed/ or http://cfpub.epa.gov/fedfund/.
  Contact: see websites.

- The Brownfields Assessment, Revolving Loan Fund, and Cleanup Grants are for the re-use and remediation of brownfield sites throughout Illinois.
  Eligibility: local governments, private not-for-profit (501C3) groups, and others.
  Assistance: $2 to $3 million annually. Cleanup grants require 25% cost-share, grants range from under $15,000 to over $50,000.
  Website: http://www.epa.gov/brownfields/
  Contact: Call 312-886-7576 or 301-589-5318.

- The Environmental Education Grants Program funds environmental education activities such as curricula design or dissemination, designing or demonstrating educational field methods for the public, and training educators.
  Eligibility: Educational organizations, private not-for-profit groups, and local governments.
  Assistance: Minimum of 25% matching funds or in-kind services required. Awards of $25,000 or less are granted by regional offices.
  Website: http://www.epa.gov/enviroed/grants.html
  Contact: Call 312-353-5282 or visit the website for most current information and deadlines.

- The Environmental Justice Grant Programs include community-based approaches for environmental protection.
  Eligibility: Educational organizations, private not-for-profit groups.
  Assistance: No match is required. Up to $15,000 per non-superfund site, other project grants variable up to $100,000.
  Website: http://www.epa.gov.
  Contact: Call 312-886-5993 or 1-800-962-6215.

- Smart Growth Technical Assistance Opportunities assist local communities develop in an environmentally-friendly, sustainable manner.
  Eligibility: Local governments, private not-for-profit groups, and others.
  Assistance: In-kind contributions with assistance preferred.
  Website: http:/www.epa.gov/smartgrowth/techasst.htm/.
  Contact: Call 202-566-2853.

- The Priority Lake and Watershed Implementation Program provides funding to implement protection/restoration practices that improve water quality. Eligibility: Local governments, private not-for-profit groups. Priority given to publicly-owned and accessed lakes.
  Assistance: Funding up to 100%, projects range up to $40,000.
  Website: http://www.epa.gov/smartgrowth/techasst.htm/.
  Contact: 217-782-3362.

U.S. Army Corps of Engineers (USACE) Civil Works programs involve the planning, design, construction management, operation and maintenance of water resource management and restoration projects to meet flood and storm damage reduction, navigation, environmental restoration, hydropower, recreation and other water related goals.

- Flood Hazard Mitigation and Riverine Ecosystem Restoration Program ("Challenge 21") focuses on non-structural, sustainable approach to flood protection, including watershed-based planning, wetland conservation, relocation of buildings out of the floodplain, riparian corridor restoration, and pre-disaster mitigation planning. Funding has not yet been authorized.
  Eligibility: Local governments; study area must be within a floodplain.
  Assistance: Federal cost share at 50 percent for studies and 65 percent for project implementation. Maximum federal allocation is $30 million.
  Website: Information is available at http://www.saw.usace.army.mil/floodplain/Challenge%2021.htm.
  Contact: For information, contact USACE (Headquarters) Planning Division, 20 Massachusetts Avenue NW, Washington, DC 20314. Phone: 202-761-4750.

- Continuing Authorities Program allows the Corps to respond quickly to water resources problems. Some of the legislative authorities of the program include Aquatic Ecosystem Restoration (Section 206), Environmental Dredging (Section 312), and Environmental Restoration (Section 1135). See website for full listing.
  Eligibility: Local public entities are eligible for studies, planning engineering, construction, and administration.
  Assistance: Federal–local cost share percentages

vary depending on the program. Up to $5 million federal assistance provided.
Website: The USACE Vicksburg District provides an overview of the Continuing Authorities Program at http://www.mvk.usace.army.mil/Offices/pp/Projects/Small_Projects_Program/basics.htm.
Contact: USACE Chicago District, 111 N. Canal St, Suite 600, Chicago, IL 60606. Phone: 312-846-5498.

Federal Emergency Management Agency (FEMA) manages a number of programs that assist communities in disaster planning and hazard mitigation.

- Flood Mitigation Assistance (FMA) helps states and communities identify and implement measures to reduce the risk of flood damage to structures insured under the National Flood Insurance Program (NFIP). Awards planning grants to assist development of Flood Mitigation Plans and project grants for projects that reduce flood losses, such as elevation, relocation, demolition, acquisition of insured structures and property, flood proofing, and minor structural projects that reduce the risk of flood to insured structures.
  Eligibility: State agencies, NFIP communities, qualified local organizations, Tribal governments.
  Assistance: Federal cost share maximum of 75 percent.
  Website: http://www.fema.gov/fima/fma.shtm
  Contact: FEMA Region 5, 536 South Clark St., Chicago, IL 60605. Phone: 312-408-5500.

- Hazard Mitigation Grant Program (HMGP) implements long-term hazard mitigation measures following a major disaster declaration and, in Illinois, for post-disaster floodplain building buy-outs, elevation, relocation, retrofit, and demolition on public and private land.
  Eligibility: State and local governments, qualified non-profit organizations, Tribal governments.
  Assistance: Federal cost share maximum of 75 percent.
  Website: http://www.fema.gov/fima/hmgp/
  Contact: Mr. Ron Davis, Illinois Emergency Management Agency, 110 East Adams Street, Springfield, IL 62701-1109. Phone: 217-782-8719. E-mail: RDavis@iema.state.il.us.

- Pre-Disaster Mitigation Program (formerly Project Impact) implements the pre-disaster mitigation program for states and communities to reduce risk to the population, the costs and disruption caused by severe property damage and the cost to all taxpayers of Federal disaster relief efforts. Eligible projects include: acquisition, relocation, elevation, and strengthening of structures, development of standards to protect structures from disaster damage, and drainage improvement projects.
  Eligibility: State and local governments, universities, Tribal governments.
  Assistance: Federal cost share maximum of 75 percent with a $3 million cap.
  Website: http://www.fema.gov/fima/pdm.shtm.
  Contact: FEMA Region 5, 536 South Clark St., Chicago, IL 60605. Phone: 312-408-5500.

- National Flood Insurance, Increased Cost of Compliance Program provides flood insurance policyholders with flood damaged homes and businesses in high-risk areas, also known as Special Flood Hazard Areas, with assistance to help pay the costs to bring their home or business into compliance with their community's floodplain ordinance, including building elevation, relocation, demolition, or floodproofing.
  Eligibility: flood insurance policy holders.
  Assistance: Federal assistance up to $30,000.
  Website: http://www.fema.gov/nfip/icc.shtm.
  Contact: FEMA Region 5, 536 South Clark St., Chicago, IL 60605. Phone: 800-427-4661.

US Department of Agriculture, Natural Resource Conservation Service (NRCS), the successor agency to the Soil Conservation Service, partners with state conservationist offices and provides funding and technical assistance to landowners to promote soil and water conservation.

- Environmental Quality Incentives Program (EQIP) provides incentive payments and cost-shares to implement conservation practices.
  Eligibility: Non-federal landowners engaged in farming or ranching.
  Assistance: Federal share maximum of 75 percent, $450,000 aggregate cap on EQIP contracts. Beginning farmers and ranchers, as well as limited resource producers, may qualify for a 90 percent cost-share.
  Website: http://www.il.nrcs.usda.gov/programs/eqip/.
  Contact: 500 C Street, SW Washington, D.C. 20472. Phone: (202) 566-1600. State: 217.353.6600.

- Conservation Reserve Program (CRP) offers annual rental payments, incentive payments for certain activities, and cost-share assistance to remove highly erodable cropland or sensitive acres from crop production. Program encourages farmers to plant long-term resource conserving vegetative covers to improve soil, water, and wildlife resources. Eligible practices include riparian buffers along streams, ditches, lakes, wetlands, and ponds, grass or contour filter strips, and windbreaks. Funds also may be used to retire agricultural floodplain land. Program is administered by the Farm Service Agency.
  Eligibility: Non-federal landowners engaged in farming or ranching.
  Assistance: Farmers receive compensation, based on agricultural rent, for retiring sensitive land over a multiyear contract, usually 10-15 years.
  Website: http://www.nrcs.usda.gov/programs/crp/.
  Contact: USDA Farm Service Agency, 1400 Independence Ave, SW Washington, DC 20250-0506 Phone: 800-457-3642. State office: 217-353-6600.

- Emergency Watershed Protection Program (EWP) provides assistance to reduce hazards to life and property in watersheds from erosion and flooding due to severe natural events. May be used to establish vegetative cover, open restricted channels, repair diversions and levees, and purchase floodplain easements on flooded land in non-urban areas.
  Eligibility: Public and private landowners with a project sponsor, i.e., a state or local government or special government district. Applications must be submitted within 60 days of disaster or 10 days in an emergency.
  Assistance: Up to 75 percent federal cost-share for projects.
  Website: http://www.nrcs.usda.gov/programs/ewp/.
  Contact: USDA, NRCS, Financial Assistance Programs Division, 14th and Independence Ave., SW, Room 6103A-S, Washington, DC 20250. Phone: 202-690-0793. State: 217.353.6600.

- Soil and Water Conservation Assistance program provides cost share and incentive payments to farmers and ranchers to voluntarily address threats to soil, water, and related natural resources, including grazing land, wetlands, and wildlife habitat. Requires a conservation plan and certification of eligible conservation practices by state conservationist.
  Eligibility: Farmers and ranchers who own or control land.
  Assistance: 5 to 10 year contracts with NRCS, 75 percent federal cost share, $50,000 maximum benefit.
  Website: http://www.nrcs.usda.gov/programs/swca/.
  Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1873.

- Watershed Protection and Flood Prevention Program (PL 83-566) includes the Watershed Surveys and Planning program as well as the Watershed Operations program. The latter provides funding for installing conservation practices in small watersheds for flood prevention, erosion and sediment control, water quality, habitat enhancement, wetland creation and restoration.
  Eligibility: Sponsorship by a state/local government or special government district, watershed less than 250,000 acres.
  Assistance: Project grants.
  Website: http://www.nrcs.usda.gov/programs/watershed/index.html#Watershed_ops.
  Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-8770.

- Wetland Reserve Program provides funds to purchase permanent or 30-year easements and restoration agreement, or assist in a cost-share agreement with landowners, to restore wetlands and floodplain habitat on private land.
  Eligibility: Individual landowners who have owned land for at least one year. Eligible lands must be restorable, contribute significantly to wetland functions and values, and be suitable for wildlife habitat
  Assistance: Permanent easement purchased by USDA with 100 percent of restoration funded by federal government; thirty year easement purchased by USDA with 75 percent of restoration funded federally; or restoration cost-share only with USDA contributing 75 percent of cost.
  Website: http://www.nrcs.usda.gov/programs/wrp/.
  Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1062. State contact: 217-353-6600.

- Wildlife Habitat Incentives Program (WHIP) provides funding and technical assistance for private landowners to develop and improve fish and wildlife habitat.
  Eligibility: Private lands and some federal, state, and local government lands.
  Assistance: Cost-share agreements up to 75% depending on landowner commitment, increased assistance for agreements longer than 15 years.
  Website: http://www.nrcs.usda.gov/programs/farmbill/index.html
  Contact: USDA NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1062. State contact: 217.353.6600.

- The Streambank Stabilization Restoration Program, administered by the Soil and Water Conservation District, goals are to develop and demonstrate vegetative, stone structure and other low-cost bio-engineering techniques for stabilizing streambanks and to encourage the adoption of low-cost streambank stabilization practices by making available financial incentives, technical assistance and educational information to landowners with critically eroding streambanks.
  Eligibility: All landowners and project sites (rural and urban) in each Illinois county.
  Assistance: check with the Lake County SWCD for details.
  Website: http://www.lakeswcd.org/.
  Contact: Lake County Soil and Water Conservation District, 100 N Atkinson Rd, Suite 102A, Grayslake, IL 60030 Phone: 847-223-1056. Email: lcswcd@sbcglobal.net.

- The Conservation Security Program (CSP) promotes the conservation of soil, water, air, energy, plant and animal life located on working lands.
  Eligibility: Individuals, organizations, and others. Contact administrator for details.
  Assistance: check with the county-based USDA Service Centers for application deadlines and most current information. In-kind services or operations are required.
  Website: http://www.nrcs.usda.gov/programs/farmbill/index.html.
  Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1062.

- The Farm and Ranch Lands Protection Program (FRPP) is intended to permanently preserve prime farmland or protect lands with historical and archeological resources.
  Eligibility: local units of government, private not-for-profit (501C3) groups, educational institutions, and others.
  Assistance: matching and in-kind match required. Check website for details.
  Website: http://www.nrcs.usda.gov/programs/farmbill/index.
  Contact: USDA, NRCS, 14th and Independence Avenue, SW, Washington, DC 20250. Phone: 202-720-1062.

United States Department of Agriculture, Forest Service (USDA-FS) manages programs that promote forestry and natural enhancement of urban areas through urban forestry programs.

- Urban and Community Forest Challenge Cost-Share Grant Program helps establish and support urban and community forests and forestry activities.
  Eligibility: local governments, educational organizations, individuals, and others.
  Assistance: Non-federal match of 50% required
  Website: http://www.fs.fed.us/ucf/.
  Contact: USDA, Forest Service 1400 Independence Ave., SW, Washington, D.C., 20250-0003. Phone (202) 205-8333.

United States Department of Energy (USDOE) compiles and distributes a list of monthly funding opportunities relating to energy and the environment. Go to http://www.eere.energy.gov/ and click on financial opportunities.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS) manages programs to protect wildlife and habitat by means such as issuing rules for hunters and anglers, administering the Endangered Species Act, and awarding grants for environmental restoration.

- Coastal Program provides grants for habitat restoration and other purposes.
  Eligibility: Individuals, state and local governments, universities, non-profit organizations.
  Assistance: Project grants at 50 percent local match. Award typically varies between $5,000 and $50,000.
  Website: http://www.fws.gov/cep/cepcode.html.
  Contact: USFWS, Branch of Habitat Restoration, Room 400, 4401 N. Fairfax Blvd., Arlington VA 2220 Phone: (703) 358-2201 USFWS Region 3 Office, 2651 Coolidge Rd, East Lansing, MI 48823. Phone: (517) 351-8470.

- Challenge Cost Share Program provides grants for conservation practices, ecosystem protection, and enhancement of wildlife and plant habitat.
  Eligibility: Individuals, businesses, federal, state, and local governments, universities, and non-profit organizations.
  Assistance: Grants at 50 percent local match. Average award is about $7,800.
  Website: See Catalog of Federal Domestic Assistance (15.642), http://www.cfda.gov.
  Contact: USFWS National Wildlife Refuge System, 4401 N. Fairfax Drive, Suite 670, Arlington, VA 22203. Phone: 703-358-1744.

- Private Stewardship Program provides cost share funding for conservation practices by private landowners or community groups that benefit threatened, endangered, and at-risk species.
  Eligibility: Individuals, businesses, private nonprofit organizations, local or county governments. Cooperating private landowners must be identified in proposals.
  Assistance: Project grants at 10 percent local match. Average award about $70,000.
  Website: http://endangered.fws.gov/grants/private_stewardship/index.html.
  Contact: USFWS Region 3, One Federal Drive, Fort Snelling, MN 55111-4056. Phone: 612-713-5343.

- Partners for Fish and Wildlife Programs assists private landowners in restoring habitat in accordance with USFWS goals, including, for example, restoration of wetland hydrology, use of prescribed burns, and planting with native vegetation. Wetlands are the primary focus of the program in Illinois. Landowners enter into at least a 10-15 year agreement to refrain from returning the land to its former use or otherwise nullifying the restoration. Eligible projects include restoration or enhancement of transient waterfowl habitat, improve water quality, flood protection, and groundwater recharge.
  Eligibility: Non-state and non-federal landowners, individuals, local government, and non-government organizations.

Assistance: Project grants at 50-60 percent local cost-share with matching or in-kind services preferred, but not required.
Website: http://ecos.fws.gov/partners/.
Contact: USFWS, Branch of Habitat Restoration, Room 400, 4401 N. Fairfax Blvd., Arlington VA 2220 Phone: (703) 358-2201 USFWS Region 3 Office, 2651 Coolidge Rd, East Lansing, MI 48823. Phone: (517) 351-8470.

- Northeastern Illinois Wetlands Conservation Account is intended for restoration, enhancement, and/or replacement of wetland functions and values which have been degraded or destroyed as a result of activities conducted in violation of the Clean Water Act or the Rivers and Harbors Act. Also funds activities that promote understanding, appreciation, and stewardship of wetlands.
  Eligibility: Governmental agencies, non-profit conservation organizations, and private home owner associations.
  Assistance: Project grants up to $150,000. Matching funds preferred but not required.
  Website: http://www.fws.gov/midwest/chicago/neiwca2004rfp.htm.
  Contact: USFS Chicago Illinois Field Office, 1250 South Grove Ave., Suite 103, Barrington, Illinois 60010. Phone: 847-381-2253.

National Park Service (NPS) manages the nation's system of national parks, historic sites, etc. and serves as a conduit for some recreation-related conservation funding.

- Land and Water Conservation Fund (LWCF) provides funds to states and localities for park and recreational land planning, acquisition, and development. Public access must be granted in perpetuity. Funds are awarded through the Illinois Department of Natural Resources, which also manages a similar program, using state funding, called the Open Space Lands Acquisition and Development (OSLAD) Program. Points are generally awarded for applications that place natural resources in protection.
  Eligibility: Local government agencies with authority to develop land for parks.
  Assistance: Up to $750,000 for acquisition projects, with 50 percent match required.
  Website: http://dnr.state.il.us/ocd/newoslad1.htm.
  Contact: Illinois DNR, One Natural Resources Way, Springfield, IL 62702. Phone: 217-782-6302.
- Challenge Cost-Share Program (CCSP) provides matching funds for a variety of projects relating to conservation, natural area enhancement, and recreation, but tends to fund projects on or near lands managed by the National Park Service.
  Eligibility: State and local governments, private nonprofit organizations.
  Assistance: Up to $30,000 with 50 percent match.
  Website: http://www.nps.gov/ncrc/programs/ccsp/index.htm.
  Contact: National Center for Recreation and Conservation, NPS, 1849 C Street NW (Org. Code 2220), Washington, DC 20240. Phone: 202-354-6912.

National Oceanic and Atmospheric Administration (NOAA)
NOAA guides the conservation and management of coastal resources through a variety of mechanisms, including collaboration with the coastal resource management programs of states and US territories.

- Coastal Zone Management Program (CZMP) assists states in implementing Coastal Zone Management programs approved by NOAA. Generally supports large and small projects by local governments and non-profit organizations through the Coastal Zone Enhancement Grants Program (Section 309, Coastal Zone Management Act). Funding for watershed projects in Illinois is expected in upcoming years, following program adoption and establishment by the State of Illinois.

- Coastal Services Center Cooperative Agreements provide technical assistance and project grants through

a range of programs and partnering arrangements, all focused on protecting and improving coastal environments.
Eligibility: Varies by program, but includes state and local governments, universities, non-profit corporations, and others.
Assistance: Project grants and cooperative agreements.
Website: http://www.csc.noaa.gov/funding/.
Contact: 2234 South Hobson Avenue, Charleston, SC 29405-2413. Phone: 843-740-1200.

U.S. Department of Transportation (DOT) regulates the federally mandated metropolitan planning process and administers federal transportation funding.

- Transportation Enhancement Program (TEA-21) funds projects that may include, among others, control technologies to prevent polluted highway runoff from reaching surface water bodies, scenic easements, pedestrian and bicycle trails, and wetland mitigation efforts including mitigation banking, wetland preservation and restoration, wetland planning, and natural habitats. Projects must relate to surface transportation and fall into one of twelve eligible categories. Funding is disbursed through State of Illinois.
  Eligibility: Local government units with taxing authority.
  Assistance: 80 percent federal share of project costs in general, 50 percent for acquisition. Awards up to $2 million.
  Website: http://www.fhwa.dot.gov/environment/te/overview.htm (Federal), http://www.dot.il.gov/opp/itep.html (Illinois).
  Contact: Illinois DOT, 2300 S. Dirksen Pkwy., Springfield, IL 62764. Phone: 217-782-7820.

Illinois Department of Natural Resources (IDNR)

- Conservation 2000 supports nine conservation programs across three state agencies and provides financial and technical support to groups (ecosystem partners) which seek to maintain and enhance ecological and economic conditions in key watersheds of Illinois.
  Eligibility: Varies by program. Eligible projects include habitat protection or improvement, technical assistance, and education.
  Assistance: Project grants, varies by program.
  Website: http://dnr.state.il.us/orep/c2000/.
  Contact: IDNR Region 2, 2050 W. Stearns Road, Bartlett, IL 60103. Phone: 847-608-3100.

- Conservation Reserve Enhancement Program (CREP) cooperative effort between landowners, state, local and federal agencies designed to enhance the Illinois River by protecting water quality and land in the Illinois River Watershed. Landowners who take environmentally sensitive land out of agricultural production in the Illinois River Watershed will receive financial incentives, cost-share incentives and technical assistance for establishing long-term, resource-conserving covers. Supported practices include: tree planting, habitat, wetlands, filter strips, and buffers. Terms may be 15, 30, or 50 years or permanent.
  Eligibility: Individuals, corporations, non-governmental organizations.
  Assistance: varies by practice and type of land.
  Website: http://www.ilcrep.org.
  Contact: IDNR Region 2, 2050 W. Stearns Road, Bartlett, IL 60103. Phone: 847-608-3100. State: 217.785.8287.

- Urban Flood Control Assistance involves initial study process and determination of appropriate flood control solutions. Funding depends on General Assembly appropriations for tributary studies and project feasibility investigations, focused on structural flood control solutions.
  Eligibility: Local sponsorship, positive net benefit formally shown by benefit-cost analysis, membership in good standing in National Flood Insurance Program.
  Assistance: Varies with appropriation.
  Website: http://dnr.state.il.us/owr/OWR_programs.htm.
  Contact: IDNR Office of Water Resources, One Natural Resources Way, 2nd Floor, Springfield, Illinois 62702-1271. Phone: (217) 782-4637.

- Small Projects Fund provides direct assistance to rural and small urban communities statewide to reduce stormwater related flood damages by alleviating localized, significant drainage and flood problems.
  Eligibility: Local government sponsorship, membership in good standing in National Flood Insurance Program.
  Assistance: Maximum of $100,000 per locality.
  Website: http://dnr.state.il.us/owr/OWR_programs.htm.
  Contact: IDNR Office of Water Resources, One Natural Resources Way, 2nd Floor, Springfield, Illinois 62702-1271. Phone: (217) 782-4637.

- The Illinois Habitat Fund The Illinois Habitat Fund is one of three programs funded through the purchase of a State Habitat Stamp. For the Illinois Habitat Fund Grant Program, eligible projects are limited to those seeking to preserve, protect, acquire or manage habitat (all wetlands, woodlands, grasslands, and agricultural lands, natural or altered) in Illinois that have the potential to support populations of wildlife in any or all phases of their life cycles.
  Eligibility: not-for-profit organization or government agency that has the expertise, equipment, adequate staff/workforce and permission from the landowner (if applicable) to develop and/or manage habitat..
  Assistance: projects designed to protect, preserve, acquire, or manage habitat. Contact program administrator for assistance amounts.
  Website: http://www.dnr.state.il.us/grants/Special_Funds/WildGrant.htm.
  Contact: Vera Bojic, RiverWatch Coordinator, 618-468-4870 or vbojic@lc.edu.

- The Open Space Lands Acquisition and Development (OSLAD) Program is a state-financed grant program that provides funding assistance to local government agencies for acquisition and/or development of land for public parks and open space. The federal Land & Water Conservation Fund program (known as both LWCF and LAWCON) is a similar program with similar objectives.
  Eligibility: Local governments having statutory authority to acquire and develop land for public park purposes.
  Assistance: Under both programs, funding assistance up to 50% of approved project costs can be obtained. Grant awards up to $750,000 are available for acquisition projects, while development/renovation projects are limited to a $400,000 grant maximum.
  Website: http://dnr.state.il.us/ocd/newoslad1.htm.
  Contact: IDNR Office of Office of Architecture, Engineering and Grants, One Natural Resources Way, 2nd Floor, Springfield, Illinois 62702-1271. Phone: 217/782-6302.

- The Division of Wildlife or Resource Protection and Stewardship Trees, Shrubs and Seedlings at No Cost program is intended to encourage landowners to reforest land, increase wildlife, and control erosion.
  Eligibility: individuals; landowner must have an approved management / conservation plan.
  Assistance: Seedlings provided at no charge. Shipping costs paid by grantee.
  Contact: IDNR 217-785-2361.

- The Forestry Assistance Grant Programs are intended to create or enhance landowner or local forestry programs.
  Eligibility: Local governments, individuals, and others.
  Assistance: varies by program; 50% cost share grants and reimbursement up to $5,000.
  Website: http://dnr.state.il.us/conservation/forestry/.
  Contact: 217-782-2361.

- *Schoolyard Habitat Action Grants support* enhancement of wildlife habitat, with emphasis on youth involvement and education.
  Eligibility*:* Educational organizations and others. Project must involve a trained Project WILD educator or facilitator.
  Assistance: Maximum funding to $600.
  Website: http://dnr.state.il.us/lands/education/CLASSRM/grants.htm.
  Contact: 217-524-4126.

- Illinois Biodiversity Field Trip Grants & Free Educational Materials supports field trips for students to visit natural areas, natural history museums, and other natural resource related activities. Conservation education materials, including lesson plans, can be

used separately.
Eligibility: Educational organizations and others.
Assistance: funding for field trips up to $500 per class, per project.
Website: http://dnr.state.il.us/lands/education/CLASSRM/grants.htm.
Contact: 217-524-4126.

Illinois Department of Agriculture (IDA)

- Streambank Stabilization & Restoration Program (SSRP) is designed to support naturalized stream bank stabilization practices in rural and urban communities. 10 year program term.
  Eligibility: All organizations and individuals.
  Assistance: 25% match required.
  Website: http://www.agr.state.il.us/environment/conserv.
  Contact: 217-782-6297, 800-864-7311, or contact the local Soil & Water Conservation District that serves your county.

- Sustainable Agriculture Grant (Conservation 2000) Program supports projects include those that carry out research, education, and on-farm demonstration projects that support sustainable agriculture, conserve soil, protect the environment, and maintain profitability.
  Eligibility: Individuals, corporations, local governments. Landowner must have an approved management / conservation plan.
  Assistance: Grants awarded up to $10,000 per individual; $50,000 per unit of government, or other eligible organization. 60% cost-share; 10 year term.
  Website: http://www.agr.state.il.us/Environment/conserv.
  Contact: 217-782-6297, 800-864-7311, or contact the local Soil & Water Conservation District that services your county.

Illinois State Board of Education (ISBE)

- Useful website to search for educational grants at http://www.isbe.state.il.us/grants/default.htm.

State of Illinois Tax Incentives for Conservation are available for organizations and individuals. See http://dnr.state.il.us/OREP/C2000/Incentives.htm for details.

- Real Property Conservation Rights Act (765 ILCS 120/1 et seq.): if land is qualified by having a conservation easement, it may be assessed at 8 1/3 fair market value.

- Illinois Natural Areas Preservation Act (525 ILCS 30/1 et.seq)/17 Ill Adm. Code: if land is qualified by being designated as an Illinois Nature Preserve, it may be assessed at $1/year in perpetuity.

- Preferential Assessment of Farmland (Property Tax Code, Sec. 1-60 (Definitions.) Sec. 10-110 et seq.: if qualified, assessments are based on Cropland as 33 1/3% of the agricultural economic value; Permanent Pasture as 1/3 of its value of cropland; other farmland at 1/6 of its value as cropland; and wasteland without a contributory value to farmland at zero.

- Open Space Assessment (Illinois Property Tax Code Sections 10-155): a lower use evaluation is used for land in open space; 10 acre minimum area.

- Preferential Assessment of Common Areas (Illinois Property Tax Code Sections 10-35): Purpose is to encourage open space in residential developments; if qualifying, assessment is reduced to $1/year.

- Non-Clear Cut Assessment (P.A. 91-907, Property Tax Code Sec. 10-153): land is valued at 1/12th of its productivity index equalized assessed value as cropland if it is within 15 yards of waters listed by IDNR as navigable and has not been clear cut of trees; incentive is not applicable in jurisdictions with populations greater than 500,000.

- Other tax incentives may also apply. Contact IDNR regarding the Real Property Conservation Rights Act and the Illinois Natural Areas Preservation Act at 217-785-8774. Contact your local township or county assessor to determine eligibility under other incentives.

Lake County

- Lake County SMC Watershed Management Board Fund
  Eligibility: Watershed Management Board members in good standing with the National Flood Insurance Program and comply with SMC policies.
  Assistance: Cost-share at least 50% with funds or in-kind services or a combination of both. Approximately $100,000 to $150,000 is available each year for planning, engineering analysis, alternate solution evaluation, design, capital construction, maintenance and repairs projects.
  Website: http://www.co.lake.il.us/smc/projects/wmb/..
  Contact: Lake County Stormwater Management Commission, 333 Peterson Road, Libertyville, Illinois, 60048. For information on Des Plaines River and North Branch of the Chicago River WMBs, call Tony Wolff, 847.918.5264 or email twolff@co.lake.il.us. For information on Fox River and Lake Michigan WMBs, call Rasto Vrazda, 847.918.7696 or email rvrazda@co.lake.il.us.

Other Sources

Project funding sources that could potentially qualify as federal/state matching funds may come from a variety of local government, private, or community trusts or foundations that support initiatives reflecting organizational policies. Eligibility criteria are as varied as the donors. Most of these sources require a Not-For-Profit (501c3,*c4, etc.) corporate status.

- The *Illinois Clean Energy Community Foundation* supports projects that enhance natural areas, increase renewable energy, or improve energy efficiency. Can be used to purchase land.
  Eligibility: private not-for-profit organizations, educational organizations, local governments.
  Assistance: call for details, which change year to year.
  Website: http://www.illinoiscleanenergy.org.
  Contact: Illinois Clean Energy Foundation, 312-372-5191.

- The *Illinois Conservation and Climate Initiative* (ICCI) is a joint project of the State of Illinois and the Delta Institute that allows farmers and landowners to earn greenhouse gas emissions credits when they use conservation tillage, plant grasses and trees, or capture methane with manure digesters. Program term runs through 2010.
  Eligibility: individuals and corporations.
  Assistance: contact the Delta Institute for details.
  Website: http://www.illinoisclimate.org.
  Contact: The Delta Institute, 312-554-1909.
- Riverwatch is a volunteer-driven effort to collect stream data from Illinois streams and submit the data to the Illinois Natural History Survey. This former IDNR program is now being adminstered by The National Great Rivers Research & Education Center.
  Eligibility: all Illinois streams.
  Assistance: monitoring training, forms, and kits.
  Website: http://ngrrec.org/river_watch.htm.
  Contact: Vera Bojic, RiverWatch Coordinator, 618-468-4870 or vbojic@lc.edu.

- *Habitat Restoration Funds for Northeastern Illinois River Watersheds* supports wetland restoration and aquatic wildlife habitat projects.
  Eligibility: individuals, all organizations, educational organizations, local governments.
  Assistance: 25% cost share.
  Website: http://www.lakeswcd.org.
  Contact: Lake County SWCD, 100 N. Atkinson Road, Suite 102-A, Grayslake, IL 60030-7805. Phone: 847-223-1056. E-Mail: lcswcd@sbcglobal.net.

- The *Great Lakes Basin Program for Soil Erosion and Sediment Control* supports projects that protect Great Lakes Water Quality, such as by controlling erosion and sedimentation,
  Eligibility: Educational organizations, local governments, and not-for-profit organizations in Lake, Cook, and Will Counties.

Assistance: Grant amounts awarded for small-scale ($30,000) and large-scale ($100,000) projects.
Website: http://www.glc.org/basin/.
Contact: Great Lakes Commission, Eisenhower Corporate Park, 2805 S. Industrial Hwy, Suite 100, Ann Arbor, MI 48104-6791. Phone: 734-971-9135.

- *The National Fish and Wildlife Foundation General Matching and Special Grant Programs* supports habitat restoration and protection on private lands.
  Eligibility: varies.
  Assistance: Sample grant sizes in Illinois range from $3,000 to over $100,000.
  Website: http://www.nfwf.org.
  Contact: 202-857-0166.

- *The Trust for Public Lands (TPL)* works with local organizations to conserve lands for a variety of uses, to include farms, ranches, natural lands and lands of historic importance.
  Eligibility: local government, private not-for-profit organizations, educational organizations, and others.
  Assistance: technical and informational assistance to identify lands to be protected and assist in financing and land transactions.
  Website: http://www.tpl.org. Click on local programs-North Central Region.
  Contact: 312-427-1979 & 314-436-7255.

Reference Sources

Several grant search engines and organizations exist to help identify funding sources. Fees for services or products may be charged by these organizations. When searching, be sure to clarify whether charges will be incurred. For "do-it-your-selfers," local grant data collection centers are available throughout Illinois.

- *Resources for Global Sustainability*
  RGS publishes a yearly catalog called “Environmental Grantmaking Foundations”. P.O. Box 3665, Cary, NC 27519. Phone: 1-800-724-1857. http://www.environmentalgrants.com.

- *Environmental Grantmaker’s Association*
  Provides a list of environmental grant foundations. http://www.ega.org.

- *Minnesota Office of Environmental Assistance*
  http://www.nextstep.state.mn.us/

- *The Foundation Center*
  79 Fifth Street, New York, New York 10003. Phone: 212-620-4230. http://www.fdncenter.org.

- *Sonoran Institute*
  Look for Conservation Assistance Tools (CAT) at http://www.sonoran.org.

- *Illinois Department of Natural Resources*
  IDNR has a very comprehensive grant search engine at: http://dnr.state.il.us/orep/c2000/grants/

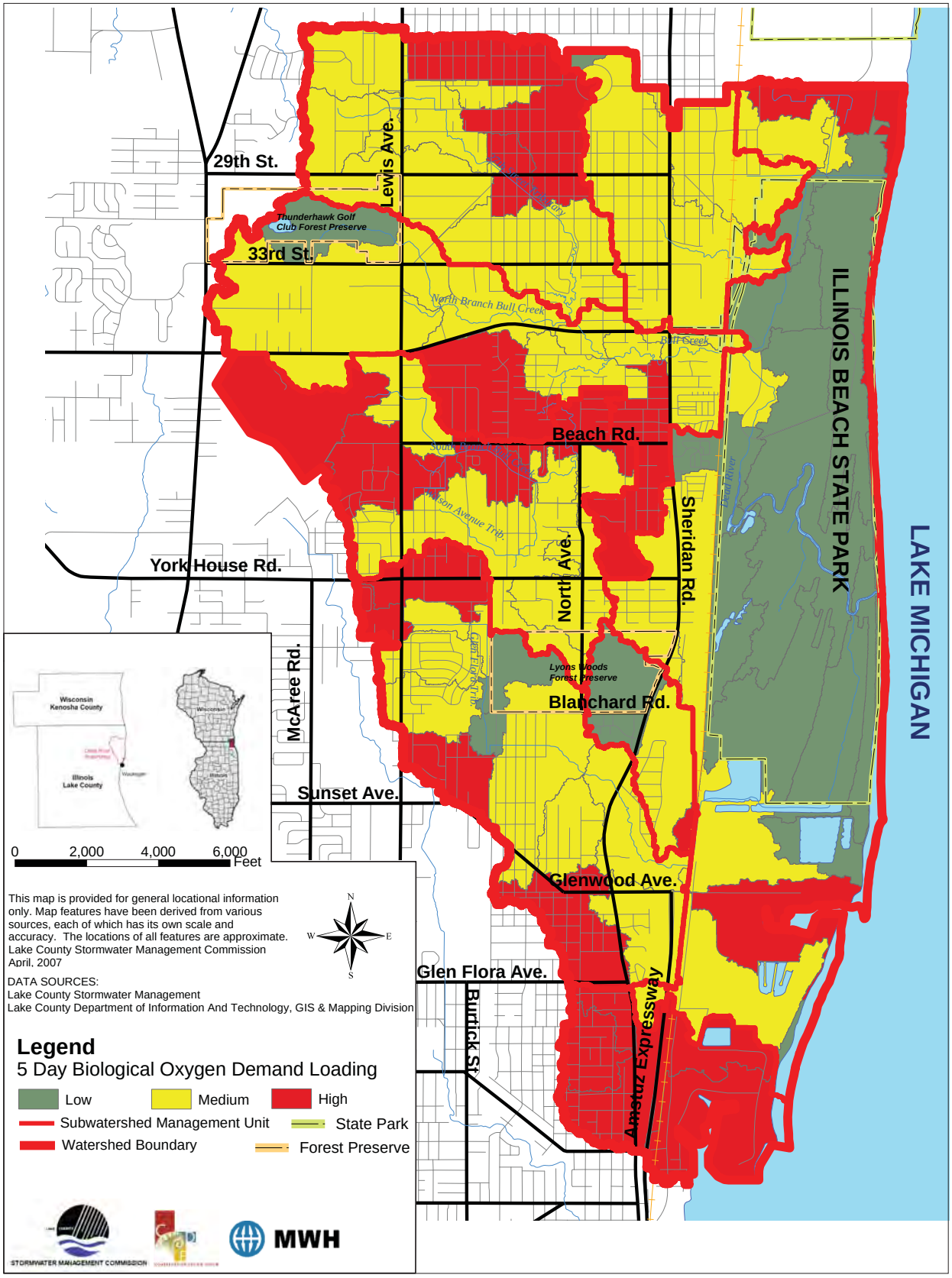
- *The Donor’s Forum of Chicago*
  208 S. LaSalle St., Suite 735, Chicago, IL 60604. Phone: 312-578-0175. http://www.donorsforum.org. E-mail: info@donorsforum.org

- *Metropolitan Association for Philanthropy*
  1320 Olive Street St. Louis, MO. http://www.mapstl.org. Phone: 314-621-6220.

- *eCivis Grants Network*
  Assistance for local governments to improve their grants success through expert grant research, information, grant training, and technology. eCivis, Inc. 3452 E. Foothill Blvd, Floor 9, Pasadena, CA 91107. Phone: 877-232-4847. Email info@ecivis.com.

appendix M - non-point source pollutant loading maps

This appendix presents a series of pollutant loading maps for each of the 12 pollutants discussed in the non-point source pollutant loding modeling results in Chapter 3. The loading data used to create these maps is included in Appendix K.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This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
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April, 2007
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Lake County Department of Information And Technology, GIS & Mapping Division
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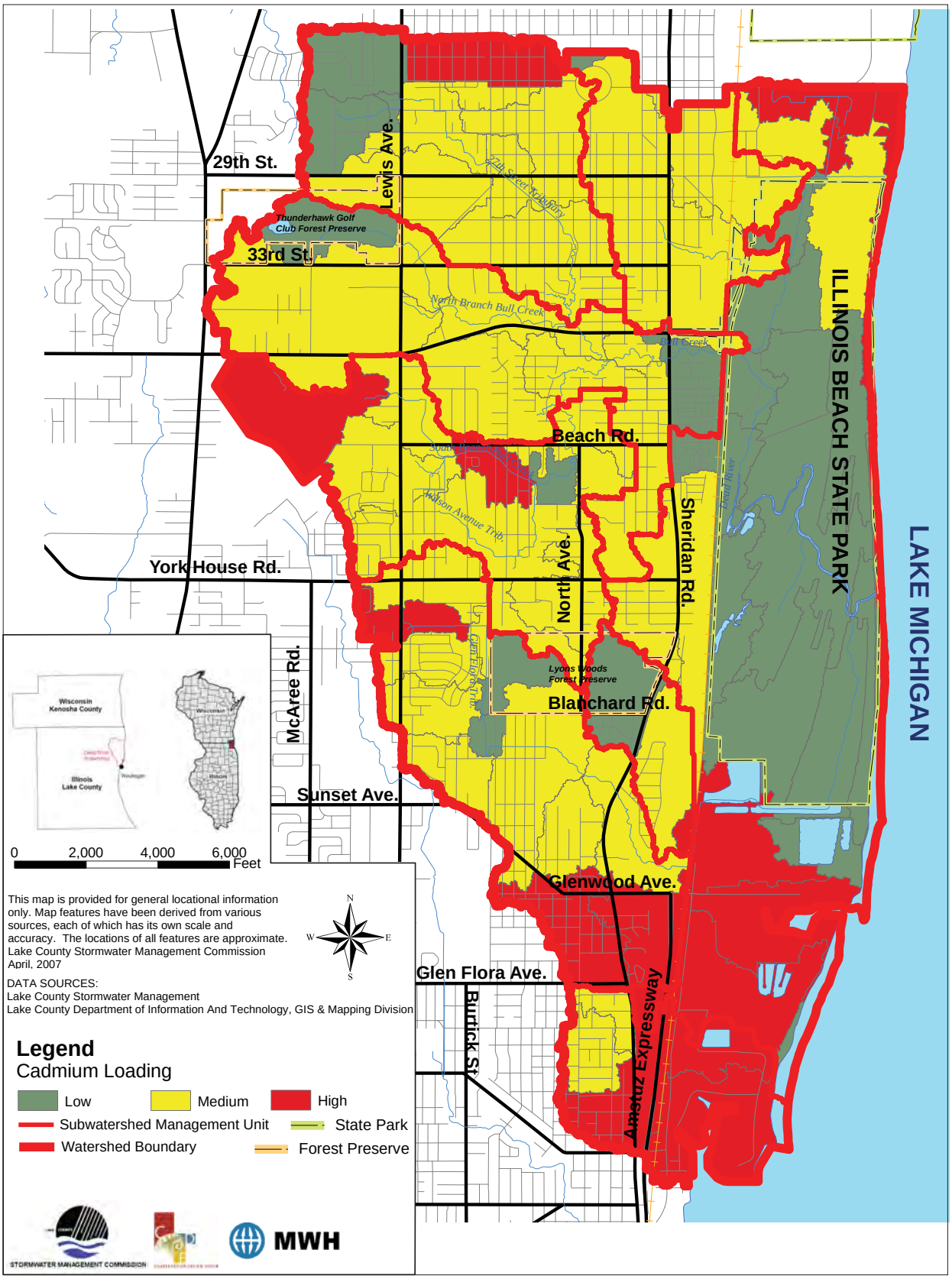
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April, 2007
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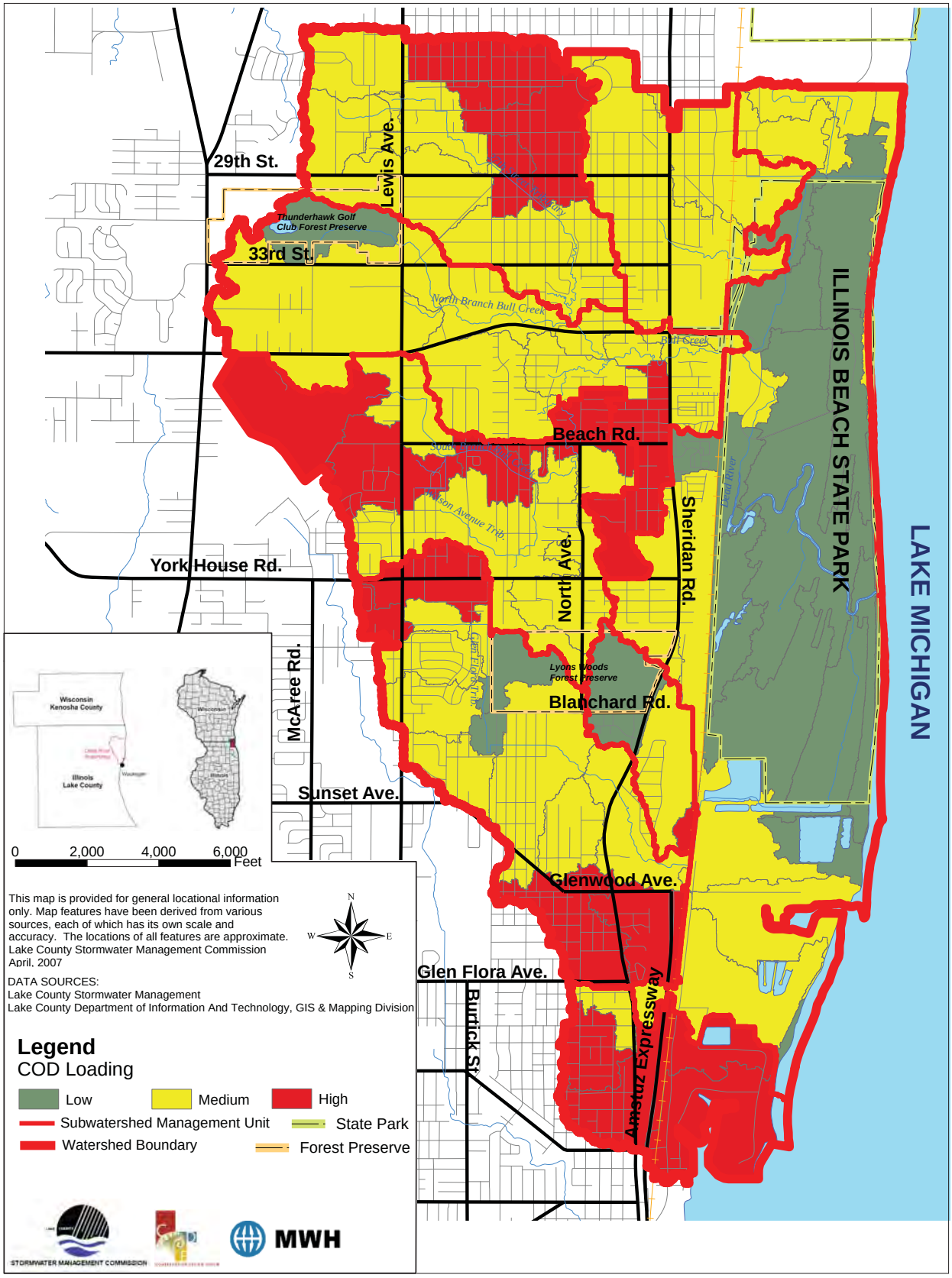
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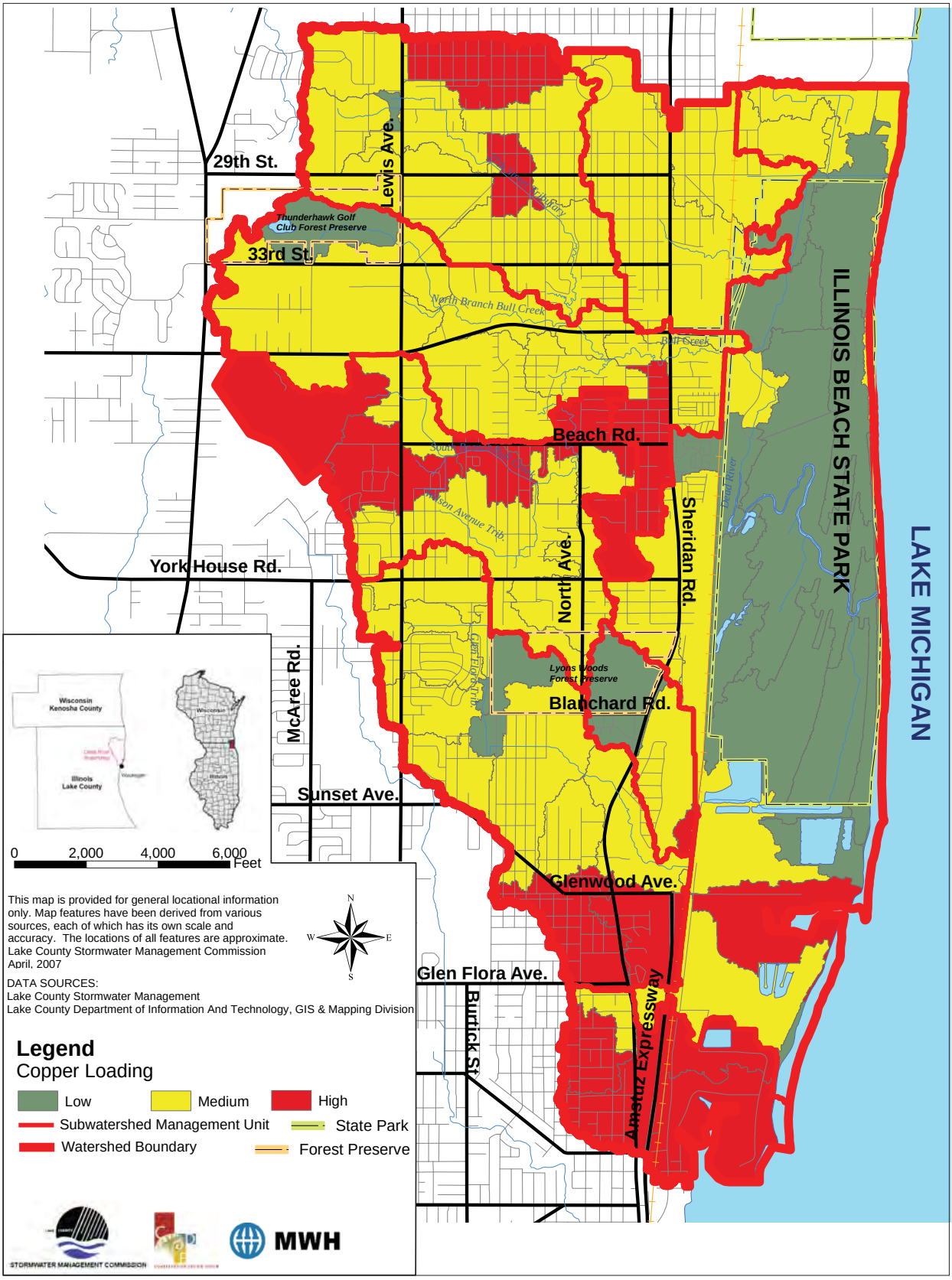
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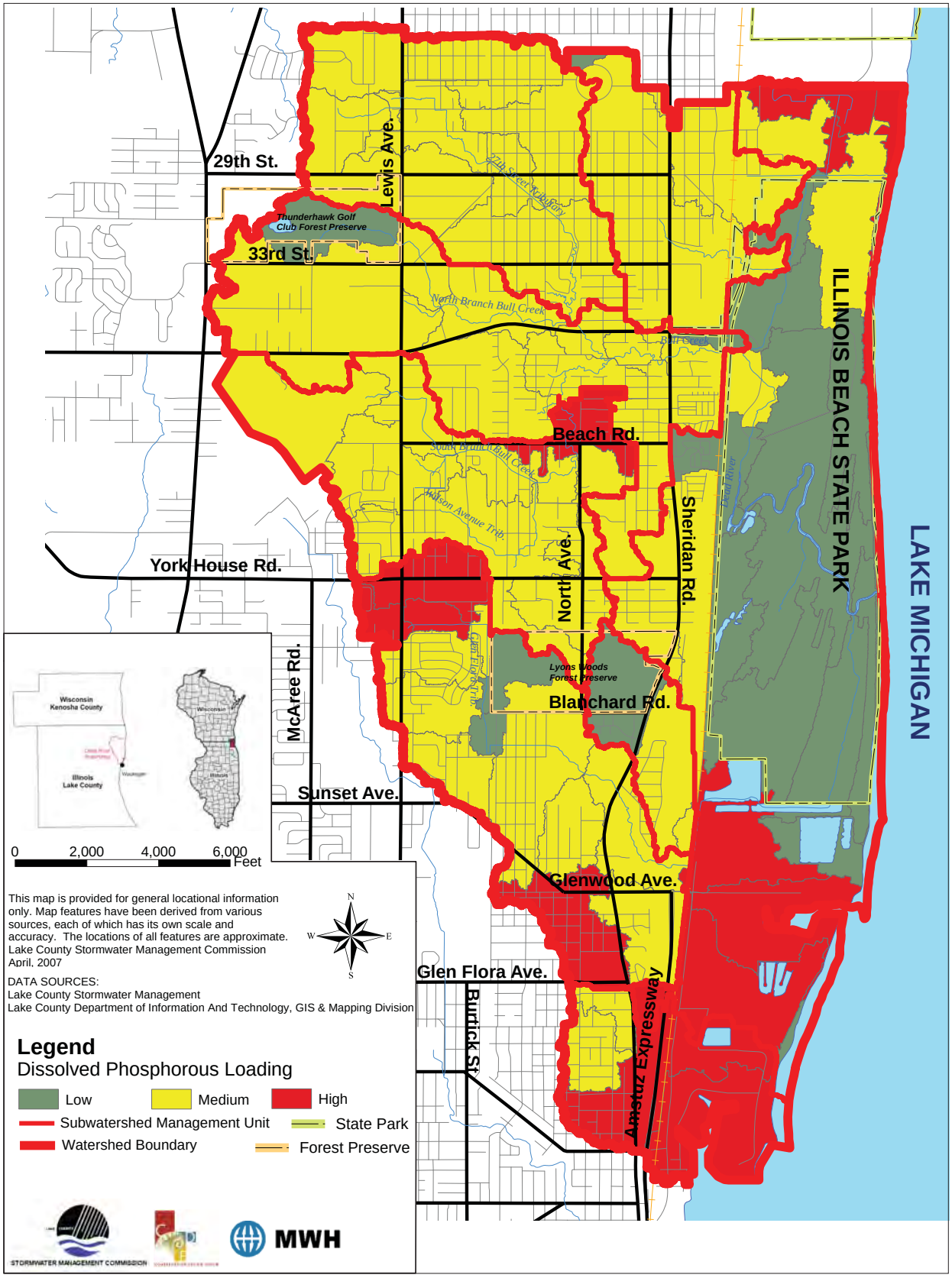
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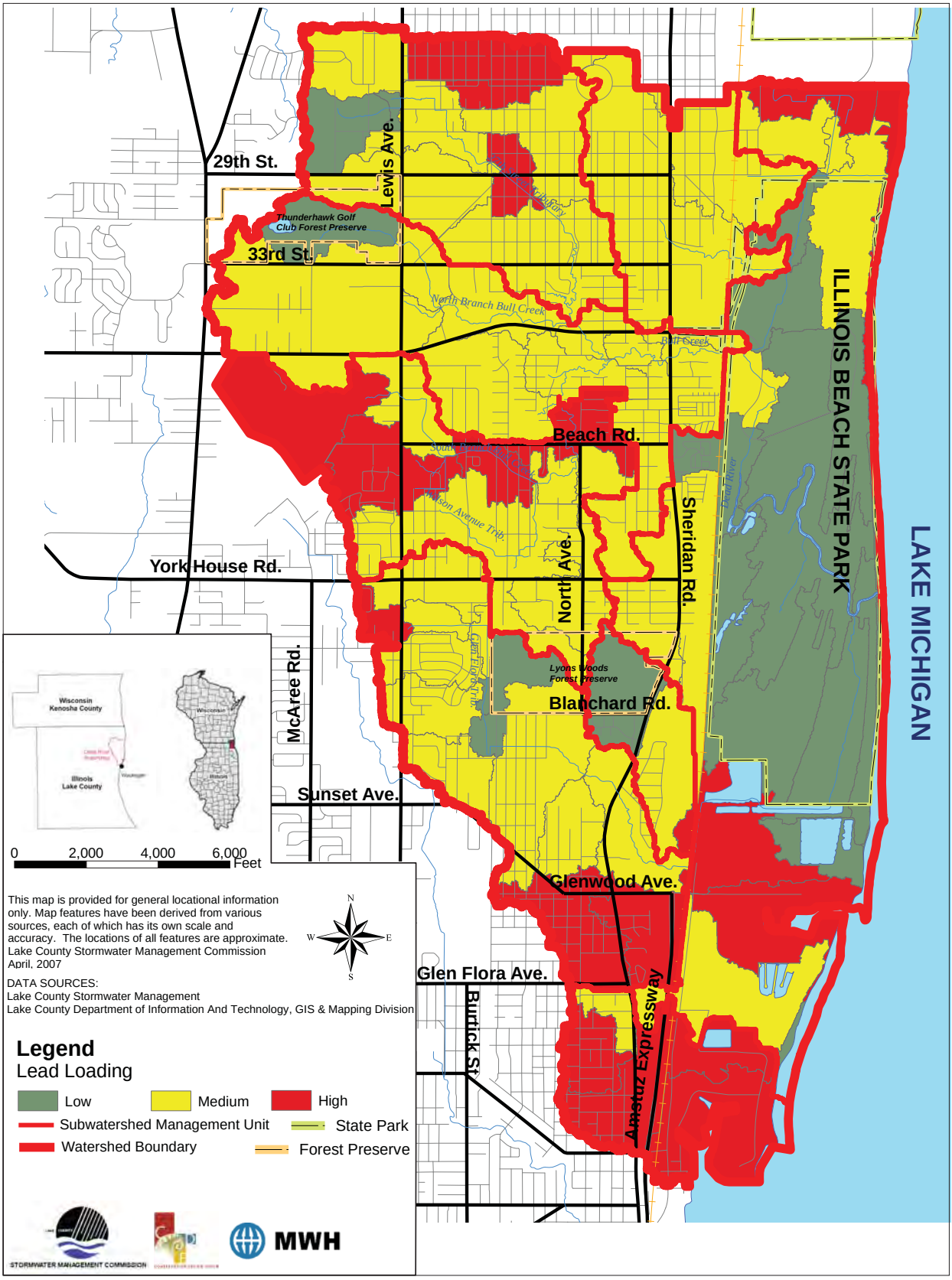
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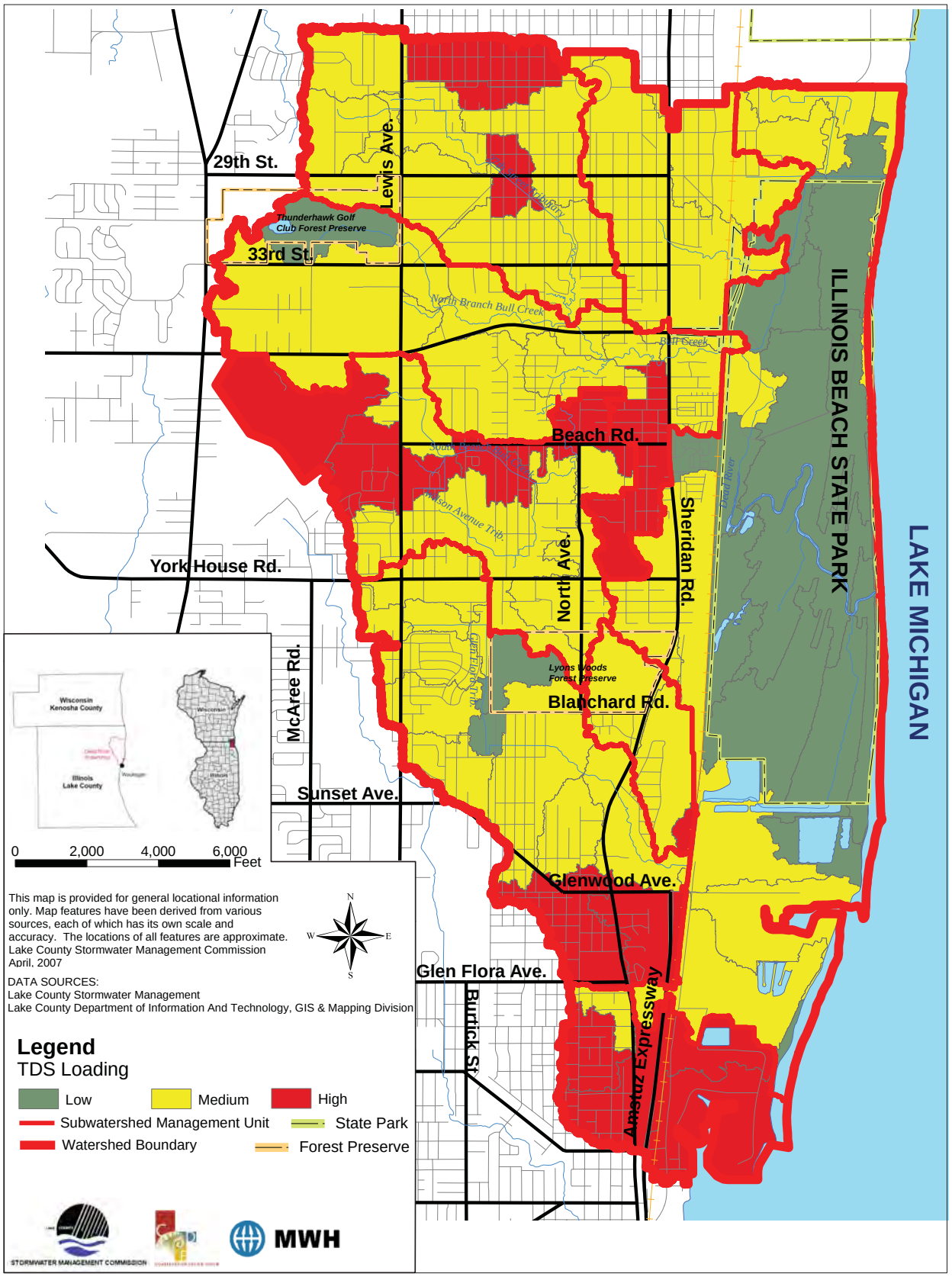
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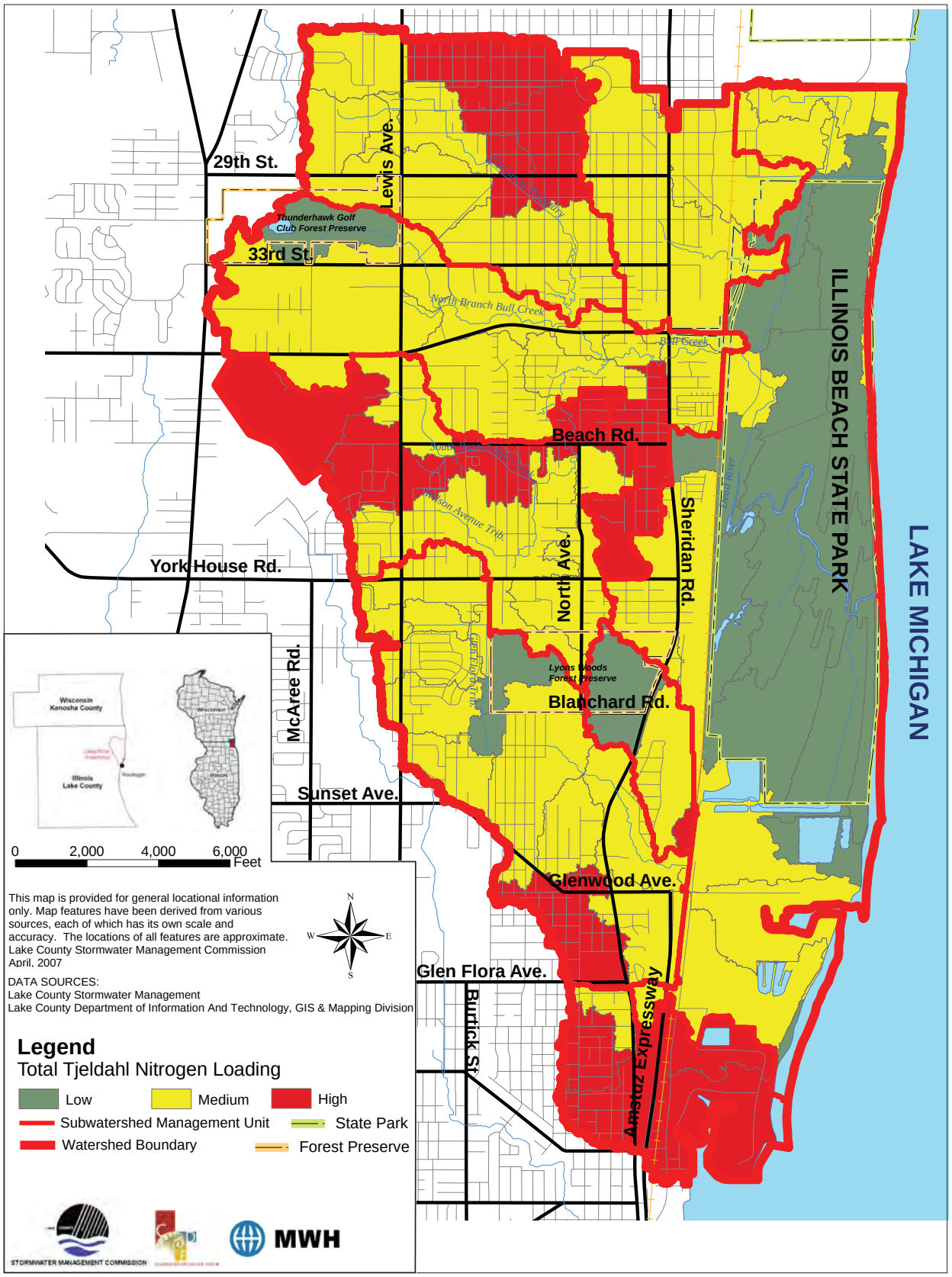
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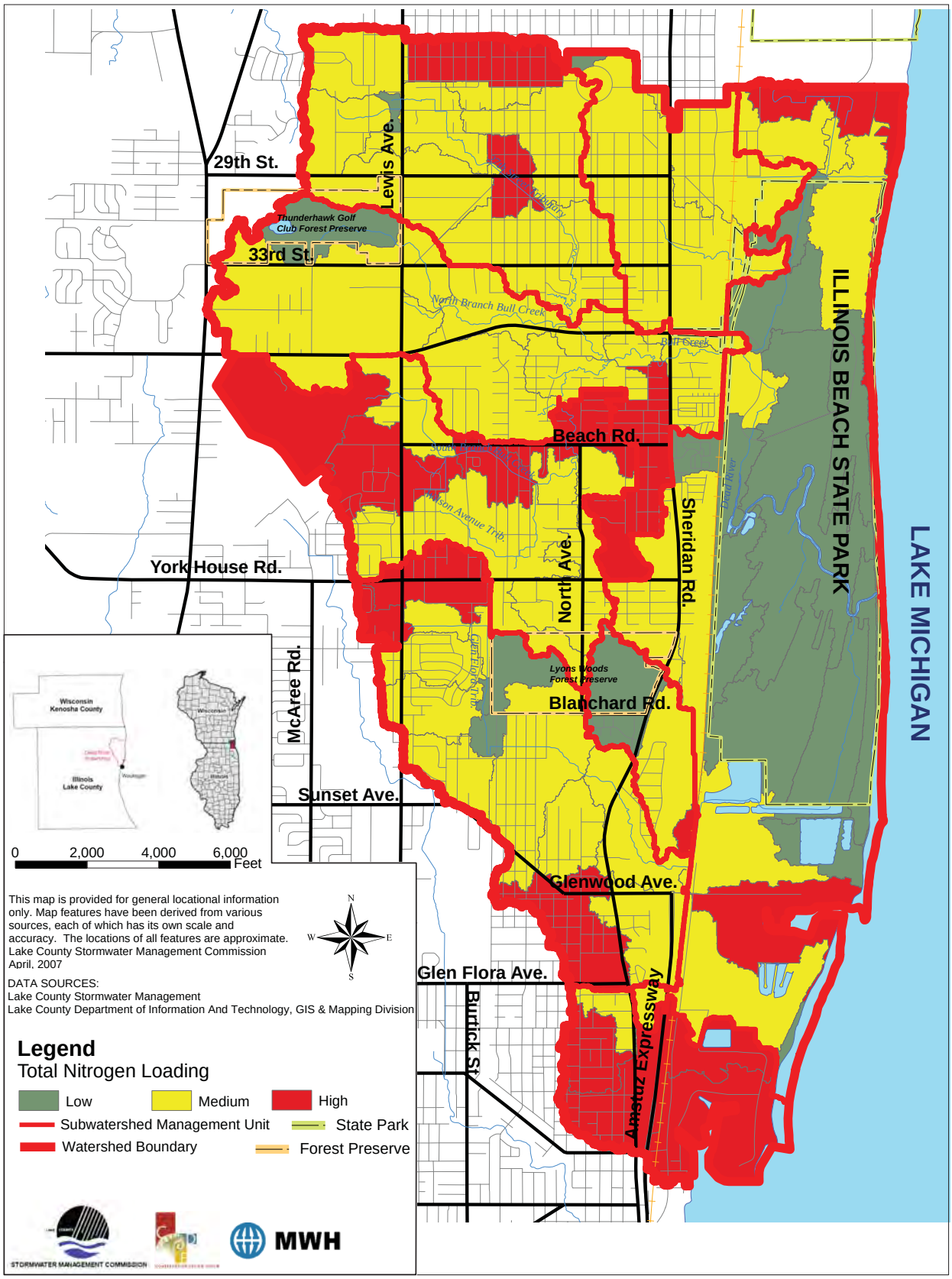
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Lake County Stormwater Management Commission
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Lake County Department of Information And Technology, GIS & Mapping Division
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Subwatershed Management Unit
State Park
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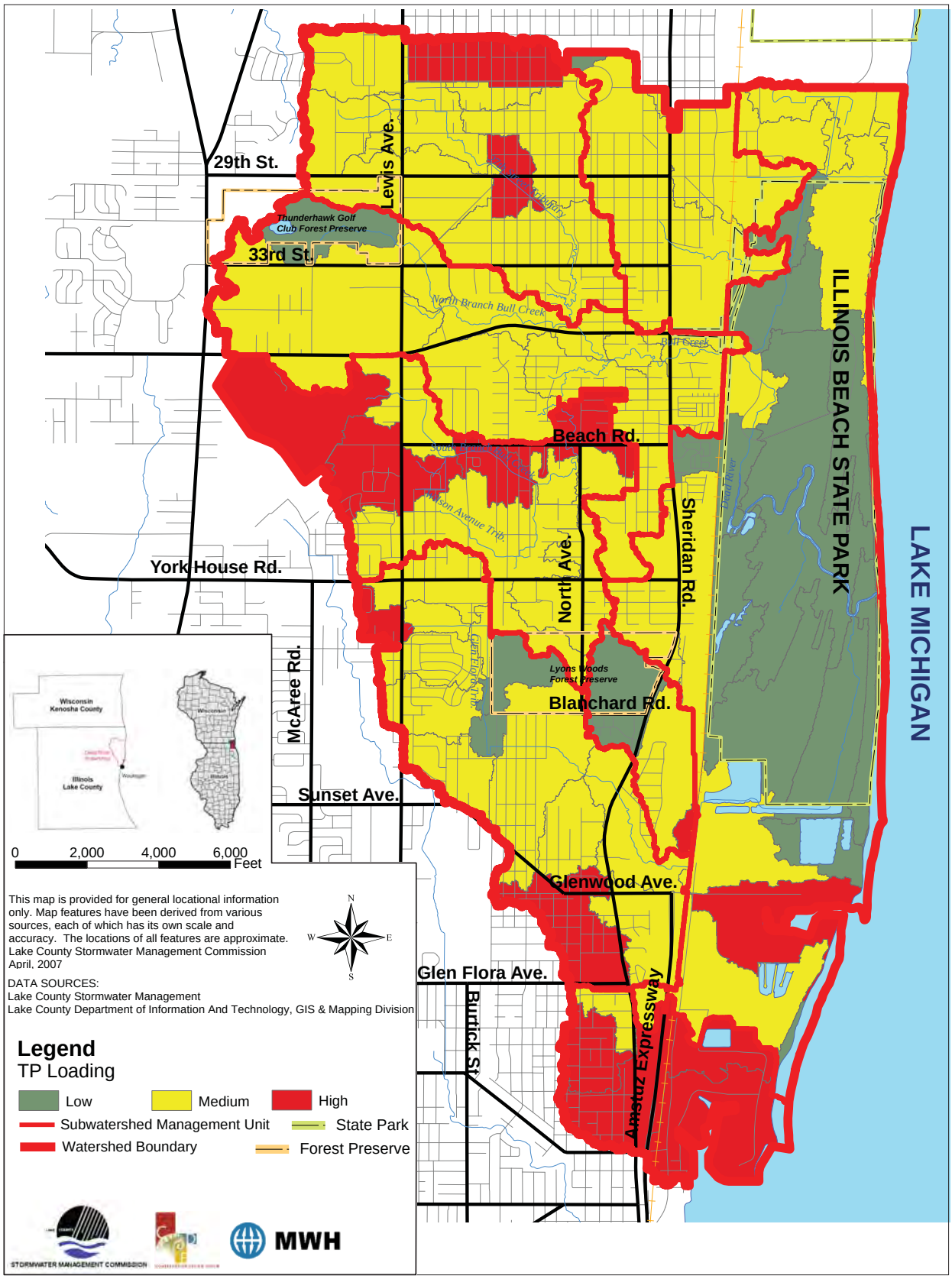
STORMWATER MANAGEMENT COMMISSION
MWH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33rd St.
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Bull Creek
Beach Rd.
Wilson Avenue Trib.
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York House Rd.
McAree Rd.
Lyons Woods Forest Preserve
Blanchard Rd.
Sunset Ave.
Glenwood Ave.
Glen Flora Ave.
Burrick St.
Amtrak Expressway
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This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
Lake County Stormwater Management Commission
April, 2007
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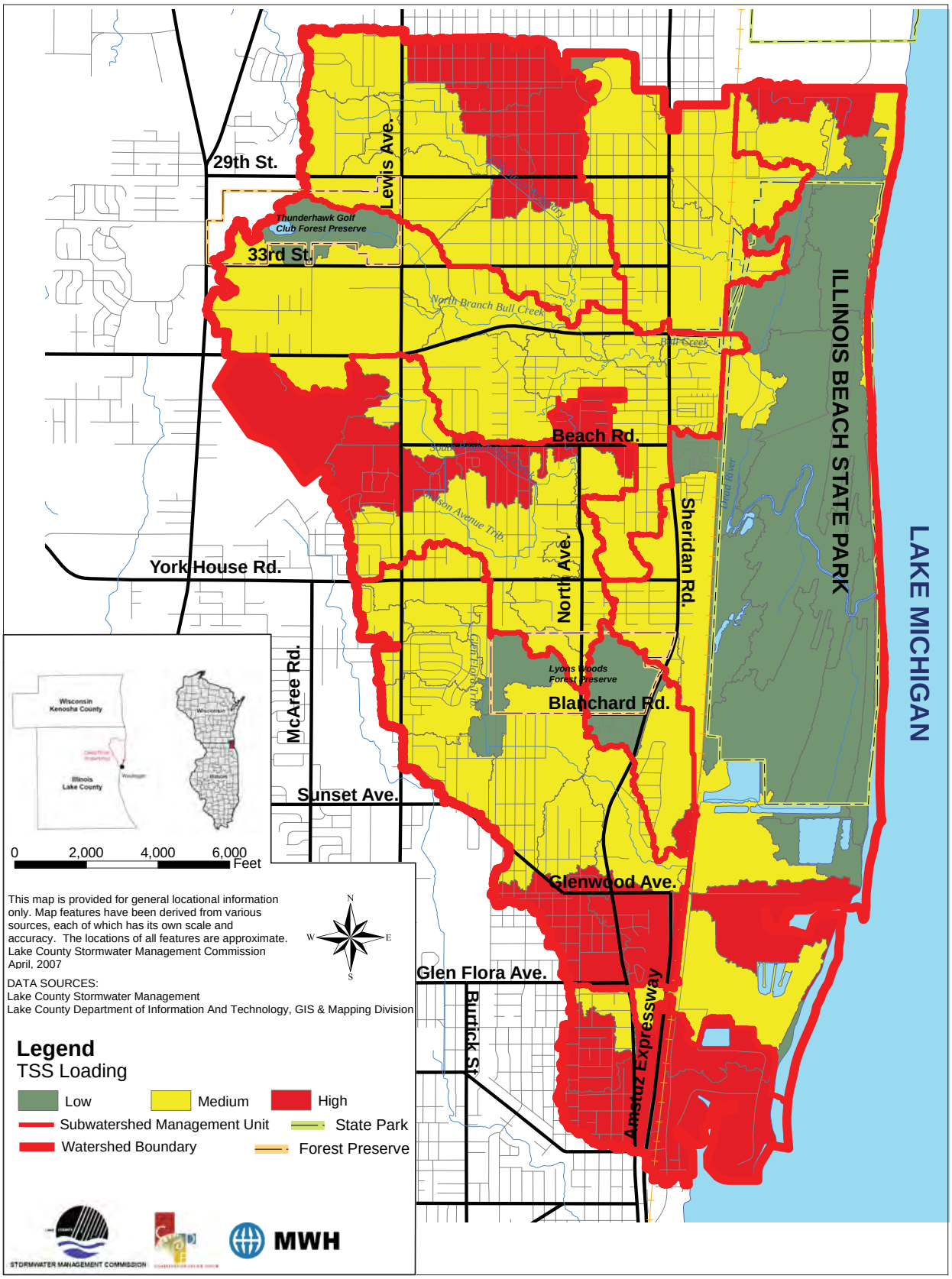
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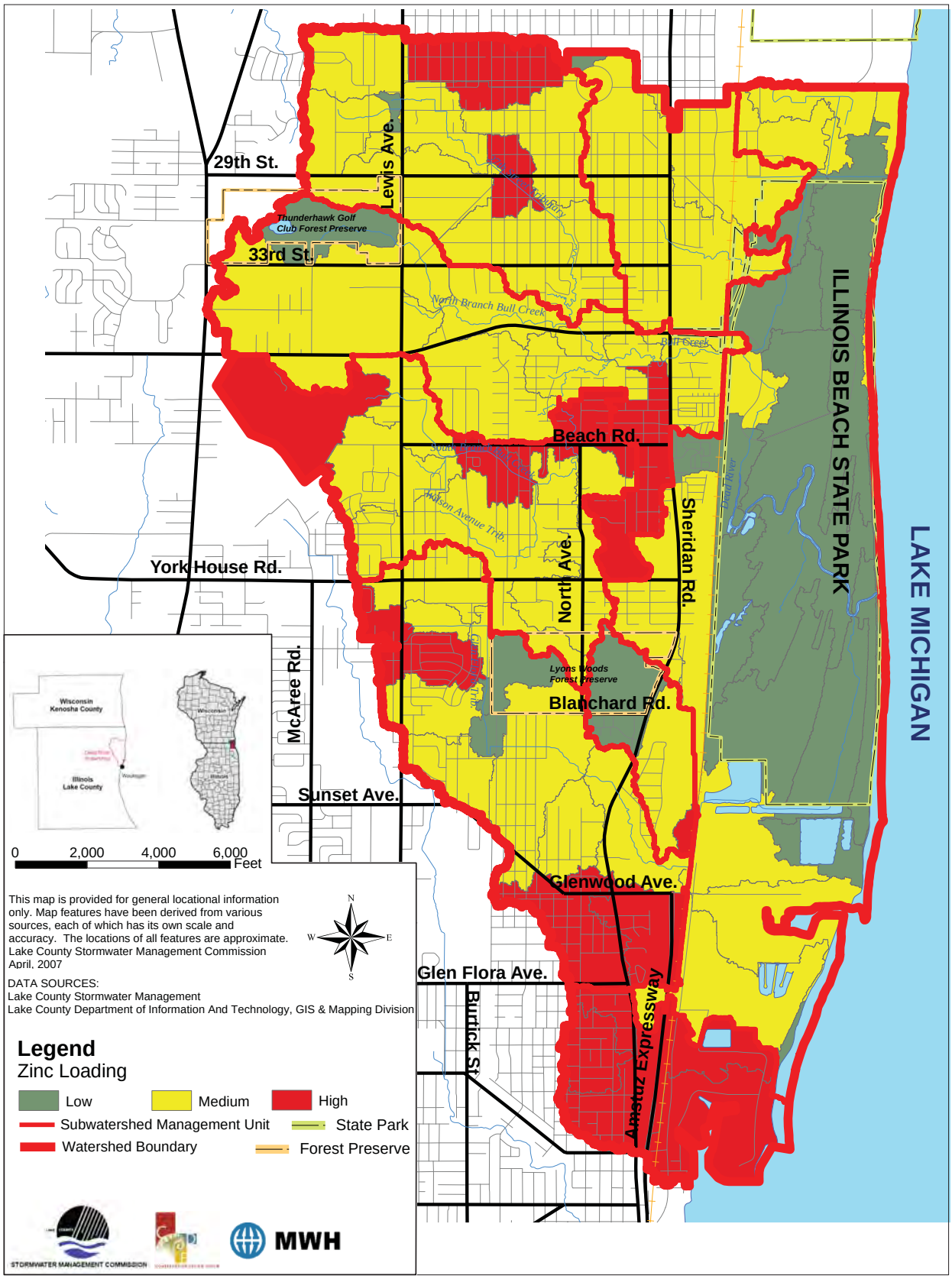
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Lake County Stormwater Management Commission
April, 2007
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Lake County Department of Information And Technology, GIS & Mapping Division
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State Park
Watershed Boundary
Forest Preserve
STORMWATER MANAGEMENT COMMISSION
MWH

appendix N - watershed planning committee meeting summaries

DEAD RIVER/KELLOGG CREEK
1ST JOINT WATERSHED PLANNING MEETING
OCTOBER 4, 2006 3-5PM

ILLINOIS BEACH STATE PARK CONFERENCE CENTER

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS

Patty Werner with Lake County Stormwater Management Commission (SMC) kicked off the meeting with a welcome from SMC, followed by consultant and participant introductions. Conservation Design Forum (CDF) is under contract to SMC for the completing the Kellogg Creek watershed plan and Kabbes Engineering (KEI) is under contract-to SMC to complete the Dead River watershed plan. CDF will be assisted by Montgomery Watson Harza (MWH); and KEI will be assisted by GeoSyntec (Geo) and Integrated Lakes Management (ILM). Jason Navota will be the point of contact for CDF and Karen Kabbes will be the point of contact for Kei. (A list of meeting attendees is attached.)

2.0 WATERSHED PLANNING (Copies of all of the PowerPoint presentations from the meeting can be found at: http://www.co.lake.il.us/smc/shedprofiles/Dead/DeadKell_Kickoff.asp.)

Scott Paszkiewicz of the Lake County Stormwater Management Commission (SMC) explained the concept of a watershed and the purpose of watershed planning efforts in Lake County. Dead and Kellogg are 2 of the 26 sub-watersheds in the county.

General watershed plan components consist of:

- Goals and objectives for the watershed plan
- An assessment of present and future watershed conditions
- Best management practices tool box
- An action plan for management and improvement

The plan will address stakeholders' (residents, governmental jurisdictions, businesses, other organizations) priorities including:

- Flood damage reduction
- Water quality improvement
- Protection/enhancement of the natural resources of the drainage system
- Others as defined by the stakeholders

This is scheduled to be a 15-month process, and separate planning committees and plans will be created for each watershed. Plan implementation will require municipalities and county agencies cooperation along with property owners.

3.0 WATERSHED PRESENTATIONS

Characterization of the Kellogg Creek Subwatershed

Jason Navota with Conservation Design Forum gave a virtual tour of the Kellogg Creek Watershed. The watershed includes three tributaries North Kellogg, South Kellogg, and an unnamed tributary sometimes referred to Dead Dog Creek. The watershed planning area includes parts of Winthrop Harbor, Zion, Beach Park, Zion and Benton Townships. The northern limits of the

watershed include Pleasant Prairie, WI and efforts will be made to incorporate Wisconsin stakeholders and data into developing the plan.

The presentation included maps of the watershed accompanied by photos taken during a recent field visit. Maps displayed included topography, water resources, land use and population, and were used to illustrate the impact of land uses on the tributaries. Photos demonstrated both positive and negative field observations: Illinois Beach State Park, open stream channels, ravines, problem stream channels (erosion, debris, structural damage), floodplains and forests, wetlands, and stormwater management practices.

Characterization of the Dead River Subwatershed

Patty Werner with SMC provided a snapshot view of the Dead River watershed. Beginning downstream, Patty discussed the Dead River in Illinois Beach State Park (IBSP), which is a dedicated nature preserve. Bull Creek flows into IBSP eventually reaching the Dead River, which flows into Lake Michigan during high flow events. The water flow patterns in Illinois Beach State Park are not always clear, as the topography is very flat. Bull Creek through Beach Park is the primary tributary for the northern part of the watershed, while Glen Flora Tributary drains the southern part of the watershed in Waukegan.

Patty presented information on watershed land use, water features (wetlands and streams) and demographics as part of the watershed characterization, and showed photos of the stream character and condition highlighting a restoration project completed on the downstream reach of Bull Creek by SMC and the Bull Creek Stakeholders Association.

- 31% of the watershed is wetland (mostly in IBSP).
- 27% of the wetlands are ADID (or high quality).
- The watershed stream tributaries include:
    - Dead River
    - An unnamed tributary (north of Bull Creek),
    - Bull Creek North
        - Includes 27th Street Tributary (Rachel Forester unofficially named this tributary Rachel Forester Creek for a recent US Army Corps of Engineers project),
    - Bull Creek South,
        - Includes Wilson Avenue Tributary,
    - Glen Flora Tributary.
- The highest elevation in the watershed is 756 feet.
- The lowest elevation is 578 feet (in IBSP).
- 42,463 people, 7% of the county's population, live in the watershed.
- The watershed land use is
    - 25% residential,
    - 44% wetland, forest, open space and
    - 18% transportation.

Patty discussed how land use & impervious cover (rooftops, roads, parking lots etc.) affect water quality and stream condition. Photos of different upstream and downstream sections of Bull Creek and Glen Flora Tributary were presented. The Glen Flora tributary is dammed and ponded at the Glen Flora Country Club.

Bull Creek Restoration Project

Project on Bull Creek between Sheridan Road and Railroad has dealt with:

- Steep banks, exposed utilities and included spending $500-600,000 over 8 years.
- The stream banks were pulled back, creating floodplain terraces.
- The project was done because of the Bull Creek Stakeholders Association.

- The group is made up of homeowners who dedicated land for the project.
- This reach has a large debris blockage, which has not been addressed yet.

4.0 WATERSHED ASSESSMENT STATUS

Stream Inventory

Patty Werner presented a brief synopsis of the elements of the SMC stream inventory. Each stream tributary is divided into stream reaches of about 2000 feet generally demarcated by roads or other major junction points. Stream inventory information is recorded and compiled by stream reach. The information is in a database with associated photos and is available to anyone who would like to have it in an Arc Reader application.

Floodplain Studies

Dead River Subwatershed

Tony Wolff, SMC Watershed Engineer, described ongoing floodplain studies. The original Federal Emergency Management Agency (FEMA) floodplain studies date back from 1979. Bull Creek and Glen Flora Tributary are each being studied separately. Illinois State Water Survey (ISWS) is conducting the studies under contract to SMC. A site-specific flood mitigation study has also been prepared for Lake County Gardens subdivision in Waukegan.

Kellogg Creek Subwatershed

Montgomery Watson Harza (MWH) is conducting the Kellogg and Dead Dog Creek floodplain study updates under contract to SMC.

Water Quality Study

Mike Adam of the Lake County Health Department – Lakes Management Unit (LCHD-LMU), presented an overview of a water quality study for Dead Dog, Kellogg and Bull Creeks. The Health Department is under contract to SMC to collect and analyze water quality data during 2006-2007.

Presentation highlights:

- LCHD-LMU is collecting water quality and flow measures.
- Duration of data collection will be August – November 2006 and March/April – November 2007.
- Flow velocity, water level and discharge data are being collected as well as DO, conductivity, pH, turbidity and water temperature.
- Data are collected at 15 minutes intervals, 24 hours/day, 7 days/week.
- The Bull Creek site is more open and in summer gets warmer than other sites.
- Higher conductivity values usually indicate a more degraded stream.
- Higher conductivity is usually due to chloride from road salt applications.

5.0 QUESTIONS AND COMMENTS FROM THE STAKEHOLDERS

- What are the rights, obligations and restrictions of homeowners along the creek?
    - Landowners are responsible for maintaining stream channel conveyance on their property. Any activity undertaken by a landowner that results in any type of fill material being placed in a floodplain will require floodplain and wetland permits.
    - A portion of Bull Creek is within the Beach Park Drainage District, which does perform drainage improvement projects, but may not be very active due to limited financial resources as a result of a relatively low landowner assessment in their service area.
- What is the availability of data/maps? When will they be available on SMC's website?
    - The data and maps presented today will be posted on the SMC website along with the meeting report

when it is completed.

- What is the outcome expected from the process?
    - An action plan will be developed for each subwatershed that will include recommendations for both site or location specific practices (such as correcting areas of streambank erosion) and policy changes that will reduce flood damage and improve water quality and the natural resources of the drainage system.
- Fish can't get upstream because of blockages to fish passage – need to add fish passage from Lake Michigan to tributary streams as a watershed issue.
- There are downed trees along the creek.
- From Beach Road, Bull Creek runs SE to Wilson Ave. – in this stretch of the creek there are tank cars buried. The tanks cars were never properly sealed leaving gaps between the cars that have allowed soil accumulation.
- Under the east side of Wilson Ave., there are more buried tank cars that have totally filled up with debris. This area is deceiving because there is a concrete spillway on top of these culverts.
- About 135 feet east of Wilson Ave., where the Wilson Ave meets Bull Creek, underneath that ditch transite (asbestos) pipes are buried; these pipes were not sealed when they were laid so they have also filled up.
- On the corner of Manor and Edgewood leading north is more transite piping that goes into the system.
- Sanitary sewer overflow is an issue.

6.0 FACILITATED BRAINSTORMING SESSION

The meeting participants were divided into two subwatershed groups, one for the Dead River and one for the Kellogg Creek. SMC staff along with CDF and Kei conducted a facilitated session to identify watershed issues and opportunities that need to be addressed by the watershed plan. The lists below reflect the input from the participants of each of the groups.

Issues & Opportunities – Dead River Watershed

1. Information on control and identification of invasive plants
2. Habitat identification and management
3. Investigate impact of changing land use on groundwater and surface water levels
4. Erosion control
5. Adopt corrections in floodplain maps
6. Coordinate transportation projects with SMC
7. Better coordination among governments within the watershed
8. Encourage or restore fish passage from lakes up into stream
9. Stormwater infiltration into sanitary sewers in streams and other areas
10. Create group to maintain stream where homeowners are unable
11. Encourage good stream bank protection measures and remove poor practices or debris
12. Whoever has drainage easement needs to maintain property
13. Establish regular (annual/semi-annual) stream cleanup
14. Periodic homeowner newsletter of BMP
15. Streambank erosion control
16. Streambank vegetation restoration
17. Stream obstructions/enclosures
18. Reduce flooding
19. Restore hydrology for Glen Flora Tributary historic floodplain/wetland outfall location per Waukegan City Master Plan
20. Streambank restoration in ravine areas
21. How to update the map to remove properties or buildings from the flood insurance purchase requirement
22. Floodplain maps – up-to-date
23. Garbage/yard waste in streams

24. Location and cleaning of existing infrastructure including concrete “banks”
25. Exotic species control
26. Bluff erosion in ravines
27. Stream maintenance
28. Algae in creeks on Glen Flora and electric property
29. Stormwater management goals and responsibilities
30. Make grant funds available for homeowner to make bank repairs
31. Identify responsibilities of each jurisdiction and homeowners
32. Identify historic water flow patterns (ground and surface)
33. Remove concrete from abandoned properties
34. Road salt (chlorides) and other pollutants in runoff

Issues & Opportunities - Kellogg Creek Watershed

1. Flood Prevention
2. Impact of future development
3. Protect wetlands (mitigation)
4. Prevent wetland loss
5. Need detail hydrologic study
6. Streambank erosion (bird sanctuary, Novotny Park)
7. Dumping of yard waste
8. Stormsewer infrastructure aging
9. Protect streamside trees
10. Property loss due to streambank erosion
11. Debris (trees) blockages in ravines
12. Education of riparian land owners (buffers)
13. Compatibility of SWM with WI
14. Impediments to fish migration- reduced salmon runs
15. Remove manmade debris
16. WQ coming from storm sewers (city)
17. Streambank erosion from, and at, stormsewers
18. Disconnection of channels from Lake Michigan (drain at state line)
19. Mystery discharge- dewatering during construction?
20. Beaver dams
21. Lack of wetland maintenance
22. Funding for projects
23. Public involvement for watershed management
24. Acquire and protect open space in watershed
25. Creation of a management district or association
26. Exposed utilities within stream corridors
27. Infrastructure affected by erosion (roadways)

NEXT MEETINGS

Dead River will be November 1, 2006 at 7:00PM.

Kellogg Creek will be November 9, 2006 at 5:30 PM (regular meetings will be on second Thursday of the month)

For the next meeting we will discuss:

- Stream naming

- Vote on priority watershed issues/opportunities
- Draft list of future meeting topics

October 4, 2006 Meeting Attendees

NAME OF ATTENDEE	REPRESENTING
Larry Matson	City of Waukegan
Mary Peloza	Self
Calvin & Lavonne Wilcox	Self
Joseph Sekulich	Self
John Moore	City of Waukegan
Thomas Chefalo	Lake Cty. Planning, Bldg. & Dev.
Janice Bock	Self
Richard & Jean Bogdala	Self
Ron Molinaro	Village of Winthrop Harbor
Marilyn Ross	Self
Natasha Shaw	State Rep. Eddie Washington
Terry Staples	Self
Judith Wilkes	Self
Rachel Foerster	Self
Lloyd Wickersheim	Self
S. I. Harris	Self
Gene Gross	Beach Park & Benton Township
Steve Rowan	Self
Jim Battista	Midwest Group/Pineview Cemetery
Debra Nelson	IDNR
Karen Kabbes	Kabbes Engineering
Bill Ward	Geosyntec Consultants
Lyle DeGraff	Self
Richard Vanderhoef	Self
Diana Vanderheyden	Self
William & Susan Fishback	Self
Bob Asma	Self
Jim Stanczak	Waukegan Airport
John M. Crombie	Self
Paula Illich	Self
Shartal Taylor	Self
Sandy Kubillus	Integrated Lakes Management
Robert Martin	Village of Pleasant Prairie

Donald White	Lake County Public Water Dist.
Bill Zika	Self
Ric Robinson	Self
Howard Parks	Self
Ronald Weldon	Self
Glenn Smith	Self
Jim Anderson	Lake County Forest Preserve
Adrienne Orr	Lake County Health Dept.
Jack Forney	Zion Industrial Park
Erica Heyl	Self & Bob Long
Mike Adam	Lake County Health Dept.
Joe Leccise	Self
Chip Parrott	RHMG/Beach Park
John Beardsley	Bill White, IL State Water Survey
Joe Synovic	Self
Judy Mackey	Self
Joe Robinson	NSSD
Curtis Mitzelfelt	Self
Tom Price	Conservation Design Forum
Jason Navota	Conservation Design Forum
Eric Otto	Conservation Design Forum
Justin Bartels	Montgomery Watson Harza
Tony Wolff	Lake County Stormwater Management Commission
Mike Warner	Lake County Stormwater Management Commission
Scott Paszkiewicz	Lake County Stormwater Management Commission
Patty Werner	Lake County Stormwater Management Commission

KELLOGG CREEK
2nd WATERSHED PLANNING MEETING
NOVEMBER 9, 2006, 5:30-7:30PM

WINTHROP HARBOR VILLAGE HALL

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS

Scott Paskiewicz [Lake County Stormwater Management Commission (SMC)] kicked off the meeting with a welcome from SMC, followed by consultant and participant introductions. Conservation Design Forum (CDF) is under contract to SMC for the completing the Kellogg Creek watershed plan. CDF will be assisted by Montgomery Watson Harza (MWH). Jason Navota will be the point of contact for CDF.

2.0 REVIEW OF WATERSHED PLANNING PROCESS AND SCHEDULE

(Copies of all of the PowerPoint presentations from the meeting can be found at: 2006-11-09_CDF Kellogg WPC mtg schedule and process.ppt)

Jason Navota (CDF) reviewed the watershed planning process and the project schedule.

1. 9/2006–1/2007
    a. Watershed Inventory-data collections and analysis
    b. GIS mapping and analysis
2. 2/2007–3/2007
    a. Develop watershed goals and objectives
    b. Develop watershed management toolbox
3. 4/2007–5/2007
    a. Develop watershed improvement recommendations
    b. Develop watershed improvement action plan
4. 6/2007–8/2007
    a. Develop implementation plan
5. 9/2007–11/2007
    a. Develop draft and final watershed plan, maps, graphics, and illustrations

Questions from the participants included:

1. Is water quality data being collected and incorporated?
    a. DOH collected basic water quality data (pH, DO, Specific Conductivity, Temperature) for 8/2006–11/2006.
2. Does the watershed plan get submitted to ACoE?
    a. No.
3. What are the dynamic of the SMC-public relationship?
    a. SMC leads the watershed planning process with input from public.
4. Whose [watershed] plan is it?
    a. The plan belongs to the residents of the watershed.

3.0 REPORT ON STREAM CONDITION IN THE WATERSHED

Scott Paskiewicz (SMC) detailed the 2001 SMC Stream Inventory, performed by summer interns.

Questions from the participants included:

1. What streambed slope causes headcutting?
    a. There is no “magic slope,” a combination of factors lead to headcutting.

Comments from the participants included:

1. Juvenile snapping turtles were seen in the stream.

4.0 PRIORITIZATION OF THE WATERSHED ISSUES AND OPPOTUNITIES

Scott Paskiewicz (SMC) reviewed the issues and opportunities developed at the last meeting. Following that, the issues and opportunities were ranked by the meeting participants. Final ranking, from most important to least important with rank in parenthesis were:

- Property loss due to steambank erosion (23)
- Naturalize stream and flow patterns in state park (14)
- Funding for projects (12)
- Need for detailed hydrologic study (11)
- Streambank erosion [bird sanctuary, Novotny Park] (10)
- Education of riparian land owners [buffers] (10)
- Streambank erosion from, and at, stormsewers (9)
- Disconnection of channels from Lake Michigan [drain at state line] (9)
- Acquire and protect open space in watershed (8)
- Lack of wetland maintenance (7)
- Protect wetlands [mitigation] (6)
- Flood prevention (5)
- Impediments to fish migration-reduced salmon runs (4)
- Debris (trees) blockages in ravines (2)
- Beaver dams (2)
- Impact of future development (2)
- Prevent wetland loss (1)
- Protect streamside trees (0)
- Exposed utilities within stream corridor (0)
- Promote native vegetation (0)
- Stormsewer infrastructure aging (0)
- Compatibility of SWM with WI (0)
- Infrastructure affected by erosion [roadways] (0)
- Mystery discharge-dewatering during construction? (0)
- WQ coming from stormsewers [city] (0)
- Dumping of yard waste (0)
- Removing manmade debris (0)

- Water quality (0)
- Pesticides (0)
- Public involvement for watershed management (0)
- Creation of a management district or association (0)

Questions from the participants included:

1. Are there guidelines for homeowners regarding planting of non-native vegetation?
    a. No, but this could be part of the education aspect of the final watershed plan.

Comments from the participants included:

1. There is garbage being dumped at the 7th Street ravine at the state park.

5.0 SCHEDULE NEXT MEETING

The next meeting was scheduled for Thursday, December 14, from 3–5 p.m. The meeting will be a combined Kellogg Creek-Dead River meeting. Location is to-be-determined.

Comments from the participants included:

1. The meeting should be advertised in local newspapers to boost participation.

6.0 ADJOURN

KELLOGG CREEK/DEAD RIVER
3rd WATERSHED PLANNING MEETING
DECEMBER 14, 2006, 3:00-5:00PM

BEACH PARK VILLAGE HALL

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS

Patty Werner from the Lake County Stormwater Management Commission (SMC) kicked off the meeting with a welcome and introduction of the project team: Scott Paskiewicz and Rasto Vrazda from SMC, and Tom Price, Jason Navota, and Eric Otto from Conservation Design Forum (CDF). CDF is under contract to SMC for the completing the Kellogg Creek and Dead River watershed plans. CDF will be assisted by Montgomery Watson Harza (MWH). Jason Navota will be the point of contact for CDF.

The attendees introduced themselves and who they were representing.

2.0 RECAP-WATERSHED PLAN SCHEDULE AND PROCESS

Jason Navota reviewed the watershed planning process and the schedule. This was the first time that the Dead River Watershed Planning Group saw the presentation, but the second time for the Kellogg Creek Group.

The presentation can be found on the SMC Web site (http://www.co.lake.il.us/smc/shedprofiles/Dead/Dead_default.asp).

Questions/comments from the participants included:

1. Will the final watershed plans include executable tasks and identify the party (ies) responsible for executing the tasks?
    a. Yes, the plan will include both; watershed residents will be responsible for implementing some of the actions/ tasks.

3.0 WATERSHED ASSESSMENT-WATER QUALITY

Three presentations were given:

1. Overview: watershed impact on water quality, Tom Price
2. 1st season water quality monitoring results, Mike Adam, Lake County Health Department
3. Water chemistry & biology assessment finding, Jason Navota

The presentations can be found on the SMC Web site (http://www.co.lake.il.us/smc/shedprofiles/Dead/Dead_default.asp).

Questions/comments from the participants included:
Tom Price's presentation:

1. The watershed planning process is long; what can homeowners do prior to completion of the plan?
    a. Scott Paszkiewicz suggested a future meeting topic devoted to discussing this topic. Patty Werner told of other watershed groups that developed demonstration projects in conjunction with watershed planning using funds that were dedicated for this use.
2. How do proposed 40-acre developments that don't incorporate "smart-development" practices get approved? Is SMC or

CDF involved in the approval process? How can watershed residents positively affect watershed development? These questions relate specifically to Covenant Cove Phase 4 on Russell Road, east of Old Darby Road and the Walmart store in Zion, which is planning to store stormwater underground and discharging it from there directly to the creek.

a. The Watershed Development Ordinance does not require "smart-development" practices on projects; it does, however, recommend them. Municipalities are moving in the right direction, albeit slowly, with regards to "smart-development." SMC is involved in permitting the watershed development if the municipality is not certified by SMC to administer the Watershed Development Ordinance (WDO) and issue permits. Within the Kellogg & Dead watersheds the communities of Waukegan, Beach Park and Unicorporated Lake County are certified to issue watershed development permits (WDPs). Winthrop Harbor and Zion are non-certified communities; therefore, SMC will issue the WDPs in these jurisdictions. CDF is not involved in the approval process, but is involved in "smart-development." Scott Paszkiewicz will inquire as to the status of these development reviews.

Mike Adam's presentation:

3. Are the landfills indirectly responsible for the swim bans, which are caused by gull droppings? Are there techniques to discourage gulls at the landfills? The gull droppings contain *E. coli*, which is an indicator for fecal contamination.
    a. No definitive studies have been performed to prove this, but there is a large population of gulls that frequents the land fill. Harassment of the gulls on the beaches is effective, but they only migrate to the next available beach.
4. Road salt contributes to degraded water quality; why is it not more strictly regulated and monitored? Why isn't water quality monitoring done during the winter when road salt is being applied?
    a. There is a balancing act between human safety and environmental quality. When the road salt application decision is made communities err on the side of human safety.
    b. Winter monitoring is difficult and potentially costly due to the potential for damage to the equipment during extreme weather conditions (i.e., ice). Each monitoring sonde costs approximately $7,000. We do plan on taking some chloride and conductivity samples in the spring before we reinstall the monitoring equipment.

Jason Navota's presentation:

5. Patty Werner commented that the low IBI score on Bull Creek in 2005 may be attributed to the stream biota not yet recovering from the restoration work done on the sampled reach of Bull Creek between Sheridan Road and the railroad tracks. There was also a sanitary sewer spill into the stream a few months prior to the sampling that resulted in a fish kill.

4.0 STREAM NAMING PROTOCOL UPDATE

This topic was not covered at the meeting. It will be discussed at a future meeting when more information on the stream naming effort by the County's established work group is available. The work group will continue researching historic names. They are focusing on naming unnamed lakes and detention ponds first.

5.0 SUBWATERSHED BREAKOUT GROUPS

Refer to the following pages.

6.0 NEXT MEETING

The next meeting was scheduled for Thursday, January 11, 2007, from 6:30–8:30 p.m., a location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

December 14, 2006 Meeting Attendees

NAME OF ATTENDEE	REPRESENTING	WATERSHED
Don Wilson	Self	Both
Gene Gross	Beach Park	Dead
LeRoy Boldt	Beach Park	Dead
John Moore	City of Waukegan	Dead
Tom Chefalo	Lake County Planning abd Development	Both
Sara Creque	Illinois Natural History Survey	Both
Nick Huber	Lake County Forest Preserves	Dead
Jeffrey Koziel	Land Conservancy of Lake County	Dead
Dan Shappert	Self and Bull Creek Stakeholders Association	Dead
Curtis Mitzelfelt	Self	Kellogg
Judith Wilkes	Self	Dead
Rachel Forester	Self	Dead
Richard Vanderhoef	Self	Dead
Adrienne Orr	Lake County Health Department	Both
Mike Adam	Lake County Health Department	Both
Chip Parrott	RHMG/Beach Park	Dead
Jim Stanczak	Waukegan Regional Airport	Dead
Jeff Greenspan	Trust For Public Land	Both
Tom Rush	Beach Park	Dead
Erica Heyl	Self and Bob Long	Kellogg
Diana Vanderheyden	Self	Kellogg
Larry Anglada	Zion Benton Township High School	Both
Bruce Mihelich	City of Zion	Both
Susie Schreiber	Waukegan CAG	Both
John M Crombe	Homeowner	Kellogg
Pat Bleck	Beach Park Drainage District	Dead
Tom Price	Conservation Design Forum	Project team
Eric Otto	Conservation Design Forum	Project Team
Jason Navota	Conservation Design Forum	Project Team
Rasto Vrasda	Lake County Stormwater Managment Commission	Project Team
Scott Paskiewicz	Lake County Stormwater Managment Commission	Project Team
Patty Werner	Lake County Stormwater Managment Commission	Project team

KELLOGG CREEK/DEAD RIVER
4th WATERSHED PLANNING MEETING
JANUARY 11, 2007, 6:30-8:30PM

BEACH PARK VILLAGE HALL

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS

Patty Werner from the Lake County Stormwater Management Commission (SMC) announced that Scott Paskiewicz would be leaving SMC, and would no longer be the project manager for the Kellogg Creek Watershed Planning project.

Scott Paskiewicz delivered a welcome and introduction of the project team: Patty Werner and Tony Wolff from SMC; Tom Price, Jason Navota, and Eric Otto from Conservation Design Forum (CDF); and Justin Bartels and Erin Maloney from Montgomery Watson Harza (MWH). CDF is under contract to SMC for completing the Kellogg Creek and Dead River watershed plans. CDF will be assisted by MWH. Jason Navota will be the point of contact for CDF.

The attendees introduced themselves and who they were representing.

2.0 DECEMBER MEETING FOLLOW-UP

Last meeting, questions arose regarding the Covenant Cove and Walmart developments. Regarding the Covenant Cove development, attendees wanted to know if SMC had reviewed plans for the project and the current stage of the project. SMC relayed that they had not received plans for the project. SMC also found out that the project required a jurisdictional wetland determination from the Army Corps of Engineers and a Base Flood Elevation determination. The Covenant Cove development has not received approval from the municipal planning commission. Regarding the Walmart development, attendees were concerned that a stormwater outfall discharged directly to a small creek. SMC relayed that the stormwater outfall discharges to a vortex structure, followed by a bioswale, followed by a roadside ditch.

Questions/comments from the attendees included:

Q: What size particles are removed by the vortex structure?
A: Sand size particles are removed by the vortex structure. The bioswale will remove other pollutants, such as nutrients.

At the prior meeting, the answer to a question regarding land-use density was misinterpreted. Tom Price clarified that as overall land-use density increases, IBI values decrease. This is not, however, a recommendation for large (5-acre) residential lots. Alternatively, clustering of development and high-density land-use can result in large tracts of open-space, which may be beneficial to watershed resources. Tom Price also noted that many factors besides water quality are important when considering land-use planning.

Questions/comments from the attendees included:

Q: Is this a recommendation for multi-family housing?
A: No, this is not a recommendation for multi-family housing. Water quality is one of many factors that must be contemplated when planning for land-use and density. The watershed plan will not be a land-use plan or contain zoning recommendations or regulations.

Q: Where do cross-jurisdictional discussions take place?
A: Cross-jurisdictional discussions can take place at the watershed planning meetings. SMC, CDF, and MWH can present concepts and help develop issues and opportunities, but it is up to the watershed residents to voice their concerns with local governments.

Q: Are the key players for cross-jurisdictional discussions at the watershed planning meetings?
A: Efforts are made to have the key players present.

C: Property owners have rights—they can do whatever they want with their property, as long as the law permits.

Scott Paskiewicz offered to recap the issues and opportunities list revisions from the Dead River group; however, no attendees wanted a recap.

Questions/comments from the attendees included:

Q: What percentages of the attendees are from each watershed?
A: The attendees are split approximately in half, 50% from the Kellogg Creek watershed and 50% from the Dead River watershed.

Scott Paskiewicz asked for comments on the summary from last meeting. The attendees provided no comments.

3.0 STREAM CLEAN-UP

Scott Paskiewicz and Patty Werner spoke on a possible future meeting topic: Watershed Resident Riparian Clean-Ups. The Lieutenant Governor encouraged SMC to have the watershed residents apply for a grant to fund this effort.

4.0 GREEN INFRASTRUCTURE

Three presentations were given.

1. CDF & MWH: Green infrastructure elements in the Dead and Kellogg watersheds and draft open-space inventories. Jason Navota and Erin Maloney presented.

Questions/comments from the attendees included:

C: There are two groups that could potentially perceive negative outcomes of green infrastructure: developers, who can't develop wetlands and thereby lose property value, and school districts, who can't receive tax revenue from wetlands or other protected green infrastructure.

Q: What is a wetland seep?
A: A wetland seep is a wetland that is being fed by an outflow of groundwater through the ground or a hillside.

Q: Can the attendees receive an overview of wetland regulations?
A: Yes, this can be presented at a future watershed planning meeting.

Q: Are there wetlands in the watersheds that are suitable for restoration?
A: Yes, there are wetlands that would benefit from restoration and management.

Q: Are there more benefits from green infrastructure in the headwaters or lower reaches of a watershed?

A: If all else is equal, the green infrastructure in the headwaters will yield more benefits. However, it is important to consider both benefits from green infrastructure and protection from flooding, which can be accomplished by green infrastructure in the lower reaches.

Q: Do wetlands impact hydrology?
A: Yes, wetlands are an important piece of the hydrologic cycle.

2. Lake County Forest Preserve District: Highlights, issues, and opportunities for Forest Preserve properties. Debbie Maurer, Ecologist, presented.

3. Illinois Beach State Park: Highlights, issues and opportunities for the Park. Don Wilson, Steward, presented.

All three presentations can be found on the SMC Web site (http://www.co.lake.il.us/smc/).

5.0 DISCUSSION

Due to time constraints, this portion of the agenda was postponed until the next meeting.

Scott Paskiewicz and Patty Werner provided a “homework assignment” for the attendees: review the 15 green infrastructure prioritization criteria for the next meeting.

Questions/comments from the attendees included:

Q: Could the discussion on the green infrastructure prioritization criteria be done with a conference call?
A: That would be too difficult with a group this large. The next meeting will be a discussion session on: stream clean up, green infrastructure prioritization criteria, and preliminary map review. The meeting and topic schedule will be revised to accommodate discussion and catch-up needs.

Patty Werner explained how the parcel prioritization process will work.

6.0 NEXT MEETING

The next meeting was scheduled for Thursday, February 15, 2007. A time and location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

January 11, 2007 Meeting Attendees

NAME OF ATTENDEE	REPRESENTING	WATERSHED
Don Wilson	Self	Both
Larry Matson	City of Waukegan	Dead
Ronda Nissen	Self	Kellogg
Deb Maurer	Lake County Forest Preserves	Dead
Jeffrey Koziel	Land Conservancy of Lake County	Dead
Dan Shappert	Self and Bull Creek Satkeholders Association	Dead
Rachel Forester	Self	Dead
Richard Vanderhoef	Self	Dead
Adrienne Orr	Lake County Health Department	Both
Steve Wikner	Waukegan Park District	Dead
Joe Hughes	Self	Dead
Robert Cade	North Shore Sanitary District	Both
Erica Heyl	Self	Kellogg
Bob Long	Self	Kellogg
John M Crombie	Homeowner	Kellogg
Curtis Mitzelfelt	Self	Kellogg
Denise Rolando	Self	Dead
Tom Price	Conservation Design Forum	Project Team
Eric Otto	Conservation Design Forum	Project Team
Jason Navota	Conservation Design Forum	Project Team
Erin Maloney	MWH	Project Team
Justin Bartels	MWH	Project Team
Scott Paskiewicz	Lake County Stormwater Managment Commission	Project Team
Tony Wolf	Lake County Stormwater Management Commission	Project Team
Patty Werner	Lake County Stormwater Management Commission	Project Team

KELLOGG CREEK/DEAD RIVER
5th WATERSHED PLANNING MEETING
FEBRUARY 15, 2007, 3:00-5:00PM

BEACH PARK VILLAGE HALL

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS

Patty Werner from the Lake County Stormwater Management Commission (SMC) delivered a welcome and introduction of the project team: Patty Werner, Crissy Mehle, Tony Wolff, and Rasto Vrazda from SMC; and Jason Navota and Eric Otto from Conservation Design Forum (CDF).

Patty Werner announced that Tony Wolff was promoted to Chief Engineer. His replacement as Watershed Engineer is Crissy.

CDF is under contract to SMC for completing the Kellogg Creek and Dead River watershed plans. CDF will be assisted by MWH. Jason Navota will be the point of contact for CDF.

The attendees introduced themselves and who they were representing.

2.0 JANUARY MEETING FOLLOW-UP

Patty Werner asked for comments on the draft summary from last meeting. The attendees provided no comments, so the meeting report was accepted as presented.

3.0 STREAM CLEAN-UP

Patty Werner detailed an in-progress SMC grant application effort to obtain funding for a steam clean-up and riparian landowner workshop. SMC is partnering with the Alliance for the Great Lakes. A storm drain stenciling activity was suggested; however, the watersheds contain few storm drains, which limits the impact of this activity. A citizen monitoring activity was also suggested; however, this would likely be attractive to a few individuals and is not high profile.

Questions-answers/comments-responses from the attendees included:
(Q=question; C=comment; R=response)

Q: What is the level of effort associated with the stream clean-up?
A: Trash will be removed; in addition, there is a significant amount of woody debris that requires cutting, removal, and chipping.

C: The stream clean-up event should be high profile in order to raise awareness of the watershed planning effort. Fossland Park was the suggested location.

C: The riparian landowner workshop should include a hands-on, outdoor activity.

C: Riparian landowners would benefit from educational materials listing good/bad debris, vegetation, management practices, etc.
R: Patty Werner provided the SMC Riparian Area Management: A Citizen's Guide document to attendees. SMC will mail the riparian landowner guide with an introductory letter to all riparian landowners as a component of the proposed education and

outreach project. Several residents in Winthrop Harbor are planning to go door to door in their neighborhoods to distribute the guide and talk with their neighbors about stream clean up/restoration efforts.

C: The average watershed resident doesn't know that the watershed planning process is taking place or that the watershed planning committee exists. There needs to be more outreach to educate residents and increase involvement.

R: Patty Werner responded that all riparian landowners in the watersheds were invited to the original watershed planning committee meeting and that those who have attended all meetings and anyone else who has requested is on the contact list for the meetings and updates. She has spoken with SMC's public information coordinator about getting out press releases and community calendar and website updates – she will verify that these are being sent out.

C: There needs to be even more public outreach than previously provided. The following items were suggested:

- Press coverage for the stream clean-up,
- Watershed planning committee meeting advertisement on local public access cable television channel,
- Presentation at local garden club meetings,
- Door-to-door campaigns,
- Rotary club presentations,
- Advertisement at local libraries,
- Presentations at local women's clubs,
- Presentations at local Boy Scout meetings,
- Presentations at local ROTC meetings.

Jason Navota delivered a brief presentation on what riparian landowners can do to improve the watershed. The presentation can be found on the SMC Web site (http://www.co.lake.il.us/smc/). Hyperlinks to Web sites and publications referenced in the publication can also be found on the SMC Web site. The Ecological Planning and Design Directory contains a host of good information and can be found at: http://www.nipc.org/environment/sustainable/.

Patty Werner commented that the topic schedule for the watershed planning committee meetings has been pushed back. There may be an additional meeting in March to discuss the goals and objectives of the watershed planning effort.

4.0 GREEN INFRASTRUCTURE

Patty Werner summarized the green infrastructure plan and prioritization process discussed at the January watershed planning committee meeting. She explained that the consultant teams have produced maps of open/partially-open parcels that will be discussed during this meeting.

Patty Werner discussed the rules to facilitate discussion and decision-making, and suggested that 75 percent agreement be considered a consensus. The attendees agreed that 75 percent agreement would be considered a consensus, but will revisit this percent if it doesn't seem to work in the future. Participants will be asked for their consensus and will be expected to express their disagreement if they do not agree.

Jason Navota revisited the green infrastructure prioritization criteria, and asked for comments from the attendees.

Questions-answers/comments-responses from the attendees included:

Q: What water quality pollutants are the consultants considering as part of the non-point source pollution hotspot analysis?

A: There are approximately 6–7 pollutants including phosphorus, nitrogen, total suspended solids, and various metals.

C: Criteria #9 should be eliminated because a majority of the parcels in the watershed are undetained.
R: The attendees provided a consensus agreement.

C: Criteria #10 and 13 should be placed adjacent because they are similar.
R: The attendees provided a consensus agreement.

C: GI Prioritization Criteria/watershed planning topics matrix should be updated to show that the 100-year floodplain criteria is also applicable to all four watershed topics/concerns. It was also noted that the highly erodable soils criteria is applicable to the stream topic.

Jason Navota asked for a consensus agreement on the green infrastructure prioritization criteria.
R: The attendees provided a consensus agreement.

The revised Green Infrastructure Inventory and Prioritization document can be found on the SMC Web site (http://www.co.lake.il.us/smc/).

The Committee then divided up into several smaller groups and reviewed the Green Infrastructure maps and aerial photographs provided by CDF and provided comments on those maps. A general request was made to provide the open space inventory in opaque colors directly over the aerial photographs for the next review.

5.0 NEXT MEETING

The next meeting was scheduled for Thursday, March 8, 2007 from 6:30–8:30 pm. A location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

February 15, 2007 Meeting Attendees

NAME OF ATTENDEE	REPRESENTING	WATERSHED
Don Wilson	Self	Both
Tom Chefalo	Lake County Plan Department	Both
Susie Schriber	Waukegan Harbor Citizen's Advisory Group	Dead
Nick Huber	Lake County Forest Preserve District	Both
Jeffrey Koziel	Land Conservancy of Lake County	Dead
Dan Shappert	Self & Bull Creek Stakeholders Assn.	Dead
Jim Stanczak	Waukegan Port District Waukegan Airport	Dead
Richard Vanderhoef	Self	Dead
Adrienne Orr	Lake County Health Dept.	Both
Steve Wikner	Waukegan Park District	Dead
Joe Hughes	Self	Dead
Robert Cade	North Shore Sanitary District	Both
Leroy Bolt	Village of Beach Park	Dead
Chip Parrott	Village of Beach Park	Dead
Judy Wilkes	Self	Dead
Curtis Mitzelfelt	Self	Kellogg
Doug & Barb Jaeger	Self	Dead
Eric Otto	Conservation Design Forum	Project Team
Jason Navota	Conservation Design Forum	Project Team
Crissy Mehle	Lake County Stormwater Management Commission	Project Team
Rasto Vrazda	Lake County Stormwater Management Commission	Project Team
Tony Wolff	Lake County Stormwater Management Commission	Project Team
Patty Werner	Lake County Stormwater Management Commission	Project Team

KELLOGG CREEK/DEAD RIVER
6th WATERSHED PLANNING MEETING
MARCH 8, 2007, 6:30-8:30PM

WAUKEGAN CITY HALL

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS

Patty Werner from the Lake County Stormwater Management Commission (SMC) delivered a welcome and introduction of the project team: Patty Werner, Tony Wolff, and Mike Prusila from SMC; Jason Navota, Tom Price, and Eric Otto from Conservation Design Forum (CDF), and Erin Maloney from Montgomery Watson Harza (MWH).

Patty Werner announced that Mike Prusila is the new project manager for the Kellogg Creek Watershed Plan.

CDF is under contract to SMC for completing the Kellogg Creek and Dead River watershed plans. CDF will be assisted by MWH. Jason Navota will be the point of contact for CDF.

The attendees introduced themselves and who they were representing.

2.0 FEBRUARY MEETING FOLLOW-UP

Patty Werner asked for comments on the draft summary from last meeting. The attendees provided no comments, so the meeting report was accepted as presented.

Patty also announced that SMC did a press release for the media and community webmasters about this meeting. Someone mentioned that they saw it noticed in the Sun Times.

3.0 EDUCATION AND OUTREACH

Patty Werner explained that the grant application for the outreach and education activities (including stream clean-up) was submitted to the Great Lakes Basin Program.

Proposed Education and Outreach activities include:

1. Mailing of the Riparian Area Management Guide (available from Patty Werner);
2. Stream Clean-Up Training/Event (lead: Alliance for the Great Lakes);
3. Watershed Bus Tour (lead: SMC);
4. Riparian Landowner BMP Workshop (lead: Alliance for the Great Lakes).

The Stream Clean-Up Training/Event location is still undetermined, but Fossland Park was suggested. Patty will follow-up on this.

The Watershed Bus Tour will take place for both Kellogg Creek and Dead River watersheds and will be approximately 6 hours long and held on a Saturday morning and early afternoon.

The Riparian Landowner BMP Workshop will include indoor and field training segments.

4.0 WATERSHED ASSESSMENT RESULTS

Patty pointed out that while the watershed assessment is not complete at this time, CDF is going to present the results to-date. Several components of the assessment will have to be presented at a future meeting. These include:

- the results of the flood plain study and re-mapping; (draft completed – being reviewed and revised)
- the flood damage and flood risk assessments;
- potential regional storage sites;
- potential wetland restoration sites;
- the impervious cover analysis and vulnerability assessment for subwatershed management units;
- the non-point pollutant loadings assessment,
- point sources of pollution,
- causes and sources of pollution
- identification of critical areas; and
- the green infrastructure prioritization

Jason Navota presented the draft watershed assessment results. The presentation can be found on the SMC Web site (http://www.co.lake.il.us/smc).

Questions/answers and comments/responses from the attendees and consultants included:

Q: What makes a ravine steep – are all ravines steep?

A: A ravine is steep by nature, but there is no quantitative measurement to determine what is 'steep'. The County considers a slope of 8% or more a steep slope.

Q: What is a high FQI?

A: A Floristic Quality Index (FQI) above 70 is considered high and indicates good diversity of plant species.

Q: What are ADID wetlands?

A: ADID (ADvanced IDentification) wetlands are wetlands that have one or more high quality functional characteristics such as natural value, wildlife habitat, water quality or flood reduction as determined at the time of the assessment.

Q: What is runoff potential for soil?

A: Runoff potential is the tendency for water to flow off of a soil rather than infiltrate into or be absorbed by the soil. High runoff potential corresponds to low soil infiltration potential. As an example, sandy soils infiltrate very quickly, whereas tight clay soils infiltrate very slowly.

C: The watershed demographic slide should read "Projected" not "Planned."

R: Noted.

Q: Why does the Dead River employment projection decrease?

A: A possible reason (offered by meeting attendees) is that some areas of the watershed are projected to change from industrial to residential land uses, resulting in fewer jobs. CDF will follow up on this and check to see if this projection is in error.

Q: What is the tree density of Savanna?

A: The tree density varies, but is approximately one (1) tree per acre.

C: The Upland Forest on the presettlement map is not the dense, overgrown forest that is common in the watershed today.
R: Noted

C: The land use along Sheridan Road for the Kellogg Creek map appears to have the incorrect color.
R: Noted.

C: The widening of Green Bay Road is not reflected in IDOT CIP, but should be reflected in the Watershed Plan.
R: Noted

C: The narrowing of Sheridan Road is also a potential future project that should be considered in the Watershed Plan.
R: Noted.

C: The Watershed Plan should include detailed information on detention basins.
R: Noted.

C: The Little Dead River historically connected the harbor south of Johns Manville to the Dead River. It has been brought to the project team's attention that there is an approximate six (6) inch elevation change over a swale reach connecting the John Mansville Lagoons to IL Beach State Park to the north that may be causing some odd hydrologic conditions, such as a reversal of flow during heavy rainfall. Patty Werner and the project team will be looking into it.
R: Noted.

Q: What is the orange color on the channelization maps?
A: CDF will investigate this issue. Isn't Kellogg Creek in IL Beach State Park channelized?

Q: Is channelization only a result of human influences?
A: Yes.

Q: Why does the 27th Street Tributary change from High to Moderate channelization at 33rd Street?
A: The actual change at that point of the stream is not that drastic, this is an inherent property of the map and the data, which show average conditions over an entire reach—if the average condition changes between two reaches, the color will abruptly change where those reaches join.

Q: What is a gully?
A: A gully is a defined channel, wet or dry.

C: The stream channel in Beulah Park has significant bank erosion.
R: Increased streamflow volumes and rates resulting from urbanization have resulted in this erosion, and the lack of ground plain vegetation has not helped to hold the soil in place.

Q: Is tree removal necessary to restore light to the forest floor adjacent to the stream to allow for low-growing vegetation?
A: Yes, however it does not necessarily mean removal of big canopy trees. Understory trees such as buckthorn should be removed, which may allow sufficient light to the forest floor.

C: The Dead River has a silty substrate, which makes for poor habitat, and it's the only river that constantly maintains contact with Lake Michigan.
R: CDF will confirm this.

Q: Are lost wetlands recoverable?
A: Yes, generally you can restore wetlands by returning the natural hydrology to a historic wetland area. You can also plant/seed it with wetland plant species, but in areas where the soil has not been significantly disturbed, the historic seed bank in the soil may be sufficient to repopulate the wetland with plants on its own.

C: Sand Pond will be sampled again by LCHD from May–September 2007.
R: Noted.

C: Paxton Drive is in Beach Park, not Wadsworth.
R: Noted.

C: A corrected version of the dissolved oxygen graph with the corresponding sample dates is available.
R: Noted.

C: Dissolved oxygen (DO) trends are not correlated to precipitation.
R: Noted. In some of the sampled streams such as Bull Creek there are large daily swings in the DO.

C: Peak turbidity measurements were delayed from peak storm events.
R: Noted.

C: The Outboard Motor Corporation should be correctly cited as Outboard Marine Corporation.
R: Noted.

Q: Why are only Johns Manville and Outboard Marine Corporation listed as contaminated sites when many others exist?
A: CDF will research and include additional known contaminated sites in the Watershed Plan.

C: The City of Waukegan has performed infiltration tests on its sanitary sewer system. There is a problem with stormwater getting into the sanitary lines.
R: Noted.

Q: Where are the Low Priority Green Infrastructure Parcels?
A: The analysis is forthcoming.

C: Some future planned developments are not reflected in the Green Infrastructure maps.
R: Noted. The map may not reflect recent changes or developments in the discussion or approval stages.

5.0 GOALS AND OBJECTIVES

Will be discussed at the next meeting.

6.0 NEXT MEETING(S)

Patty Werner announced that it may be necessary to have two meetings in April to complete goals, objectives and indicators for the watershed plans. The group agreed to see how far we get at the April 12th meeting before scheduling a second meeting in April.

The next meeting was scheduled for Thursday, April 12, 2007. The meeting will be held in the afternoon, and a location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

KELLOGG CREEK/DEAD RIVER
7th WATERSHED PLANNING MEETING
April 12, 2007, 3:00-5:00PM

BEACH PARK VILLAGE HALL

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS

Patty Werner from the Lake County Stormwater Management Commission (SMC) delivered a welcome and introduction of the project team: Patty Werner, Tony Wolff, Crissy Mehle, Rasto Vrazda, and Mike Prusila from SMC; Jason Navota and Tom Price from Conservation Design Forum (CDF). CDF is under contract to SMC for completing the Kellogg Creek and Dead River watershed plans. CDF will be assisted by MWH. Jason Navota will be the point of contact for CDF. The attendees introduced themselves and who they were representing. An attendance list is attached.

Announcements: Patty Werner announced that SMC will look into inventorying stream reaches in IL Beach State Park where possible. These reaches were missed during the first inventory. The Wilson Avenue Tributary and any other missed tributaries will be added to the inventory also. IEPA and IDNR will be sampling for water quality, macroinvertebrates, and fish in Kellogg Creek, Dead-Dog Creek and Bull Creek this summer. North Shore Sanitary District has offered to also sample chemical water quality parameters in the same creeks, and will also sample Glen Flora Tributary quarterly. Lake County Forest Preserve District, Illinois State Geologic Survey, US Geologic Survey, Illinois Department of Natural Resources and Lake County Health Department have teamed up to conduct a hydrologic and water quality study of Illinois Beach State Park this year also.

2.0 MARCH MEETING FOLLOW-UP

Patty Werner asked for comments on the draft summary from last meeting. The attendees provided no comments, so the meeting report was accepted by the group as presented.

3.0 EDUCATION AND OUTREACH

Patty Werner is scheduled to give presentations on Dead River/Kellogg Creek watershed planning at the Waukegan Harbor Citizen's Advisory Group, and the Lake Michigan Watershed Ecosystem Partnership this month. She will follow-up on some contacts Judith provided and will check into making future presentations for several garden clubs.

SMC is looking into having Lake County Department of Transportation post a sign about the watershed planning effort being underway below the watershed identifier signs that are already posted in several locations around the watershed. There were comments that these signs might include a telephone number for getting involved in the watershed planning effort. Additional stream crossings could be signed as well. SMC will continue to look into this.

Patty requested an update about the Waukegan Airport runway expansion study, and Jim Stanczak replied that the airport is conducting an environmental impact study for the runway extension options being considered. A public hearing will be held to discuss the extension plans at some point in the future.

4.0 WATERSHED ASSESSMENT RESULTS (CONT.)

CDF presented updated results for instream habitat, riparian habitat, and pollutant loading hot spot analysis. CDF then presented the results of the Watershed Vulnerability Analysis and the Green Infrastructure Prioritization mapping. The presentation will be posted on the SMC Web http://www.co.lake.il.us/smc site.

CDF requested input on whether ranking Green Infrastructure parcels into two or three categories were preferred by the Watershed Planning Committee. An informal vote indicated that 7 stakeholders prefer three categories, and 2 stakeholders prefer two categories, some stakeholders expressed no preference. A comment was offered, and discussion ensued, regarding the language used to describe the rankings. “high”, “medium”, and “low priority” rankings seemed to be “loaded” words that may communicate something other than what is intended. “First”, “second”, or “third priority” was suggested as an alternative. The choice of colors was also discussed, and red, yellow, and green seem also to connote the wrong message. CDF will look into changing the colors to be more appropriate.

5.0 GOALS AND OBJECTIVES

CDF presented and handed out a compiled list of watershed issues based on stakeholder input and the watershed assessment and inventory. CDF asked whether there was any concern or opposition to using the same list of issues for both watersheds, since both watersheds exhibit similar conditions and problem areas. There were no objections.

This lead into a discussion of how to develop Goals, Objectives, and Indicators for the watershed plan. CDF presented and handed out a list of draft goals and objectives for the two watersheds based on the issues categories. The watershed stakeholders then divided up into four teams, each of which met to discuss and provide suggestions for modifying the draft list of goals and objectives. The revised draft of goals and objectives will be sent out prior to the next meeting for discussion.

6.0 NEXT MEETING(S)

Patty Werner announced that it may be necessary to have an additional meeting in May to catch up to the watershed planning schedule. The group agreed to see how far we get at the May 10th meeting before scheduling a second meeting in May.

The next meeting was scheduled for Thursday, May 10, 2007. The meeting will be held in the evening, and a location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

April 12, 2007 Meeting Attendees

(NAME OF ATTENDEE)	(REPRESENTING)	(WATERSHED)
Robert Cade	North Shore Sanitary District	Both
Nick Huber	Lake County Forest Preserve District	Both
Paul Kakuris	Illinois Dunesland Preservation Society	Both
Jeffrey Koziel	Land Conservancy of Lake County	Dead
Adrienne Orr	Lake County Health Dept.	Both
Chip Parrott	Village of Beach Park	Dead
Susie Schreiber	Waukegan Harbor CAG	Dead
Jim Stanczak	Waukegan Port District Waukegan Airport	Dead
Rachel Foerster	Self	Dead
Joe Hughes	Self/Bull Creek Stakeholders Association	Dead
Curtis Mitzelfelt	Self	Kellogg
Richard Vanderhoef	Self	Dead
Calvin & Lavonne Wilcox	Selves	Dead
Judith Wilkes	Self	Dead
Jason Navota	Conservation Design Forum	Project Team
Tom Price	Conservation Design Forum	Project Team
Crissy Mehle	Lake County Stormwater Management Commission	Project Team
Mike Prusila	Lake County Stormwater Management Commission	Project Team
Rasto Vrazda	Lake County Stormwater Management Commission	Project Team
Patty Werner	Lake County Stormwater Management Commission	Project Team
Tony Wolff	Lake County Stormwater Management Commission	Project Team

KELLOGG CREEK/DEAD RIVER
8th WATERSHED PLANNING MEETING
May 17, 2007, 6:30-8:30PM

Zion-Benton Public Library

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS

Patty Werner from the Lake County Stormwater Management Commission (SMC) delivered a welcome and introduction of the project team: Patty Werner, Tony Wolff, Crissy Mehle, and Mike Prusila from SMC; Jason Navota and Tom Price from Conservation Design Forum (CDF); and Erin Maloney from MWH. CDF is under contract to SMC for completing the Kellogg Creek and Dead River watershed plans. CDF will be assisted by MWH. Jason Navota will be the point of contact for CDF. The attendees introduced themselves and who they were representing. An attendance list is attached.

Announcements: Patty Werner announced that IDNR was in the watershed on May 10 for fish sampling in Illinois Beach State Park and will return at the end of June. North Shore Sanitary District will begin quarterly chemical sampling on all tributaries to IBSP. IEPA was sampling macroinvertebrates on Dead Dog Creek, Bull Creek, and Kellogg Creek on May 10 and 14.

2.0 APRIL MEETING FOLLOW-UP

Patty Werner asked for comments on the draft summary from last meeting. The attendees provided no comments, so the meeting report was accepted by the group as presented.

3.0 EDUCATION AND OUTREACH

SMC is scheduled to present for the Rotary Club and will continue to pursue a presentation for the Garden Club. At the next Watershed Planning meeting there will be a brief presentation on conservation easements and tax incentives.

4.0 WATERSHED ASSESSMENT RESULTS (CONT.)

Tony and Crissy of SMC presented results from the flood studies and flood risk assessments for Kellogg Creek and the Dead River. Tony stressed that the studies are still draft and are under review.

Erin from MWH presented results from the Lake County Gardens flooding assessment.

CDF presented updated results for the detention basin inventory; regional and depressional storage areas; problem hydraulic structures, discharge points, and other areas; Flood Problem Area Inventory and IDOT flood report sites; trails and greenways. CDF then presented the revised results of the Green Infrastructure Prioritization mapping to reflect comments from the April meeting.

Patty asked if there were any comments about additional flooding areas in these watersheds. Additional flooding was not mentioned, but two problem sites were indicated: significant erosion on Dead Dog Creek near Novotny Park, and debris dumping along Bull Creek near Beach Road and North Ave. Both locations were noted by CDF.

The presentations will be posted on the SMC Web site (http://www.co.lake.il.us/smc).

5.0 GOALS AND OBJECTIVES

Goals and objectives were not discussed.

6.0 NEXT MEETING(S)

Patty Werner announced that meeting attendance is better during afternoon time slots and asked how many of the attendees could not come to meetings in the 3:00 to 5:00 time slot. Only one attendee could not make it, but he stays informed through his neighbor, who does attend the meetings.

The next meeting was scheduled for Thursday, June 14, 2007. The meeting will be held in the afternoon, and a location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

KELLOGG CREEK/DEAD RIVER
9th WATERSHED PLANNING MEETING
June 21, 2007, 3:00-5:00PM

Beach Park Village Hall

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS & UPDATES

Patty Werner from the Lake County Stormwater Management Commission (SMC) delivered a welcome and introduction of guest speaker Tim Girmscheid from the Liberty Prairie Conservancy and the project team: Patty Werner, Tony Wolff, Chris Gaines, Rasto Vrazda, and Mike Prusila from SMC; and Jason Navota and Tom Price from Conservation Design Forum (CDF). The attendees introduced themselves and who they were representing. An attendance list is attached.

Announcements:

Patty Werner announced that the fish survey scheduled for June 26-27 has been rescheduled for August.

She also announced that as part of a continuing watershed outreach effort, SMC will distribute watershed maps to each municipality and possibly to community libraries for posting. It was suggested that the Beach Park Village Hall bulletin board would be a good spot to post a map.

SMC gave a presentation on the watershed planning effort at the last IL Beach Sunrise Rotary Club meeting.

The stream cleanup grant application submitted by SMC and the Alliance for the Great Lakes was not awarded due to a lack of federal funding for the grant program this year. We will continue to pursue other funding for a stream cleanup project.

Watershed planning in-progress signs will be added to the existing watershed signs that are posted on county roads. Lake County Department of Transportation will be adding these signs as their schedule allows.

2.0 MAY MEETING FOLLOW-UP

Patty Werner asked if there were any comments/changes needed on the draft meeting summary for the May meeting. The attendees provided no comments, so the meeting report was accepted by the group as presented.

3.0 BEST MANAGEMENT PRACTICE TOOL BOX

Conservation Easements

Tim Girmscheid of the Liberty Prairie Conservancy, a county-wide land trust, presented information about the Conservancy and conservation easements and tax incentives associated with conservation easements. Joe Hughes of the Bull Creek Stakeholders Association provided comments on that organization's conservation easement, which was dedicated for a stream restoration project. The Bull Creek Stakeholders Association holds an easement that ranges from 30-50 feet along the stream channel to protect the riparian buffer on 10 or 11 properties along Bull Creek.

Question: Is there a minimum acreage or area required for a conservation easement?

Response: There is no minimum area, and location and characteristics of the land are more important features than the area. A small area is more likely to be protected if it fits into a larger network of properties that have conservation value. 'Conservation value' isn't limited to rare natural features or ecosystems but can also include aesthetic / scenic value as well.

Question: Could an area where a road is planned, or where a right-of-way easement exists, be protected with a conservation easement?
Response: Not unless the existing easement is vacated by the current holder of the easement.

Question: Could a conservation easement cover contaminated property?
Response: It is unlikely unless the property is cleaned up first.

Tim would be happy to answer any additional questions about the conservation easement potential for specific properties. He can be reached at tim@libertyprairie.org or 847-548-5989 X32.

Best Management Practice Tool Box

Tom Price from CDF presented the Best Management Practice Tool Box for the Kellogg Creek and Dead River Watershed Based Plans.

Question: Could I turn my ditch into a naturalized swale by letting it grow?
Response: Yes, but there may be some municipal codes, or maintenance practices, that govern native landscaping. Check with your municipality. Also, you don't want to let trees grow in the ditch if you do let it grow out.

Question: Runoff from commercial properties along Sheridan Road is carrying debris into the stream. What can be done?
Response: the landowners can use property management practices such as sweeping the parking lots and ground maintainance and/or install filtration BMPs on the edges of their property to capture debris running off the land.

Tim and Tom's presentations will be posted on the SMC Web site (http://www.co.lake.il.us/smc).

4.0 DISCUSSION

Meeting participants were divided into two groups for discussion and to fill out best management practice worksheets: one group discussed best management practices that landowners could implement, and the other discussed community-level best management practices. The groups discussed the following implementation elements: ease of implementation; term (when to implement); maintenance requirements; and technical and financial assistance requirements.

5.0 NEXT MEETING(S)

The next meeting will be held in the afternoon again since we are getting better attendance at the afternoon meetings. A location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

June 21, 2007 Meeting Attendees

(NAME OF ATTENDEE)	(REPRESENTING)	(WATERSHED)
Robert Cade	North Shore Sanitary District	Both
Emma Bialecki	Lake County Forest Preserve District	Both
Paul Kakuris	Illinois Dunesland Preservations Society	Both
Jeffrey Koziel	Land Conservancy of Lake County	Dead
Tom Chefalo	Lake County Planning, Bldg., & Dev.	Both
Frances Canonizado	Alliance for the Great Lakes	Both
Tim Girmscheid	Liberty Prairie Conservancy	Both
Chip Parrott	RHMG/Village of Beach Park	Dead
Gene Cross	Benton Twp./Village of Beach Park	Both
Jim Stanczak	Waukegan Regional Airport	Dead
Ronda Nissen	Self	Kellogg
Bruce Cliff	Self	Kellogg
Judith Wilkes	Self	Dead
Joe Hughes	Bull Creek Stakeholders Association	Dead
Jason Navota	Conservation Design Forum	Project Team
Tom Price	Conservation Design Forum	Project Team
Chris Gaynes	Lake County Stormwater Management Commission	Project Team
Mike Prusila	Lake County Stormwater Management Commission	Project Team
Patty Werner	Lake County Stormwater Management Commission	Project Team
Tony Wolff	Lake County Stormwater Management Commission	Project Team
Rasto Vrazda	Lake County Stormwater Management Commission	Project Team

KELLOGG CREEK/DEAD RIVER
10th WATERSHED PLANNING MEETING
July 19, 2007, 3:00-5:00PM

Zion City Hall

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS & UPDATES

Patty Werner from the Lake County Stormwater Management Commission (SMC) delivered a welcome and introduction of the project team: Patty Werner, Chris Gaines, and Mike Prusila from SMC; and Jason Navota and Tom Price from Conservation Design Forum (CDF). The attendees introduced themselves and who they were representing. An attendance list is attached.

Announcements:

Patty announced that a date has not yet been selected for the IDNR fish survey of Kellogg Creek / Dead River.

2.0 MAY MEETING FOLLOW-UP

Patty Werner asked if there were any comments/changes needed on the draft meeting summary for the June meeting. The attendees provided no comments, so the meeting report was accepted by the group as presented.

3.0 BEST MANAGEMENT PRACTICE TOOL BOX

Best Management Practice Tool Box Discussion (continued)

Meeting participants continued to fill out best management practice worksheets on landowner and community Best Management Practices. The groups discussed the following implementation elements: ease of implementation; term (when to implement); maintenance requirements; and technical and financial assistance requirements. The summary tables are included with these minutes.

4.0 GOALS & OBJECTIVES

Mike Prusila introduced the revised list of Issues, Goals and Objectives, which will be distributed to the group and discussed at the next meeting. The draft goals and objectives were provided as a handout.

5.0 NEXT MEETING(S)

The next meeting will be held in the evening or afternoon on Thursday August 9th. A location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

KELLOGG CREEK/DEAD RIVER
11th WATERSHED PLANNING MEETING
August 9, 2007, 3:00-5:00PM

Beach Park Village Hall

DRAFT MEETING SUMMARY

1.0 INTRODUCTIONS & ANNOUNCEMENTS & UPDATES

Patty Werner from the Lake County Stormwater Management Commission (SMC) delivered a welcome and introduction of the project team: Patty Werner, Chris Gaynes, Mike Prusila, and Rasto Vrazda from SMC; and Jason Navota and Eric Otto from Conservation Design Forum (CDF). The attendees introduced themselves and who they were representing. An attendance list is attached.

Patty Werner asked for input from the group regarding the distribution of email announcements to the group. Attendees appreciate being informed about watershed events and activities and would like to continue to receive them. SMC will forward all watershed-related emails that stakeholders request be distributed to the group.

There were no announcements.

2.0 JULY MEETING FOLLOW-UP

Patty Werner asked if there were any comments/changes needed on the draft meeting summary for the June meeting. The attendees provided no comments, so the meeting report was accepted by the group as presented.

Patty provided a summary of the watershed plan status: a draft plan will be submitted to SMC in early September; draft plan to stakeholders in October; final plan to all by end of November, 2007.

3.0 GOALS & OBJECTIVES

Mike Prusila introduced the revised list of Issues, Goals and Objectives, which were distributed to the group via email and as a handout. The group proceeded to review, discuss and suggest revisions to the Goals, Objectives, and Indicators for the following issues: Stream Restoration and Enhancement, Flood Risk and Flood Damage, and Watershed Hydrology. The discussion will continue at the next meeting.

4.0 NEXT MEETING(S)

The next meeting will be held in the afternoon on Thursday September 13th. A location will be determined and forwarded to everyone with a meeting announcement prior to the meeting.

August 9, 2007 Meeting Attendees

(NAME OF ATTENDEE)	(REPRESENTING)	(WATERSHED)
Tom Chefalo	Lake County Planning, Bldg., & Dev.	Both
Chip Parrott	RHMG/Village of Beach Park	Dead
Bruce Mihelich	City of Zion	Both
Gene Gross	Village of Beach Park	Dead
LeRoy Bolt	Village of Beach Park	Dead
John Moore	City of Waukegan	Dead
Nick Huber	LCFPD	Both
Don Wilson	Self	Both
Richard Vanderhoef	Self	Dead
Judith Wilkes	Self	Dead
Susie Schreiber	Waukegan CAG	Dead
Jeffrey Koziel	Land Conservancy of Lake County	Dead
Jason Navota	Conservation Design Forum	Project Team
Eric Otto	Conservation Design Forum	Project Team
Chris Gaynes	Lake County Stormwater Management Commission	Project Team
Mike Prusila	Lake County Stormwater Management Commission	Project Team
Patty Werner	Lake County Stormwater Management Commission	Project Team
Rasto Vrazda	Lake County Stormwater Management Commission	Project Team

appendix O - stream inventory data sheets

Appendix O includes the data collection sheets used during the Lake County Stormwater Management Commission 2001 stream inventory.

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL01	DATE:	7/18/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	Glen Flora Trib
STREAM REACH #:	1		
REACH BOUNDARIES UPSTREAM:	culverts at railroad	REACH BOUNDARIES DOWNSTREAM:	lagoon/ marsh area
UPSTREAM GPS#	261	DOWNSTREAM GPS#	259

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2000	85	09:00:00	RB/KK	Normal	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:	1	BASEFLOW SINUOSITY:	1	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):	5.75	BANK HT RANGE:	from: 3	to: 8.5	
MEAN BANK SLOPE:	.4/1	BANK SLOPE RANGE:	from: .3/1	to: .5/1	
MEAN WATER DEPTH (ft):	2.125	WATER DEPTH RANGE:	from: 1.25	to: 3	
TOP MEAN CHAN. WIDTH (ft):	53.5	TOP CHANNEL WIDTH RANGE:	from 30	to: 77	
BOTTOM MEAN CHAN. WIDTH (ft):	43.5	BOT. CHAN. WIDTH RANGE:	from 20	to: 67	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %	None:	0	Grass:	20	Lawn:	0	Wetland: 40
	Trees:	10	Shrub:	30	Rowcrop:	0	

PREDOMINANT TREE/SHRUB: Willows ☐ Box Elder ☐ Honeysuckle ☐ Buckthorn ☐ Hardwoods ☑ Other:

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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL01	Culvert	3			Concrete

LOCATION/GPS#: 260

NOTES: under railroad tracks- right bank drain wetlands

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL01	Culvert	3	0	0	Concrete

LOCATION/GPS#: 260

NOTES: under railroad tracks- right bank draining wetlands

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL01	Culvert	5			Concrete

LOCATION/GPS#	NOTES:
261	stream continues from under railroad tracks

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL01	Culvert	5			Concrete

LOCATION/GPS#	NOTES:
261	stream continues from under railroad tracks

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	30
Recreational:	0	Commercial Industrial:	70
Residential:	0	Other	0
Other Description:			

VEGETATION %

Forest:	30	Lawn/Grass:	10	Wetlands:	30
Crops:	0	Shrub/Weeds:	30	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 70

COMMENTS (Riparian Corridor/Floodplain): left bank- 100ft right bank- 30ft

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	0	Sand:	0	Cobble:	0	Silt	30
Concrete:	0	Organic Matter:	70	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	Moderate
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	Moderate
FILAMENTOUS ALGAE:	High

GREASE/OIL IN WATER COLUMN: ☑

GREASE/OIL IN SEDIMENT: ☑

TURBIDITY: Low

WATER COLOR: Clear

COMMENTS: water is very clear- enough to see the excessive vegetation, but vegetation is too thick to see the

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☐	☑	☐	☑	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☐	☑

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL01	Russell Brunner		425	lagoon/ marsh

GPS #
259

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL01	Russell Brunner		426	culverts under railroad

GPS #
260

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL01	Russell Brunner		427	representative reach

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL01	Russell Brunner		428	culverts

GPS #
261

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL02	DATE:	7/18/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	Glen Flora Trib
STREAM REACH #:	2		
REACH BOUNDARIES UPSTREAM:	culverts at Sheridan	REACH BOUNDARIES DOWNSTREAM:	culverts at railroad
UPSTREAM GPS#	279	DOWNSTREAM GPS#	262

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
4000	85	12:30:00	RB/KK	Normal	24 hrs	

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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	2
DEGREE OF BANK EROSION:	1	Types/Locations of High Cases: photos		DEGREE OF ARMORING:	1
Types/Locations of High Cases: photos					
SEDIMENT ACCUMULATIONS:	2				

MEAN BANK HT (ft):	1.5	BANK HT RANGE:	from: 1	to: 2	
MEAN BANK SLOPE:	.475/1	BANK SLOPE RANGE:	from: .2/1	to: .75/1	
MEAN WATER DEPTH (ft):	.375	WATER DEPTH RANGE:	from: .25	to: .5	
TOP MEAN CHAN. WIDTH (ft):	10.5	TOP CHANNEL WIDTH RANGE:	from 5	to: 16	
BOTTOM MEAN CHAN. WIDTH (ft):	6.25	BOT. CHAN. WIDTH RANGE:	from 3.5	to: 10	
MEAN VELOCITY (ft/s):	20/35	VELOCITY RANGE:	from: 20/35	to: 20/35	

PREDOMINANT BANK VEG. %: None: 0 | Grass: 5 | Lawn: 5 | Wetland: 25 | Trees: 35 | Shrub: 30 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ Box Elder ☐ Honeysuckle ☐ Buckthorn ☑ Hardwoods ☑ Other:

CANOPY (% shaded cov. of channel): 60 | BEAVER ACTIVITY: ☐ | # OF DAMS:

INSTREAM DEBRIS LOAD: Fail | OVERBANK DEBRIS LOAD: Pass

COMMENTS:

IMPOUNDED: ☑ | MID-STREAM BARS _ISLANDS: ☑

EST. MANNINGS n: Right Overbank: | Instream: | Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL02	Culvert	5			Concrete

LOCATION/GPS#: 262

NOTES: west side railroad tracks

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL02	Culvert	5			Concrete

LOCATION/GPS#: 262

NOTES: west side railroad tracks

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL02	Culvert	5			Concrete

LOCATION/GPS# 262

NOTES: west of railroad tracks

HYDRAULIC STRUCTURES:

LAKE CO ID: BL02 | TYPE: Culvert | SIZE (ft): W: 4 H: L: | MATERIAL: Concrete

LOCATION/GPS# 263

NOTES: west of railroad tracks

HYDRAULIC STRUCTURES:

LAKE CO ID: BL02 | TYPE: Bridge | SIZE (ft): W: 5 H: 6.5 L: 31 | MATERIAL: Wood

LOCATION/GPS# 273

NOTES: pedestrian bridge- wood/steel/ and conc.

HYDRAULIC STRUCTURES:

LAKE CO ID: BL02 | TYPE: Culvert | SIZE (ft): W: 6 H: 7 L: 0 | MATERIAL: Concrete

LOCATION/GPS# 279

NOTES: east side Sheridan Rd.

POINT DISCHARGE:

LAKE CO ID: BL02 | TYPE: Swale/Open Channel | SIZE (ft): Top: 4 Bottom Deep:

LOCATION/GPS # 264

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID: BL02 | TYPE: Swale/Open Channel | SIZE (ft): Top: 2 Bottom Deep:

LOCATION/GPS # 265

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID: BL02 | TYPE: Swale/Open Channel | SIZE (ft): Top: 5 Bottom Deep:

LOCATION/GPS # 268

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID: BL02 | TYPE: Swale/Open Channel | SIZE (ft): Top: 2 Bottom Deep:

LOCATION/GPS # 269

NOTES: left bank- creating backwaters?

POINT DISCHARGE:

LAKE CO ID: BL02 | TYPE: Swale/Open Channel | SIZE (ft): Top: 6 Bottom Deep:

LOCATION/GPS # 271

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL02	Concrete Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 274

NOTES: left bank- erosion, forming channel

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL02	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #: 275

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL02	Plastic Pipe	Top: 0.33	Bottom	Deep:

LOCATION/GPS #: 276

NOTES: right bank- residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL02	Steel Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 277

NOTES: right bank- residential armoring, stone and concrete- channelization?

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL02	Steel Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 279

NOTES: above culvert

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL02	Concrete Pipe	Top: 1.5	Bottom	Deep:

LOCATION/GPS #: 279

NOTES: in culvert

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL02	Concrete Pipe	Top: 1.5	Bottom	Deep:

LOCATION/GPS #: 279

NOTES: in culvert

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	50
	Recreational:	5	Commercial Industrial:	5
	Residential:	40	Other	0
	Other Description:			

VEGETATION %						
	Forest:	30	Lawn/Grass:	10	Wetlands:	30
	Crops:	0	Shrub/Weeds:	30	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 90

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	Sand:	Cobble:	Silt:
10	20	10	40

Concrete:	Organic Matter:	Boulder:	Claypan:
5	0	5	10

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Moderate

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Moderate

FILAMENTOUS ALGAE: High

GREASE/OIL IN WATER COLUMN: ☑

GREASE/OIL IN SEDIMENT: ☑

TURBIDITY: Moderate

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑
Pools Over 28" Deep: ☑
Macrophytes: ☑
Logs: ☑
Overhanging Veg: ☑
Rootwads: ☑
Boulders: ☑
Backwaters: ☑

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		429	culverts at railroad tracks

GPS # 262

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		430	culvert

GPS #
262

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		431	other side of culvert

GPS #
263

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		432	oil and grease in water

GPS #
263

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		433	open channel

GPS #
264

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		434	open channel with debris

GPS #
265

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		435	debris- left bank

GPS #
266

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		436	debris- log jam

GPS #
267

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		437	open channel

GPS #
268

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		438	open channel

GPS #
269

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		439	debris- log jam

GPS #
270

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		440	open channel

GPS #
271

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		441	erosion

GPS #
272

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		442	bridge

GPS #
273

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		443	drain pipe

GPS #
274

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		444	open channel

GPS #
275

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		445	drain pipe

GPS #
276

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		446	concrete/ drain pipes

GPS #
277

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		447	armoring

GPS #
278

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		448	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL02	Russell Brunner		449	culvert/ 2 drain pipes

GPS #
279

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL03 | DATE: 7/31/2001

PRIMARY WATERSHED: Bull Creek(LM) | STREAM REACH NAME: Glen Flora Trib | STREAM REACH #: 3

REACH BOUNDARIES UPSTREAM: culvert at end of golf course

REACH BOUNDARIES DOWNSTREAM: culverts at Sheridan Rd.

UPSTREAM GPS# 394 | DOWNSTREAM GPS# 376

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
3000	95	10:30:00	RB/KK	Normal	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: 1 | BASEFLOW SINUOSITY: 1 | POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 0 | Types/Locations of High Cases: | DEGREE OF ARMORING: 2 | Types/Locations of High Cases: see photos

SEDIMENT ACCUMULATIONS: 0

MEAN BANK HT (ft):	1.16	BANK HT RANGE:	from: .5	to: 2
MEAN BANK SLOPE:	0/1	BANK SLOPE RANGE:	from: 0/1	to: 0/1
MEAN WATER DEPTH (ft):	.48	WATER DEPTH RANGE:	from: .2	to: .75
TOP MEAN CHAN. WIDTH (ft):	14.5	TOP CHANNEL WIDTH RANGE:	from 9.5	to: 21
BOTTOM MEAN CHAN. WIDTH (ft):	12	BOT. CHAN. WIDTH RANGE:	from 8.5	to: 15
MEAN VELOCITY (ft/s):	20/150	VELOCITY RANGE:	from: 0	to: 20/150

PREDOMINANT BANK VEG. %: None: 0 | Grass: 0 | Lawn: 90 | Wetland: 0 | Trees: 10 | Shrub: 0 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☐ | Hardwoods ☑ | Other:

CANOPY (% shaded cov. of channel): 0 | BEAVER ACTIVITY: ☐ | # OF DAMS: 5

INSTREAM DEBRIS LOAD: Pass | OVERBANK DEBRIS LOAD: Pass

COMMENTS:

IMPOUNDED: ☐ | MID-STREAM BARS _ISLANDS: ☑

EST. MANNINGS n: Right Overbank: | Instream: | Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Culvert	6	7		Concrete

LOCATION/GPS# 376 | NOTES: west side Sheridan Rd.- into golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Dam	5	4		Concrete

LOCATION/GPS# 376 | NOTES: golfcourse- landscape maipulation

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	5	3	21	conc./steel/wood

LOCATION/GPS#
377

NOTES:
recreational

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Dam	8	3		Concrete

LOCATION/GPS#
379

NOTES:
landscape manipulation

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Dam		7	13	Concrete

LOCATION/GPS#
380

NOTES:
landscape manip.- creating pond/armoring

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	8	2	60	conc./wood

LOCATION/GPS#
382

NOTES:
island/ armoring

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	7.5	3.5	41	conc./wood

LOCATION/GPS#
383

NOTES:
recreational

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Culvert	6	3.5		Steel

LOCATION/GPS#
384

NOTES:
golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	8	3.5	30	conc./wood

LOCATION/GPS#
385

NOTES:
golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Dam		3	18	Concrete

LOCATION/GPS#
386

NOTES:
golf course lanscape manipulation

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	7.5	3	25	conc./wood

LOCATION/GPS#
387

NOTES:
golf course lanscape manipulation

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	6	5	30	conc./wood

LOCATION/GPS#
389

NOTES:
golf course lanscape manipulation

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Culvert	2			Concrete

LOCATION/GPS#: 390

NOTES: armoring

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Culvert	2			Concrete

LOCATION/GPS#: 390

NOTES: armoring

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Dam	10	3		Concrete

LOCATION/GPS#: 390

NOTES: golf course lanscape manipulation

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	8	4	36	Concrete

LOCATION/GPS#: 391

NOTES: golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	5	4	30	conc/steel/wood

LOCATION/GPS#: 392

NOTES: golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Bridge	7	5	22	conc/steel/wood

LOCATION/GPS#: 393

NOTES: golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL03	Culvert	3			Steel

LOCATION/GPS#: 394

NOTES: with armoring- cont. underground from outside of golf course

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft): Top:	Bottom	Deep:
BL03	Plastic Pipe	0.33		

LOCATION/GPS #: 376

NOTES: left bank- draining from Sheridan

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft): Top:	Bottom	Deep:
BL03	Plastic Pipe	0.33		

LOCATION/GPS #: 376

NOTES: left bank- draining golf course

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Plastic Pipe	Top: 0.33	Bottom	Deep:

LOCATION/GPS #: 378

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Steel Pipe	Top: 0.75	Bottom	Deep:

LOCATION/GPS #: 378

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Plastic Pipe	Top: 0.33	Bottom	Deep:

LOCATION/GPS #: 378

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Plastic Pipe	Top: 0.33	Bottom	Deep:

LOCATION/GPS #: 379

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Steel Pipe	Top: 0.75	Bottom	Deep:

LOCATION/GPS #: 381

NOTES: left bank- erosion

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Plastic Pipe	Top: 0.5	Bottom	Deep:

LOCATION/GPS #: 381

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Plastic Pipe	Top: 0.4	Bottom	Deep:

LOCATION/GPS #: 383

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Plastic Pipe	Top: 0.4	Bottom	Deep: 0

LOCATION/GPS #: 383

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL03	Plastic Pipe	Top: 0.4	Bottom	Deep:

NOTES:	LOCATION/GPS # 383
right bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL03	Plastic Pipe	Top: 0.33 Bottom Deep: 0

NOTES:	LOCATION/GPS # 384
left of culvert	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL03	Swale/Open Channel	Top: 9 Bottom Deep:

NOTES:	LOCATION/GPS # 384
left bank- created?/used by golf course for draining purposes, retention pond	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL03	Plastic Pipe	Top: 0.75 Bottom Deep:

NOTES:	LOCATION/GPS # 388
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL03	Swale/Open Channel	Top: 3 Bottom Deep:

NOTES:	LOCATION/GPS # 394
right bank- created?/used by golf course for draining purposes	

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	0
	Recreational:	100	Commercial Industrial:	0
	Residential:	0	Other	0
	Other Description:			

VEGETATION %						
	Forest:	10	Lawn/Grass:	90	Wetlands:	0
	Crops:	0	Shrub/Weeds:	0	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 10

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %								
	Gravel:	10	Sand:	20	Cobble:	30	Silt:	10
	Concrete:	0	Organic Matter:	10	Boulder:	20	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	High
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	Low
FILAMENTOUS ALGAE:	Low

GREASE/OIL IN WATER COLUMN:	GREASE/OIL IN SEDIMENT:
☐	☐

TURBIDITY:	High		
WATER COLOR:	Brown	**COMMENTS:**	

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☑	☑	☐	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☐	☐	☑	☑

F. 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:
☐	☐	☐	unidentified

BIRDS:

Ducks:	Geese:	Herons:	Kingfishers:	Sandpipers/Plovers:
☑	☐	☐	☐	☐

Gulls/Terns:	Others:
☐	

ADDITIONAL COMMENTS:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		69	culvert/ drain pipes/ dam

GPS #
376

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		70	bridge

GPS #
377

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		71	drain pipe

GPS #
378

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		72	drain pipe

GPS #
378

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		73	drain pipe

GPS #
378

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		74	dam with armoring

GPS #
379

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		75	drain pipe

GPS #
379

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		76	dam

GPS #
380

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		77	drain pipes x2

GPS #
381

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		78	bridge

GPS #
382

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		79	drain pipes x3

GPS #
383

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		80	bridge

GPS #
383

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		81	culvert with drain pipe

GPS #
384

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		82	open channel

GPS #
384

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		83	bridge

GPS #
385

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		84	dam

GPS #
386

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		85	bridge

GPS #
387

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		86	drain pipe

GPS #
388

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		87	bridge

GPS #
389

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		88	culverts x2 with armoring

GPS #
390

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		89	dam

GPS #
390

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		90	bridge

GPS #
391

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		91	bridge

GPS #
392

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		92	bridge

GPS #
393

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL03	Russell Brunner		93	culvert and open channel

GPS #
394

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL04	DATE:	7/19/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	Glen Flora Trib
STREAM REACH #:	4		
REACH BOUNDARIES UPSTREAM:	culvert at Lewis	REACH BOUNDARIES DOWNSTREAM:	culvert at Montesano
UPSTREAM GPS#	292	DOWNSTREAM GPS#	280

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
7000	89	10:00:00	RB/KK	Normal	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:	1	BASEFLOW SINUOSITY:	1	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	1	Types/Locations of High Cases:		DEGREE OF ARMORING:	0
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	3				

MEAN BANK HT (ft):	2.7	BANK HT RANGE:	from: .9	to: 4.5	
MEAN BANK SLOPE:	.375/1	BANK SLOPE RANGE:	from: .25/1	to: .5/1	
MEAN WATER DEPTH (ft):	.175	WATER DEPTH RANGE:	from: .1	to: .25	
TOP MEAN CHAN. WIDTH (ft):	13.75	TOP CHANNEL WIDTH RANGE:	from 12.5	to: 15	
BOTTOM MEAN CHAN. WIDTH (ft):	6.5	BOT. CHAN. WIDTH RANGE:	from 5	to: 8	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %	None:	0	Grass:	20	Lawn:	0	Wetland:	40	
	Trees:	10	Shrub:	30	Rowcrop:	0			

PREDOMINANT TREE/SHRUB	Willows ☑	Box Elder ☐	Honeysuckle ☐	Buckthorn ☐	Hardwoods ☐	Other:

CANOPY (% shaded cov. of channel):	10	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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL04	Culvert	2.5			Concrete

LOCATION/GPS#: 280

NOTES: north side Montesano- continues to golfcourse underground

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL04	Bridge	3	2	10	Wood

LOCATION/GPS#: 283

NOTES: residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL04	Bridge	3	5	12	Wood

LOCATION/GPS#	NOTES:
286	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL04	Bridge	W: 3.5	H: 3	L: 12		Wood

LOCATION/GPS#	NOTES:
288	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL04	Culvert	W: 2.5	H:	L:		Steel

LOCATION/GPS#	NOTES:
289	right bank- wetland ditch

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL04	Culvert	W: 2	H: 2	L:		Concrete

LOCATION/GPS#	NOTES:
290	east side of Butrick

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL04	Culvert	W: 2	H: 2	L: 0		Concrete

LOCATION/GPS#	NOTES:
290	east side of Butrick

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL04	Culvert	W: 1	H:	L:		Concrete

LOCATION/GPS#	NOTES:
290	east side of Butrick

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL04	Culvert	W: 2	H: 2	L:		Concrete

LOCATION/GPS#	NOTES:
291	west side of Butrick

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL04	Culvert	W: 2	H: 2	L:		Concrete

LOCATION/GPS#	NOTES:
291	west side of Butrick

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL04	Culvert	W: 3	H:	L:		Concrete

LOCATION/GPS#	NOTES:
292	east side of Lewis- continues underground

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL04	Swale/Open Channel	Top:	3 Bottom	Deep:

NOTES:	LOCATION/GPS # 281
left bank- open space	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL04	Swale/Open Channel	Top: 1 Bottom Deep:

NOTES:	LOCATION/GPS # 282
right bank- open space	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL04	Steel Pipe	Top: 2.5 Bottom Deep:

NOTES:	LOCATION/GPS # 284
left bank- residential	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL04	Plastic Pipe	Top: 1.5 Bottom Deep:

NOTES:	LOCATION/GPS # 287
left bank- residential	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL04	Concrete Pipe	Top: 3 Bottom Deep:

NOTES:	LOCATION/GPS # 290
right bank- openspace/ powerlines	

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	40
	Recreational:	20	Commercial Industrial:	10
	Residential:	30	Other	0
	Other Description:			

VEGETATION %						
	Forest:	10	Lawn/Grass:	20	Wetlands:	50
	Crops:	0	Shrub/Weeds:	20	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 50

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %								
	Gravel:	5	Sand:	10	Cobble:	5	Silt:	60
	Concrete:	0	Organic Matter:	10	Boulder:	0	Claypan:	10

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	Low
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	High
FILAMENTOUS ALGAE:	Low

GREASE/OIL IN WATER COLUMN:	GREASE/OIL IN SEDIMENT:
☑	☑

TURBIDITY: Low

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑ Pools Over 28" Deep: ☐ Macrophytes: ☑ Logs: ☑

Overhanging Veg: ☑ Rootwads: ☑ Boulders: ☐ Backwaters: ☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		450	culvert- north side of Montesaro

GPS # 280

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		451	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		452	open channel

GPS #
281

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		453	open channel

GPS #
282

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		454	bridge (downstream)

GPS #
283

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		455	drain pipe/ armoring

GPS #
284

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		456	erosion

GPS #
285

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		457	bridge (downstream)

GPS #
286

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		458	drain pipe

GPS #
287

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		459	bridge

GPS #
288

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		460	culvert

GPS #
289

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		461	culvert x 3

GPS #
290

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		462	drain pipe

GPS #
290

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		463	culvert x2

GPS #
291

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL04	Russell Brunner		464	culvert at Lewis

GPS #
292

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL05 | DATE: 7/19/2001

PRIMARY WATERSHED: Bull Creek(LM) | STREAM REACH NAME: Unnamed Trib | STREAM REACH #: 5

REACH BOUNDARIES UPSTREAM: culvert at Ganster Rd.

REACH BOUNDARIES DOWNSTREAM: wetland

UPSTREAM GPS# 303 | DOWNSTREAM GPS# 293

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
3000	89	01:30:00	RB/KK	Low	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: 3 | BASEFLOW SINUOSITY: 3 | POOL/RIFFLE DEVELOPMENT: 3

DEGREE OF BANK EROSION: 2 | Types/Locations of High Cases: photos | DEGREE OF ARMORING: 1 | Types/Locations of High Cases: photos

SEDIMENT ACCUMULATIONS: 2

MEAN BANK HT (ft):	2	BANK HT RANGE:	from: 2	to: 2
MEAN BANK SLOPE:	1/1	BANK SLOPE RANGE:	from: .75/1	to: 1.25/1
MEAN WATER DEPTH (ft):	.175	WATER DEPTH RANGE:	from: .1	to: .25
TOP MEAN CHAN. WIDTH (ft):	8	TOP CHANNEL WIDTH RANGE:	from 6	to: 10
BOTTOM MEAN CHAN. WIDTH (ft):	4.75	BOT. CHAN. WIDTH RANGE:	from 2.5	to: 7
MEAN VELOCITY (ft/s):	20/140	VELOCITY RANGE:	from: 0	to: 20/140

PREDOMINANT BANK VEG. %: None: 0 | Grass: 10 | Lawn: 0 | Wetland: 10 | Trees: 40 | Shrub: 40 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☑ | Other:

CANOPY (% shaded cov. of channel): 70 | BEAVER ACTIVITY: ☐ | # OF DAMS:

INSTREAM DEBRIS LOAD: Pass | OVERBANK DEBRIS LOAD: Pass

COMMENTS: minor log jams

IMPOUNDED: ☐ | MID-STREAM BARS _ISLANDS: ☑

EST. MANNINGS n: Right Overbank: | Instream: | Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL05	Culvert	W: 4 H: L:	Concrete

LOCATION/GPS#: 303

NOTES: south side of Ganster Rd.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL05	Steel Pipe	Top: 1.5 Bottom Deep:

LOCATION/GPS #: 294

NOTES: left bank- creating 2ft channel

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL05	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS #: 295

NOTES: left bank- open space/ residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL05	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #: 296

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL05	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS #: 296

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL05	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS #: 297

NOTES: left bank- gray/blue in water

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL05	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #: 299

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL05	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS #: 300

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL05	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS #: 302

NOTES: left bank

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	70
	Recreational:	0	Commercial Industrial:	0
	Residential:	30	Other	0
	Other Description:			

VEGETATION %						
	Forest:	40	Lawn/Grass:	10	Wetlands:	15
	Crops:	0	Shrub/Weeds:	35	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 125ft

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	20	Sand:	10	Cobble:	10	Silt:	30
Concrete:	0	Organic Matter:	10	Boulder:	5	Claypan:	15

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: Moderate

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:
☑	☑	☑	☑

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☑	☑

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		465	wetland

GPS # 293

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		466	drain pipe

GPS #
294

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		467	drain pipe with open channel

GPS #
294

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		468	open channel

GPS #
295

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		469	open channel

GPS #
296

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		470	open channel

GPS #
296

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		471	open channel- gray/blue water

GPS #
297

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		472	debris- barbed wire

GPS #
298

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		473	erosion

GPS #
299

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		474	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		475	open channel

GPS #
299

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		476	open channel

GPS #
300

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		478	pond- left bank

GPS #
301

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		479	open channel

GPS #
302

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL05	Russell Brunner		480	culvert

GPS #
303

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL06	DATE:	7/31/2001

PRIMARY WATERSHED:	STREAM REACH NAME:	STREAM REACH #:
Bull Creek(LM)	Unnamed Trib	6

REACH BOUNDARIES UPSTREAM:	REACH BOUNDARIES DOWNSTREAM:
vegetation	culvert at Ganster Rd.

UPSTREAM GPS#	375	DOWNSTREAM GPS#	372

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2000	95	09:00:00	RB/KK	Low	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:	1	BASEFLOW SINUOSITY:	1	POOL/RIFFLE DEVELOPMENT:	0
DEGREE OF BANK EROSION:	1	Types/Locations of High Cases:		DEGREE OF ARMORING:	0
SEDIMENT ACCUMULATIONS:	0				

Types/Locations of High Cases:

MEAN BANK HT (ft):	2.25	BANK HT RANGE:	from: 1.5	to: 3	
MEAN BANK SLOPE:	1/1	BANK SLOPE RANGE:	from: 1/1	to: 1/1	
MEAN WATER DEPTH (ft):	.1	WATER DEPTH RANGE:	from: 0	to: .2	
TOP MEAN CHAN. WIDTH (ft):	6.75	TOP CHANNEL WIDTH RANGE:	from 5.5	to: 8	
BOTTOM MEAN CHAN. WIDTH (ft):	3.25	BOT. CHAN. WIDTH RANGE:	from 3	to: 3.5	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %					
None: 0	Grass: 20	Lawn: 0	Wetland: 0		
Trees: 30	Shrub: 50	Rowcrop: 0			

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☐	☐	☐	☑	☐	

CANOPY (% shaded cov. of channel):	80	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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL06	Culvert	4			Concrete

LOCATION/GPS#	NOTES:
372	north side Ganster

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL06	Culvert	6	2.5	0	Concrete

LOCATION/GPS#	NOTES:
373	Sheridan Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL06	Culvert	6	2.5	0	Concrete

LOCATION/GPS#	NOTES:
374	west side Sheridan Rd.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL06	Concrete Pipe	Top: 1 Bottom Deep:

LOCATION/GPS # 372

NOTES: left bank- draining Sheridan

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL06	Swale/Open Channel	Top: 2 Bottom Deep:

LOCATION/GPS # 374

NOTES: right bank

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	70
	Recreational:	0	Commercial Industrial:	0
	Residential:	30	Other	0
	Other Description:			

VEGETATION %						
	Forest:	30	Lawn/Grass:	20	Wetlands:	0
	Crops:	0	Shrub/Weeds:	50	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 60

COMMENTS (Riparian Corridor/Floodplain): 20ft to road 100+ft away from road

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
	Gravel:	10	Sand:	30	Cobble:	10	Silt: 40
	Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan: 10

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	High
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	Low
FILAMENTOUS ALGAE:	N/A

GREASE/OIL IN WATER COLUMN: ☐ GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Clear COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☐	☐	☑	
Overhanging Veg:	Rootwads:	Boulders:	Backwaters:	
☑	☑	☐	☐	

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL06	Russell Brunner		63	culvert

GPS #
372

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL06	Russell Brunner		64	drain pipe

GPS #
372

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL06	Russell Brunner		65	culvert

GPS #
373

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL06	Russell Brunner		66	culvert

GPS #
374

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL06	Russell Brunner		67	open channel

GPS #
374

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL06	Russell Brunner		68	vegetation- end

GPS #
375

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL07	DATE:	7/3/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	South Branch
STREAM REACH #:	8		
REACH BOUNDARIES UPSTREAM:	Sheridan culverts	REACH BOUNDARIES DOWNSTREAM:	culverts at railroad tracks
UPSTREAM GPS#	016	DOWNSTREAM GPS#	001

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
1800	70	10:00:00	RB/KK	Normal	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: see photos		DEGREE OF ARMORING:	1
Types/Locations of High Cases: photos					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	11.625	BANK HT RANGE:	from: 5	to: 30	
MEAN BANK SLOPE:	.81/1	BANK SLOPE RANGE:	from: .25/1	to: 1.5/1	
MEAN WATER DEPTH (ft):	1.75	WATER DEPTH RANGE:	from: .75	to: 2.5	
TOP MEAN CHAN. WIDTH (ft):	30	TOP CHANNEL WIDTH RANGE:	from 23	to: 41	
BOTTOM MEAN CHAN. WIDTH (ft):	16	BOT. CHAN. WIDTH RANGE:	from 10	to: 24	
MEAN VELOCITY (ft/s):	20/50	VELOCITY RANGE:	from: 0	to: 20/50	

PREDOMINANT BANK VEG. %					
None: 0	Grass: 0	Lawn: 10	Wetland: 0		
Trees: 40	Shrub: 50	Rowcrop: 0			

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☐	☐	☐	☑	☑	

CANOPY (% shaded cov. of channel):	50	BEAVER ACTIVITY: ☐	# OF DAMS:
INSTREAM DEBRIS LOAD:	Fail	OVERBANK DEBRIS LOAD:	Pass

COMMENTS:

IMPOUNDED: ☑ MID-STREAM BARS _ISLANDS: ☑

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL07	Culvert	10.5	7		Steel

LOCATION/GPS#: 001

NOTES: under railroad tracks

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL07	Culvert	10.5	7		Steel

LOCATION/GPS#: 001

NOTES: under railroad tracks

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL07	Culvert	10.5	7		Steel

LOCATION/GPS#	NOTES:
001	under railroad tracks

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL07	Culvert	W: 7.8 H: 10 L:	Concrete

LOCATION/GPS#	NOTES:
016	east side Sheridan Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL07	Culvert	W: 7.8 H: 10 L: 0	Concrete

LOCATION/GPS#	NOTES:
016	east side Sheridan Rd.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL07	Plastic Pipe	Top: 0.25 Bottom Deep:	005

NOTES: left bank- residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL07	Swale/Open Channel	Top: 0.5 Bottom Deep:	006

NOTES: left bank- residential/ high erosion

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL07	Swale/Open Channel	Top: 0.5 Bottom Deep:	007

NOTES: left bank- residential/ erosion

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL07	Plastic Pipe	Top: 0.25 Bottom Deep:	009

NOTES: left bank- residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL07	Steel Pipe	Top: 1 Bottom Deep:	011

NOTES: right bank- residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL07	Swale/Open Channel	Top: 1 Bottom Deep:	013

NOTES: right bank- residential

SUSPICIOUS ACTIVITIES:

C. 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:	33	Lawn/Grass:	33	Wetlands:	0
	Crops:	0	Shrub/Weeds:	33	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 40

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %								
	Gravel:	20	Sand:	30	Cobble:	20	Silt:	20
	Concrete:	5	Organic Matter:	0	Boulder:	5	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: Moderate

WATER COLOR: Brown

COMMENTS: erosion

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑	Pools Over 28" Deep: ☑	Macrophytes: ☐	Logs: ☑	COMMENTS (Instream Cover for Fish):
Overhanging Veg: ☑	Rootwads: ☑	Boulders: ☑	Backwaters: ☐	

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		94	culverts under railroad tracks

GPS #
001

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		95	erosion- left bank

GPS #
002

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		96	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		97	debris- log jam

GPS #
003

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		98	armoring

GPS #
003

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		99	erosion- left bank

GPS #
004

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		100	drain pipe- left bank

GPS #
005

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		101	open channel- left bank

GPS #
006

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		102	open channel

GPS #
007

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		103	erosion- right bank

GPS #
008

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		104	drain pipe

GPS #
009

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		105	sanitary sewer

GPS #
010

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		106	drain pipe

GPS #
011

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		107	drain pipe- sealed

GPS #
012

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		108	open channel

GPS #
013

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		109	debris- log jam

GPS #
014

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		110	erosion- left bank

GPS #
015

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL07	Russell Brunner		111	box culverts at Sheridan

GPS #
016

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL08	DATE:	7/3/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	South Branch
STREAM REACH #:	9		
REACH BOUNDARIES UPSTREAM:	fork	REACH BOUNDARIES DOWNSTREAM:	culverts at Sheridan Rd.
UPSTREAM GPS#	027	DOWNSTREAM GPS#	017

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2000	70	12:00:00	RB/KK	Normal	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:	3	BASEFLOW SINUOSITY:	3	POOL/RIFFLE DEVELOPMENT:	2
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: see photos		DEGREE OF ARMORING:	0
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	4.6	BANK HT RANGE:	from: 4.5	to: 5	
MEAN BANK SLOPE:	.91/1	BANK SLOPE RANGE:	from: .5/1	to: 1.25/1	
MEAN WATER DEPTH (ft):	.61	WATER DEPTH RANGE:	from: .33	to: 1	
TOP MEAN CHAN. WIDTH (ft):	29.2	TOP CHANNEL WIDTH RANGE:	from 19.5	to: 30	
BOTTOM MEAN CHAN. WIDTH (ft):	11.3	BOT. CHAN. WIDTH RANGE:	from 7	to: 14	
MEAN VELOCITY (ft/s):	20/107	VELOCITY RANGE:	from: 0	to: 20/180	

PREDOMINANT BANK VEG. %: None: 33 Grass: 0 Lawn: 0 Wetland: 0 Trees: 33 Shrub: 33 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ Box Elder ☐ Honeysuckle ☐ Buckthorn ☑ Hardwoods ☑ Other:

CANOPY (% shaded cov. of channel): 70 BEAVER ACTIVITY: ☐ # OF DAMS:

INSTREAM DEBRIS LOAD: Fail OVERBANK DEBRIS LOAD: Pass

COMMENTS:

IMPOUNDED: ☑ MID-STREAM BARS ISLANDS: ☑

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL08	Culvert	7.75	10		Concrete

LOCATION/GPS#: 017

NOTES: west side Sheridan Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL08	Culvert	7.8	10		Concrete

LOCATION/GPS#: 017

NOTES: west side Sheridan Rd.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL08	Concrete Pipe	Top: 2	Bottom	Deep:

LOCATION/GPS # 017

NOTES: draining Sheridan Rd. in culvert

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL08	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS # 018

NOTES: left bank- open space/erosion

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL08	Concrete Pipe	Top: 2	Bottom	Deep:

LOCATION/GPS # 019

NOTES: left bank- draining commercial road

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL08	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS # 020

NOTES: left bank- erosion/ log impoundment

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL08	Concrete Pipe	Top: 0.5	Bottom	Deep:

LOCATION/GPS # 025

NOTES: left bank- residential/ high erosion

SUSPICIOUS ACTIVITIES:

C. 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:	20	Lawn/Grass:	20	Wetlands:	0
Crops:	0	Shrub/Weeds:	60	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 100

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
Gravel:	45	Sand:	10	Cobble:	30	Silt:	10
Concrete:	0	Organic Matter:	0	Boulder:	5	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: Moderate

WATER COLOR: Brown COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑ Pools Over 28" Deep: ☑ Macrophytes: ☐ Logs: ☑

Overhanging Veg: ☑ Rootwads: ☑ Boulders: ☑ Backwaters: ☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		112	culvert

GPS # 017

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		113	drain pipe

GPS #
017

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		114	open channel- left bank

GPS #
018

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		115	drain pipe- crating open channel

GPS #
019

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		116	open channel

GPS #
020

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		117	erosion- right bank

GPS #
021

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		118	debris

GPS #
022

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		119	debris

GPS #
023

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		120	sanitary sewer manhole

GPS #
024

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		121	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		122	erosion/ drain pipe

GPS #
025

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		123	debris (downstream)

GPS #
026

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL08	Russell Brunner		124	main fork- end reach

GPS #
027

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL09	DATE:	7/3/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	South Branch
STREAM REACH #:	10		
REACH BOUNDARIES UPSTREAM:	culverts at Talmadge	REACH BOUNDARIES DOWNSTREAM:	south fork
UPSTREAM GPS#	046	DOWNSTREAM GPS#	028

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2500	70	02:10:00	RB/KK	Normal	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:	3	BASEFLOW SINUOSITY:	3	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: photos		DEGREE OF ARMORING:	1
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	2				

MEAN BANK HT (ft):	3.5	BANK HT RANGE:	from: 2.5	to: 4	
MEAN BANK SLOPE:	.83/1	BANK SLOPE RANGE:	from: .5/1	to: 1/1	
MEAN WATER DEPTH (ft):	1.16	WATER DEPTH RANGE:	from: .75	to: 1.5	
TOP MEAN CHAN. WIDTH (ft):	18.83	TOP CHANNEL WIDTH RANGE:	from 14	to: 25	
BOTTOM MEAN CHAN. WIDTH (ft):	9.8	BOT. CHAN. WIDTH RANGE:	from 6.5	to: 11.6	
MEAN VELOCITY (ft/s):	.41	VELOCITY RANGE:	from: 0	to: 1/24	

PREDOMINANT BANK VEG. %: None: | Grass: 5 | Lawn: 5 | Wetland: 0 | Trees: 10 | Shrub: 80 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☑ | Other:

CANOPY (% shaded cov. of channel): 60 | BEAVER ACTIVITY: ☐ | # OF DAMS:

INSTREAM DEBRIS LOAD: Fail | OVERBANK DEBRIS LOAD: Pass

COMMENTS:

IMPOUNDED: ☑ | MID-STREAM BARS ISLANDS: ☑

EST. MANNINGS n: Right Overbank: | Instream: | Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W: 7.5 H: 7 L:	MATERIAL:
BL09	Culvert		Steel

LOCATION/GPS#: 046

NOTES: north side Talmadge Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W: 7.5 H: 7 L:	MATERIAL:
BL09	Culvert		Steel

LOCATION/GPS#: 046

NOTES: north side Talmadge

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL09	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS # 029

NOTES: left bank- mineral/clay in sediment, rust color

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL09	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS # 035

NOTES: left bank- debris

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL09	Plastic Pipe	Top: 0.25	Bottom	Deep: 0

LOCATION/GPS # 036

NOTES: left bank- residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL09	Plastic Pipe	Top: 0.25	Bottom	Deep: 0

LOCATION/GPS # 038

NOTES: right bank- residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL09	Clay Pipe	Top: 0.75	Bottom	Deep:

LOCATION/GPS # 039

NOTES: right bank- residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL09	Concrete Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS # 040

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL09	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS # 041

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL09	Plastic Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS # 042

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL09	Concrete Pipe	Top: 1 Bottom Deep:

LOCATION/GPS #: 046

NOTES: right bank- Talmadge Rd.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL09	Concrete Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS #: 046

NOTES: right bank- Talmadge Rd.

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	10
Recreational:	90	Commercial Industrial:	0
Residential:	0	Other	0

Other Description:

VEGETATION %

Forest:	20	Lawn/Grass:	20	Wetlands:	0
Crops:	0	Shrub/Weeds:	60	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 50

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	20	Sand:	5	Cobble:	5	Silt:	20
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	50

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: High

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:
☑	☑	☑	☑

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☐	☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		124	left fork- cont. south branch

GPS #
028

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		125	open channel- mineral in sediment

GPS #
029

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		126	representative reach photo (downstream)

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		127	erosion- left bank

GPS #
030

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		128	debris

GPS #
031

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		129	armoring- left bank

GPS #
032

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		130	debris

GPS #
033

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		131	armoring- left bank

GPS #
034

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		132	drain pipe

GPS #
035

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		133	drain pipe

GPS #
036

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		134	armoring- left bank, failed

GPS #
037

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		135	drain pipe

GPS #
038

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		136	drain pipe

GPS #
039

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		137	drain pipe

GPS #
040

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		138	drian pipe

GPS #
041

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		139	drain pipe

GPS #
042

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		140	debris

GPS #
043

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		141	debris

GPS #
044

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		142	erosion- left bank

GPS #
045

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		143	culverts at Talmadge

GPS #
046

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		144	drain pipe

GPS #
046

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL09	Russell Brunner		145	drain pipe

GPS #
046

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL10

DATE: 7/5/2001

PRIMARY WATERSHED: Bull Creek(LM)

STREAM REACH NAME: South Branch

STREAM REACH #: 11

REACH BOUNDARIES UPSTREAM: Pickford Ave.

REACH BOUNDARIES DOWNSTREAM: right fork- beginning of channel

UPSTREAM GPS# 050

DOWNSTREAM GPS# 047

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
800	70	10:00:00	RB/KK	Interstitial	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: 2

BASEFLOW SINUOSITY: 0

POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 3

Types/Locations of High Cases: see photos

DEGREE OF ARMORING: 0

Types/Locations of High Cases:

SEDIMENT ACCUMULATIONS: 0

MEAN BANK HT (ft):	6.25	BANK HT RANGE:	from: .5	to: 12
MEAN BANK SLOPE:	.25/1	BANK SLOPE RANGE:	from: .25/1	to: .25/1
MEAN WATER DEPTH (ft):	0	WATER DEPTH RANGE:	from: 0	to: 0
TOP MEAN CHAN. WIDTH (ft):	9	TOP CHANNEL WIDTH RANGE:	from 3	to: 15
BOTTOM MEAN CHAN. WIDTH (ft):	4.5	BOT. CHAN. WIDTH RANGE:	from 1.5	to: 7.5
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0

PREDOMINANT BANK VEG. %

None:	Grass:	Lawn:	Wetland:
0	0	0	0
Trees:	Shrub:	Rowcrop:	
50	50	0	

PREDOMINANT TREE/SHRUB

Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
☐	☐	☐	☑	☑	

CANOPY (% shaded cov. of channel): 75

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:

POINT DISCHARGE:

LAKE CO ID: BL10

TYPE: Plastic Pipe

SIZE (ft): Top: 0.25 Bottom Deep:

LOCATION/GPS # 049

NOTES: right bank- closed up

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	20
	Recreational:	0	Commercial Industrial:	0
	Residential:	80	Other	0
	Other Description:			

VEGETATION %						
	Forest:	33	Lawn/Grass:	33	Wetlands:	0
	Crops:	0	Shrub/Weeds:	33	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 30

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
	Gravel:	5	Sand:	0	Cobble:	0	Silt 75
	Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan: 20

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Low

FILAMENTOUS ALGAE: N/A

GREASE/OIL IN WATER COLUMN: ☐ **GREASE/OIL IN SEDIMENT:** ☐

TURBIDITY: N/A

WATER COLOR: **COMMENTS:**

E. INSTREAM COVER FOR FISH

Undercut Banks: ☐ Pools Over 28" Deep: ☐ Macrophytes: ☐ Logs: ☐ COMMENTS (Instream Cover for Fish):

Overhanging Veg: ☐ Rootwads: ☐ Boulders: ☐ Backwaters: ☐

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL10	Russell Brunner		146	start of channel- fork

GPS #
047

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL10	Russell Brunner		147	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL10	Russell Brunner		148	erosion

GPS #
048

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL10	Russell Brunner		149	drain pipe

GPS #
049

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL10	Russell Brunner		150	end reach- Pickford Ave.

GPS #
050

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL11 | DATE: 7/5/2001

PRIMARY WATERSHED: Bull Creek(LM) | STREAM REACH NAME: South Branch | STREAM REACH #: 12

REACH BOUNDARIES UPSTREAM: culvert at Bertrand Rd.

REACH BOUNDARIES DOWNSTREAM: culverts at Talmadge

UPSTREAM GPS# 068 | DOWNSTREAM GPS# 051

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2500	68	01:00:00	RB/KK	Low	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: 2 | BASEFLOW SINUOSITY: 2 | POOL/RIFFLE DEVELOPMENT: 1

DEGREE OF BANK EROSION: 3 | Types/Locations of High Cases: photos | DEGREE OF ARMORING: 2 | Types/Locations of High Cases: photos

SEDIMENT ACCUMULATIONS: 1

MEAN BANK HT (ft):	2.5	BANK HT RANGE:	from: 2.5	to: 2.5
MEAN BANK SLOPE:	.75/1	BANK SLOPE RANGE:	from: .5/1	to: 1/1
MEAN WATER DEPTH (ft):	.2	WATER DEPTH RANGE:	from: .16	to: .25
TOP MEAN CHAN. WIDTH (ft):	12.25	TOP CHANNEL WIDTH RANGE:	from 9.5	to: 15
BOTTOM MEAN CHAN. WIDTH (ft):	2.5	BOT. CHAN. WIDTH RANGE:	from 2	to: 3
MEAN VELOCITY (ft/s):	20/24	VELOCITY RANGE:	from: 0	to: 20/24

PREDOMINANT BANK VEG. %: None: 20 | Grass: 0 | Lawn: 0 | Wetland: 0 | Trees: 40 | Shrub: 40 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☐ | Other:

CANOPY (% shaded cov. of channel): 75 | 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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL11	Culvert	W: 7.5 H: 7 L:	Steel

LOCATION/GPS#: 051

NOTES: south side Talmadge Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL11	Culvert	W: 7.5 H: 7 L:	Steel

LOCATION/GPS#: 051

NOTES: south side Talmadge Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL11	Culvert	W: 6 H: L:	Steel

LOCATION/GPS#
054

NOTES:
residential street/ driveway

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL11	Bridge	W: 3	H: 2	L: 10		Wood

LOCATION/GPS#
060

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL11	Bridge	W: 4.5	H: 9.5	L: 43		Wood

LOCATION/GPS#
063

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL11	Bridge	W: 4.5	H: 9.5	L: 43		Wood

LOCATION/GPS#
063

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL11	Bridge	W: 3	H: 2	L: 13		Wood

LOCATION/GPS#
064

NOTES:
residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL11	Bridge	W: 2.5	H: 4	L: 12		Wood

LOCATION/GPS#
065

NOTES:
residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):				MATERIAL:
BL11	Culvert	W: 4	H:	L:		Concrete

LOCATION/GPS#
068

NOTES:
Bertrand Rd.- draining retention pond

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL11	Concrete Pipe	Top: 1.5	Bottom	Deep:

LOCATION/GPS #
051

NOTES:
draining Talmadge from west

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL11	Concrete Pipe	Top: 1.5	Bottom	Deep:

LOCATION/GPS #
051

NOTES:
draining Talmadge from east

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL11	Plastic Pipe	Top: 2	Bottom	Deep:

LOCATION/GPS #
052

NOTES:
left bank- residential/ armoring

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Swale/Open Channel	Top: 4 Bottom Deep:

LOCATION/GPS #
056

NOTES:
left bank- dry but established

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Steel Pipe	Top: 1.5 Bottom Deep:

LOCATION/GPS #
057

NOTES:
left bank- residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Swale/Open Channel	Top: 2 Bottom Deep:

LOCATION/GPS #
058

NOTES:
left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Plastic Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS #
061

NOTES:
right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Plastic Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS #
062

NOTES:
left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Plastic Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS #
065

NOTES:
left bank- armoring

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Plastic Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS #
065

NOTES:
left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Plastic Pipe	Top: 0.25 Bottom Deep:

NOTES:	LOCATION/GPS # 066
right bank- armoring	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL11	Concrete Pipe	Top: 2 Bottom Deep:

NOTES:	LOCATION/GPS # 067
right bank- retention pond	

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	10
	Recreational:	0	Commercial Industrial:	0
	Residential:	90	Other	0
	Other Description:			

VEGETATION %						
	Forest:	10	Lawn/Grass:	50	Wetlands:	0
	Crops:	0	Shrub/Weeds:	40	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 30

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %								
	Gravel:	20	Sand:	5	Cobble:	40	Silt:	25
	Concrete:	0	Organic Matter:	0	Boulder:	5	Claypan:	5

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	High
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	Low
FILAMENTOUS ALGAE:	N/A

GREASE/OIL IN WATER COLUMN:	GREASE/OIL IN SEDIMENT:
☐	☐

TURBIDITY: Low

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☐	☐	☑	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☑	☐

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		151	drain pipe

GPS #
051

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		152	culverts

GPS #
051

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		153	drain pipe

GPS #
051

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		154	drain pipe

GPS #
052

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		155	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		156	erosion

GPS #
053

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		157	culvert with armoring

GPS #
054

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		158	debris- sediment build up

GPS #
055

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		159	open channel

GPS #
056

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		160	erosion/ armoring- left bank

GPS #
055

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		161	drain pipe

GPS #
057

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		162	open channel

GPS #
058

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		163	open channel

GPS #
059

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		164	bridge

GPS #
060

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		165	drain pipe

GPS #
061

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		166	armoring

GPS #
062

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		167	drain pipe

GPS #
062

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		168	2 bridges

GPS #
063

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		169	footbridge

GPS #
064

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		170	footbridge

GPS #
065

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		171	drain pipe

GPS #
065

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		172	drain pipe

GPS #
065

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		173	drain pipe

GPS #
066

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		174	drain pipe

GPS #
067

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL11	Russell Brunner		175	culvert at Bertrand

GPS #
068

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL12	DATE:	7/6/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	South Branch
STREAM REACH #:	13		
REACH BOUNDARIES UPSTREAM:	culvert at Beach Rd.	REACH BOUNDARIES DOWNSTREAM:	south fork from previous reach
UPSTREAM GPS#	076	DOWNSTREAM GPS#	069

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
1900	75	08:30:00	RB/KK	Low	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: see photos		DEGREE OF ARMORING:	1
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	2				

MEAN BANK HT (ft):	3.33	BANK HT RANGE:	from: 3	to: 4	
MEAN BANK SLOPE:	.5/1	BANK SLOPE RANGE:	from: .25/1	to: .75/1	
MEAN WATER DEPTH (ft):	1	WATER DEPTH RANGE:	from: .25	to: 2.5	
TOP MEAN CHAN. WIDTH (ft):	19.6	TOP CHANNEL WIDTH RANGE:	from 16	to: 22	
BOTTOM MEAN CHAN. WIDTH (ft):	10.8	BOT. CHAN. WIDTH RANGE:	from 7	to: 15	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %: None: 0 Grass: 10 Lawn: 0 Wetland: 0 Trees: 50 Shrub: 40 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ Box Elder ☐ Honeysuckle ☐ Buckthorn ☑ Hardwoods ☐ Other:

CANOPY (% shaded cov. of channel): 80 BEAVER ACTIVITY: ☐ # OF DAMS:

INSTREAM DEBRIS LOAD: Fail OVERBANK DEBRIS LOAD: Pass

COMMENTS:

IMPOUNDED: ☑ MID-STREAM BARS ISLANDS: ☑

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL12	Bridge	3	4	20.5	Wood

LOCATION/GPS#: 070

NOTES: connecting residential areas

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL12	Culvert	16	7.5		Conc\steel

LOCATION/GPS#: 076

NOTES: north side Beach Rd.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL12	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #: 074

NOTES: left bank- dry

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL12	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS #: 075

NOTES: bike path run off

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL12	Concrete Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 076

NOTES: draining Beach Rd.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL12	Concrete Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 076

NOTES: draining Beach Rd.

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	30
Recreational:	70	Commercial Industrial:	0
Residential:	0	Other	0

Other Description:

VEGETATION %

Forest:	40	Lawn/Grass:	20	Wetlands:	0
Crops:	0	Shrub/Weeds:	40	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 60

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	5	Sand:	20	Cobble:	30	Silt:	30
Concrete:	5	Organic Matter:	0	Boulder:	5	Claypan:	5

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: High

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☑	☐	☑	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☑	☑

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		185	Culvert & Drainpipes

GPS #
076

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		177	south fork from previous reach

GPS #
069

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		178	bridge

GPS #
070

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		179	erosion- right bank

GPS #
071

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		180	debris- log jam

GPS #
072

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		181	erosion- right bank

GPS #
073

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		182	open channel

GPS #
074

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		183	open channel

GPS #
075

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL12	Russell Brunner		184	open channel

GPS #

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL13	DATE:	7/6/2001
PRIMARY WATERSHED:	Bull Creek (LM)	STREAM REACH NAME:	South Branch
STREAM REACH #:	14		
REACH BOUNDARIES UPSTREAM:	culvert at Wilson Ave.- stream continues from 700ft. of underground pipe	REACH BOUNDARIES DOWNSTREAM:	culvert at Beach Rd.
UPSTREAM GPS#	101	DOWNSTREAM GPS#	077

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
3000	80	10:30:00	RB/KK	Low	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: see photos	DEGREE OF ARMORING:	2	Types/Locations of High Cases: see photos
SEDIMENT ACCUMULATIONS:	2				

MEAN BANK HT (ft):	2.8	BANK HT RANGE:	from: 2	to: 3.5	
MEAN BANK SLOPE:	.7/1	BANK SLOPE RANGE:	from: .5/1	to: .85/1	
MEAN WATER DEPTH (ft):	.58	WATER DEPTH RANGE:	from: .5	to: .75	
TOP MEAN CHAN. WIDTH (ft):	13.6	TOP CHANNEL WIDTH RANGE:	from 13	to: 14	
BOTTOM MEAN CHAN. WIDTH (ft):	7.8	BOT. CHAN. WIDTH RANGE:	from 5	to: 9.5	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %: None: 0 | Grass: 30 | Lawn: 20 | Wetland: 0 | Trees: 20 | Shrub: 30 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☑ | Other:

CANOPY (% shaded cov. of channel): 60 | BEAVER ACTIVITY: ☐ | # OF DAMS:

INSTREAM DEBRIS LOAD: Fail | OVERBANK DEBRIS LOAD: Pass

COMMENTS:

IMPOUNDED: ☐ | MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: | Instream: | Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Culvert	16	7.5		conc/steel

LOCATION/GPS#: 077

NOTES: south side Beach Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Culvert	5.5	4		conc/steel

LOCATION/GPS#: 081

NOTES: residential walkway

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Bridge	3	6	12	Wood

LOCATION/GPS#
083

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Bridge	4	5	15	Wood

LOCATION/GPS#
084

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Beaver Dam	6	10	60	Wood

LOCATION/GPS#
086

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Bridge	4	4	12	Concrete

LOCATION/GPS#
087

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Bridge	4	4	12	Concrete

LOCATION/GPS#
089

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	channelized ar	6	5	0	Concrete

LOCATION/GPS#
090

NOTES:
stream channel covered with concrete

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Bridge	5	6	40	Wood

LOCATION/GPS#
093

NOTES:
residential rock dam

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Bridge	10	10	15	con/wood/steel

LOCATION/GPS#
094

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Bridge	3	5	20	Wood

LOCATION/GPS#
095

NOTES:
residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Culvert	3			Concrete

LOCATION/GPS#
098

NOTES:
right bank- driveway

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Culvert	6	3		Concrete

LOCATION/GPS#: 100

NOTES: right bank

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	chanelized area	7	5.5		Concrete

LOCATION/GPS#: 100

NOTES: stream channel covered with conc

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL13	Culvert	11	4		Steel

LOCATION/GPS#: 101

NOTES: east side Wilson Ave- stream continues from 700ft. Undergound pipe

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft): Top:	Bottom	Deep:
BL13	Steel Pipe	1		

LOCATION/GPS #: 077

NOTES: right bank- draining Beach Rd. from south/ erosion

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft): Top:	Bottom	Deep:
BL13	Steel Pipe	0.75		

LOCATION/GPS #: 079

NOTES: left bank- erosion

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft): Top:	Bottom	Deep:
BL13	Steel Pipe	4		

LOCATION/GPS #: 082

NOTES: left bank- armoring/ North Ave.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft): Top:	Bottom	Deep:
BL13	Steel Pipe	2		

LOCATION/GPS #: 082

NOTES: left bank- armoring/ North Ave.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft): Top:	Bottom	Deep:
BL13	Steel Pipe	1		

LOCATION/GPS #: 082

NOTES: left bank- armoring/ North Ave.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft): Top:	Bottom	Deep:
BL13	Plastic Pipe	0.25		

NOTES:	LOCATION/GPS # 091
left bank- residential	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL13	Concrete Pipe	Top:	0.75	Bottom	Deep: 0

NOTES:	LOCATION/GPS # 092
right bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL13	Plastic Pipe	Top:	0.5	Bottom	Deep:

NOTES:	LOCATION/GPS # 097
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL13	Swale/Open Channel	Top:	1	Bottom	Deep:

NOTES:	LOCATION/GPS # 099
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL13	Steel Pipe	Top:	1	Bottom	Deep:

NOTES:	LOCATION/GPS # 101
draining Wilson Ave from north	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL13	Steel Pipe	Top:	1	Bottom	Deep:

NOTES:	LOCATION/GPS # 101
draining Wilson Ave. from south	

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	20
	Recreational:	0	Commercial Industrial:	0
	Residential:	80	Other	0
	Other Description:			

VEGETATION %						
	Forest:	20	Lawn/Grass:	50	Wetlands:	0
	Crops:	0	Shrub/Weeds:	30	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 30

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %	Gravel:	30	Sand:	20	Cobble:	5	Silt	30

Concrete:	10	Organic Matter:	0	Boulder:	5	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: Moderate

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑ Pools Over 28" Deep: ☑ Macrophytes: ☑ Logs: ☑

Overhanging Veg: ☑ Rootwads: ☑ Boulders: ☑ Backwaters: ☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		186	culvert at Beach Rd. (downstream)

GPS # 077

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		187	drain pipe

GPS #
077

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		188	erosion- right bank

GPS #
078

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		189	drain pipe

GPS #
079

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		190	armoring- right bank

GPS #
080

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		191	culvert

GPS #
081

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		192	drain pipes

GPS #
082

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		193	footbridge- armoring

GPS #
083

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		194	footbridge/ armoring

GPS #
084

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		195	armoring/ fence

GPS #
085

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		196	bridge

GPS #
086

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		197	bridge

GPS #
087

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		198	concrete- armoring?

GPS #
088

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		199	bridge (downstream)

GPS #
089

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		200	channel armoring

GPS #
090

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		201	drain pipe

GPS #
091

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		202	drain pipe

GPS #
092

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		203	bridge/ armoring/ dam

GPS #
093

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		204	bridge (downstream)

GPS #
094

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		205	bridge

GPS #
095

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		206	debris- log jam

GPS #
096

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		207	drain pipe

GPS #
097

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		208	culvert

GPS #
098

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		209	open channel

GPS #
099

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		210	culvert/ channelization

GPS #
100

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL13	Russell Brunner		211	culvert/ drain pipes at Wilson Ave.

GPS #
101

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL14 | DATE: 7/6/2001

PRIMARY WATERSHED: Bull Creek(LM) | STREAM REACH NAME: South Branch | STREAM REACH #: 15

REACH BOUNDARIES UPSTREAM: vegetation | REACH BOUNDARIES DOWNSTREAM: culvert at Wilson Ave heading south

UPSTREAM GPS# 107 | DOWNSTREAM GPS# 102

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
500	80	01:00:00	RB/KK	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: 0

MEAN BANK HT (ft):	4.5	BANK HT RANGE:	from: 4.5	to: 4.5
MEAN BANK SLOPE:	.75/1	BANK SLOPE RANGE:	from: .75/1	to: .75/1
MEAN WATER DEPTH (ft):	0	WATER DEPTH RANGE:	from: 0	to: 0
TOP MEAN CHAN. WIDTH (ft):	15	TOP CHANNEL WIDTH RANGE:	from 15	to: 15
BOTTOM MEAN CHAN. WIDTH (ft):	5	BOT. CHAN. WIDTH RANGE:	from 5	to: 5
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0

PREDOMINANT BANK VEG. % — None: 0 | Grass: 30 | Lawn: 0 | Wetland: 0 | Trees: 20 | Shrub: 50 | Rowcrop: 0

PREDOMINANT TREE/SHRUB — Willows ☐ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☐ | Other:

CANOPY (% shaded cov. of channel): 10 | 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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL14	Culvert	W: 7 H: L:	Concrete

LOCATION/GPS# 103 | NOTES: Wilson Ave.- right bank drain ditch

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL14	Plastic Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS # 104

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL14	Concrete Pipe	Top: 2	Bottom	Deep:

LOCATION/GPS #: 105

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL14	Plastic Pipe	Top: 0.5	Bottom	Deep:

LOCATION/GPS #: 106

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL14	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS #: 107

NOTES: left bank

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	10
Recreational:	0	Commercial Industrial:	0
Residential:	90	Other	0

Other Description:

VEGETATION %

Forest:	5	Lawn/Grass:	15	Wetlands:	0
Crops:	0	Shrub/Weeds:	80	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 10

COMMENTS (Riparian Corridor/Floodplain): residential drainage ditch- almost completely vegetated

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	5	Sand:	0	Cobble:	5	Silt:	80
Concrete:	0	Organic Matter:	10	Boulder:	0	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Low

FILAMENTOUS ALGAE: N/A

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: N/A

WATER COLOR:

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☐	☐	☐	☑	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☐	☐

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL14	Russell Brunner		212	Beginning of reach at Wilson Ave culvert S. Fork
		GPS # 102		

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL14	Russell Brunner		213	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL14	Russell Brunner		214	culvert under Wilson Ave- drain ditch

GPS #
103

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL14	Russell Brunner		215	drain pipe

GPS #
104

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL14	Russell Brunner		216	drain pipe

GPS #
105

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL14	Russell Brunner		217	drain pipe

GPS #
106

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL14	Russell Brunner		218	drain pipe

GPS #
107

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL14	Russell Brunner		219	representative reach- vegetated ditch/ end of reach

GPS #

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL15 | DATE: 7/9/2001

PRIMARY WATERSHED: Bull Creek(LM) | STREAM REACH NAME: South Branch | STREAM REACH #: 16

REACH BOUNDARIES UPSTREAM: culvert at Beach Rd.

REACH BOUNDARIES DOWNSTREAM: culvert at Manor Road- stream continues underground 700ft. to Wilson

UPSTREAM GPS# 129 | DOWNSTREAM GPS# 108

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2800	90	09:00:00	RB/KK	Low	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: 1 | BASEFLOW SINUOSITY: 1 | POOL/RIFFLE DEVELOPMENT: 2

DEGREE OF BANK EROSION: 3 | Types/Locations of High Cases: photos | DEGREE OF ARMORING: 1 | Types/Locations of High Cases:

SEDIMENT ACCUMULATIONS: 1

MEAN BANK HT (ft):	6.3	BANK HT RANGE:	from: 5.5	to: 7.5
MEAN BANK SLOPE:	1.06/1	BANK SLOPE RANGE:	from: .9/0	to: 1.3/1
MEAN WATER DEPTH (ft):	.33	WATER DEPTH RANGE:	from: .25	to: .5
TOP MEAN CHAN. WIDTH (ft):	22	TOP CHANNEL WIDTH RANGE:	from 21	to: 24
BOTTOM MEAN CHAN. WIDTH (ft):	9.5	BOT. CHAN. WIDTH RANGE:	from 7.5	to: 11
MEAN VELOCITY (ft/s):	20/2000	VELOCITY RANGE:	from: 0	to: 20/2000

PREDOMINANT BANK VEG. %: None: 10 | Grass: 20 | Lawn: 20 | Wetland: 0 | Trees: 30 | Shrub: 20 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☑ | Other:

CANOPY (% shaded cov. of channel): 40 | 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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	12	8.5		Concrete

LOCATION/GPS#: 124

NOTES: residential street

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Bridge	4.5	8		Wood

LOCATION/GPS#: 126

NOTES: residential street/ armoring

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	5			Steel

LOCATION/GPS#	NOTES:
129	south side Beach Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	7			Steel

LOCATION/GPS#	NOTES:
108	Manor Rd.- stream continues underground 700ft.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Bridge	4	7.3	24	Wood

LOCATION/GPS#	NOTES:
110	residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	7			Concrete

LOCATION/GPS#	NOTES:
111	residential street

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	6	4.5		Concrete

LOCATION/GPS#	NOTES:
113	residential street- armoring

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	8			Concrete

LOCATION/GPS#	NOTES:
118	left bank- residential road

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	7			Concrete

LOCATION/GPS#	NOTES:
111	residential street

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	6	4.5		Steel

LOCATION/GPS#	NOTES:
113	residential street

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	8			Concrete

LOCATION/GPS#	NOTES:
118	left bank-residential street

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL15	Culvert	2			Concrete

LOCATION/GPS#	NOTES:
120	left bank- redirect pond/ subdivision?

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Concrete Pipe	Top: 0.75	Bottom	Deep:

LOCATION/GPS #: 108

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS #: 109

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 0.25	Bottom	Deep: 0

LOCATION/GPS #: 110

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 1.25	Bottom	Deep:

LOCATION/GPS #: 111

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 1.25	Bottom	Deep:

LOCATION/GPS #: 111

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Concrete Pipe	Top: 1	Bottom	Deep: 0

LOCATION/GPS #: 111

NOTES: right bank- draining from culvert

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #: 112

NOTES: right bank- drain ditch

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Steel Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 113

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Steel Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 114

NOTES: over culvert- south end

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Steel Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 114

NOTES: over culvert north end

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS #: 115

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS #: 119

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Clay Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 119

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Swale/Open Channel	Top: 3	Bottom	Deep:

LOCATION/GPS #: 121

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS #: 123

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS #: 123

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Swale/Open Channel	Top: 1.5	Bottom	Deep:

NOTES:	LOCATION/GPS # 124
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 0.9	Bottom	Deep:

NOTES:	LOCATION/GPS # 125
draining rd from south	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Concrete Pipe	Top: 1	Bottom	Deep:

NOTES:	LOCATION/GPS # 125
draining road from north	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Concrete Pipe	Top: 0.75	Bottom	Deep:

NOTES:	LOCATION/GPS # 127
left bank- also tributary that willl start next reach	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Concrete Pipe	Top: 0.75	Bottom	Deep:

NOTES:	LOCATION/GPS # 127
right bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Concrete Pipe	Top: 0.5	Bottom	Deep:

NOTES:	LOCATION/GPS # 128
right bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL15	Plastic Pipe	Top: 1	Bottom	Deep:

NOTES:	LOCATION/GPS # 130
draining road	

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	10
	Recreational:	0	Commercial Industrial:	0
	Residential:	90	Other	0
	Other Description:			

VEGETATION %						
	Forest:	30	Lawn/Grass:	40	Wetlands:	0
	Crops:	0	Shrub/Weeds:	30	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 30

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	Sand:	Cobble:	Silt:
5	10	65	10

Concrete:	Organic Matter:	Boulder:	Claypan:
0	0	5	5

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Low

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☑

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Moderate

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑

Pools Over 28" Deep: ☐

Macrophytes: ☐

Logs: ☑

Overhanging Veg: ☑

Rootwads: ☑

Boulders: ☑

Backwaters: ☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		225	drain pipe

GPS # 111

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		229	culvert

GPS #
111

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		220	culvert

GPS #
108

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		221	drain pipe

GPS #
108

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		222	drain pipe

GPS #
109

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		223	bridge

GPS #
110

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		224	drain pipe

GPS #
110

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		226	open channel

GPS #
111

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		227	drain pipe

GPS #
111

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		228	drain pipe

GPS #
111

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		228	drain pipe

GPS #
111

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		230	open channel;

GPS #
112

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		231	representative reach photo (downstream)

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		232	drain pipe

GPS #
113

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		233	culvert

GPS #
113

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		234	debris- log jam/drain pipes

GPS #
114

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		235	drain pipe

GPS #
115

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		236	debris jam

GPS #
116

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		237	bike path

GPS #
117

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		238	culvert

GPS #
118

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		239	drain pipe

GPS #
119

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		240	drain pipe

GPS #
119

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		241	culvert

GPS #
120

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		242	open channel

GPS #
121

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		243	erosion

GPS #
122

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		244	drain pipe

GPS #
123

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		245	culvert

GPS #
124

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		246	open channel

GPS #
124

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		247	drain pipe

GPS #
125

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		248	drain pipe

GPS #
125

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		249	bridge and armoring

GPS #
126

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		250	oepn channel

GPS #
127

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		251	armoring

GPS #
127

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		252	drain pipe

GPS #
127

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		253	drain pipe

GPS #
128

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		254	culvert at Beach Rd.

GPS #
129

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL15	Russell Brunner		255	drain pipe

GPS #
130

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL16

DATE: 7/10/2001

PRIMARY WATERSHED: Bull Creek(LM)

STREAM REACH NAME: South Branch

STREAM REACH #: 17

REACH BOUNDARIES UPSTREAM: culvert at subdivison

REACH BOUNDARIES DOWNSTREAM: for from previous reach

UPSTREAM GPS# 133

DOWNSTREAM GPS# 130

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
350	85	09:00:00	RB/KK	Low	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: 1

BASEFLOW SINUOSITY: 1

POOL/RIFFLE DEVELOPMENT: 1

DEGREE OF BANK EROSION: 2

Types/Locations of High Cases:

DEGREE OF ARMORING: 0

Types/Locations of High Cases:

SEDIMENT ACCUMULATIONS: 3

MEAN BANK HT (ft):	6.25	BANK HT RANGE:	from: 5.5	to: 7
MEAN BANK SLOPE:	.54/1	BANK SLOPE RANGE:	from: .33/1	to: .75/1
MEAN WATER DEPTH (ft):	.2	WATER DEPTH RANGE:	from: .16	to: .25
TOP MEAN CHAN. WIDTH (ft):	18.5	TOP CHANNEL WIDTH RANGE:	from 16	to: 21
BOTTOM MEAN CHAN. WIDTH (ft):	4.5	BOT. CHAN. WIDTH RANGE:	from 4	to: 5
MEAN VELOCITY (ft/s):	20/140	VELOCITY RANGE:	from: 20/140	to: 20/140

PREDOMINANT BANK VEG. %

None:	Grass:	Lawn:	Wetland:
0	0	0	0
Trees:	Shrub:	Rowcrop:	
20	80	0	

PREDOMINANT TREE/SHRUB: Willows ☐ Box Elder ☐ Honeysuckle ☐ Buckthorn ☐ Hardwoods ☐ Other:

CANOPY (% shaded cov. of channel): 80

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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL16	Culvert	W: 5.5 H: L:	Concrete

LOCATION/GPS# 133

NOTES: draining retention pond of subdivison

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL16	Swale/Open Channel	Top: 3 Bottom Deep:

LOCATION/GPS # 131

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL16	Swale/Open Channel	Top: 5 Bottom Deep:

LOCATION/GPS #: 133

NOTES: drain ditch- next to culvert

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
Agricultural:	0	Vacant/Open Space:	40
Recreational:	0	Commercial Industrial:	0
Residential:	60	Other	0
Other Description:			

VEGETATION %					
Forest:	20	Lawn/Grass:	10	Wetlands:	0
Crops:	0	Shrub/Weeds:	70	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 50

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
Gravel:	0	Sand:	30	Cobble:	10	Silt	40
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	20

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: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☐	☐	☐	
Overhanging Veg:	Rootwads:	Boulders:	Backwaters:	
☑	☑	☐	☐	

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL16	Russell Brunner		256	fork/ begin reach

GPS #
130

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL16	Russell Brunner		257	open channel

GPS #
131

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL16	Russell Brunner		258	end of open channel

GPS #
132

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL16	Russell Brunner		259	culvert/ open channel

GPS #
133

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL16	Russell Brunner		260	sitting water(natural?) vs. retention pond-developers trying to move water?

GPS #

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL17

DATE: 7/10/2001

PRIMARY WATERSHED: Bull Creek(LM)

STREAM REACH NAME: South Branch

STREAM REACH #: 18

REACH BOUNDARIES UPSTREAM: culvert at Lewis Ave.

REACH BOUNDARIES DOWNSTREAM: culvert at Beach Rd.

UPSTREAM GPS# 149

DOWNSTREAM GPS# 134

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2400	85	11:00:00	RB/KK	Low	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: 1

BASEFLOW SINUOSITY: 1

POOL/RIFFLE DEVELOPMENT: 2

DEGREE OF BANK EROSION: 2

Types/Locations of High Cases: photos

DEGREE OF ARMORING: 2

Types/Locations of High Cases: photos

SEDIMENT ACCUMULATIONS: 1

MEAN BANK HT (ft):	2.8	BANK HT RANGE:	from: 1	to: 5
MEAN BANK SLOPE:	.83/1	BANK SLOPE RANGE:	from: .5/1	to: 1.3/1
MEAN WATER DEPTH (ft):	.28	WATER DEPTH RANGE:	from: .1	to: .5
TOP MEAN CHAN. WIDTH (ft):	12.3	TOP CHANNEL WIDTH RANGE:	from 5.5	to: 18
BOTTOM MEAN CHAN. WIDTH (ft):	6.16	BOT. CHAN. WIDTH RANGE:	from 4.5	to: 7
MEAN VELOCITY (ft/s):	20/160	VELOCITY RANGE:	from: 0	to: 20/160

PREDOMINANT BANK VEG. %: None: 0 Grass: 10 Lawn: 25 Wetland: 0 Trees: 30 Shrub: 35 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ Box Elder ☐ Honeysuckle ☐ Buckthorn ☑ Hardwoods ☑ Other:

CANOPY (% shaded cov. of channel): 60

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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Culvert	5			Steel

LOCATION/GPS# 134

NOTES: Beach Rd./ debris- log jam

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Culvert	6.5		0	Steel

LOCATION/GPS# 134

NOTES: Beach Rd.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Culvert	4.5			Steel

LOCATION/GPS#	NOTES:
136	

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Bridge	5	5	20	Wood

LOCATION/GPS#	NOTES:
137	recreation/open space footbridge- horse stables?

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Culvert	4.5		0	Concrete

LOCATION/GPS#	NOTES:
138	armoring/ golfcourse

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Bridge	6	2.5	13	Wood

LOCATION/GPS#	NOTES:
139	golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Culvert	3			Concrete

LOCATION/GPS#	NOTES:
140	golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Bridge	6	2.5	13	Wood

LOCATION/GPS#	NOTES:
142	golf course

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Bridge	4	2	7.5	Wood

LOCATION/GPS#	NOTES:
143	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Bridge	3.5	2.5	13	Wood

LOCATION/GPS#	NOTES:
144	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL17	Culvert	7	4		Concrete

LOCATION/GPS#	NOTES:
149	Lewis Ave.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 0.75	Bottom	Deep:

NOTES:	LOCATION/GPS # 135
right bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Swale/Open Channel	Top: 3	Bottom	Deep:

NOTES:	LOCATION/GPS # 135
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Steel Pipe	Top: 1	Bottom	Deep:

NOTES:	LOCATION/GPS # 137
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 0.25	Bottom	Deep:

NOTES:	LOCATION/GPS # 138
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 0.25	Bottom	Deep: 0

NOTES:	LOCATION/GPS # 139
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 0.25	Bottom	Deep: 0

NOTES:	LOCATION/GPS # 141
right bank- golfcourse	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 0.25	Bottom	Deep: 0

NOTES:	LOCATION/GPS # 143
right bank- residential	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 1.5	Bottom	Deep: 0

NOTES:	LOCATION/GPS # 145
right bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 0.25	Bottom	Deep: 0

NOTES:	LOCATION/GPS # 146
left bank- golf course	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 0.25	Bottom	Deep: 0

NOTES:	LOCATION/GPS # 147
right bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Plastic Pipe	Top: 0.25	Bottom	Deep:

NOTES:	LOCATION/GPS # 148
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Steel Pipe	Top: 1.25	Bottom	Deep:

NOTES:	LOCATION/GPS # 149
right bank- north Lewis Rd.	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Concrete Pipe	Top: 0.5	Bottom	Deep:

NOTES:	LOCATION/GPS # 149
in culvert at Lewis Rd.	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL17	Concrete Pipe	Top: 0.5	Bottom	Deep:

NOTES:	LOCATION/GPS # 149
in culvert at Lewis Rd.	

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	30
	Recreational:	25	Commercial Industrial:	15
	Residential:	30	Other	0
	Other Description:			

VEGETATION %						
	Forest:	30	Lawn/Grass:	35	Wetlands:	0
	Crops:	0	Shrub/Weeds:	35	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 25

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %	Gravel:	25	Sand:	20	Cobble:	30	Silt:	10

Concrete:	5	Organic Matter:	5	Boulder:	5	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	High
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	Low
FILAMENTOUS ALGAE:	Low

GREASE/OIL IN WATER COLUMN: ☑

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Moderate

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑ Pools Over 28" Deep: ☑ Macrophytes: ☑ Logs: ☑

Overhanging Veg: ☑ Rootwads: ☑ Boulders: ☑ Backwaters: ☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		261	culvert

GPS # 134

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		262	culvert (downstream)

GPS #
134

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		263	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		264	armoring- right bank

GPS #
135

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		265	drain pipe

GPS #
135

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		266	open channel

GPS #
135

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		267	culvert

GPS #
136

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		268	bridge (downstream)

GPS #
137

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		269	drain pipe

GPS #
137

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		270	culvert

GPS #
138

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		271	drain pipe

GPS #
138

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		272	footbridge

GPS #
139

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		273	culvert

GPS #
140

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		274	pond

GPS #
141

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		275	drain pipe

GPS #
141

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		277	bridge

GPS #
142

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		278	bridge/ drain pipe

GPS #
143

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		279	bridge

GPS #
144

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		280	drain pipe-residential

GPS #
145

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		281	drain pipe/ armoring/debris

GPS #
146

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		282	erosion

GPS #
146

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		283	drain pipe

GPS #
147

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		284	drain pipe

GPS #
148

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		285	culvert/ drain pipe

GPS #
149

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL17	Russell Brunner		286	drain pipe x2

GPS #
149

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL18	DATE:	7/10/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	South Branch
STREAM REACH #:	19		
REACH BOUNDARIES UPSTREAM:	airport culvert	REACH BOUNDARIES DOWNSTREAM:	culverts at Lewis
UPSTREAM GPS#	154	DOWNSTREAM GPS#	150

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
700	85	12:00:00	RB/KK	Low	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:	3	BASEFLOW SINUOSITY:	3	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	2	Types/Locations of High Cases:		DEGREE OF ARMORING:	0
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	2.5	BANK HT RANGE:	from: 2	to: 3	
MEAN BANK SLOPE:	.375/1	BANK SLOPE RANGE:	from: .25/1	to: .5/1	
MEAN WATER DEPTH (ft):	.375	WATER DEPTH RANGE:	from: .25	to: .5	
TOP MEAN CHAN. WIDTH (ft):	12.5	TOP CHANNEL WIDTH RANGE:	from 10	to: 15	
BOTTOM MEAN CHAN. WIDTH (ft):	6	BOT. CHAN. WIDTH RANGE:	from 5	to: 7	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %: None: 0 Grass: 0 Lawn: 0 Wetland: 0 Trees: 40 Shrub: 60 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ Box Elder ☑ Honeysuckle ☐ Buckthorn ☑ Hardwoods ☑ Other:

CANOPY (% shaded cov. of channel): 80 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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL18	Culvert	5	0	0	Steel

LOCATION/GPS#: 150

NOTES: west side Lewis

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL18	Culvert	2.5	0	0	Concrete

LOCATION/GPS#: 150

NOTES: draining Lewis from south

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL18	Culvert	3			Concrete

LOCATION/GPS#	NOTES:
150	draining Lewis from north

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL18	Bridge		3	3	12	Wood

LOCATION/GPS#	NOTES:
151	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL18	Bridge		3	3	12	Wood

LOCATION/GPS#	NOTES:
153	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL18	Culvert		4			Concrete

LOCATION/GPS#	NOTES:
154	draining retention pond from airport

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL18	Steel Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS #	NOTES:
152	left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL18	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #	NOTES:
154	left bank

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	40
Recreational:	0	Commercial Industrial:	10
Residential:	50	Other	0
Other Description:			

VEGETATION %

Forest:	30	Lawn/Grass:	30	Wetlands:	
Crops:	0	Shrub/Weeds:	40	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 35

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	10	Sand:	30	Cobble:	40	Silt:	20
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: Moderate

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑ Pools Over 28" Deep: ☐ Macrophytes: ☐ Logs: ☑

Overhanging Veg: ☑ Rootwads: ☑ Boulders: ☐ Backwaters: ☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		286	culverts at Lewis

GPS # 150

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		287	culvert- right

GPS #
150

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		288	culvert- left

GPS #
150

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		289	bridge

GPS #
151

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		290	drain pipe

GPS #
152

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		291	bridge

GPS #
153

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		292	culvert at airport

GPS #
154

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		293	open channel

GPS #
154

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL18	Russell Brunner		294	representative reach photo (downstream)

GPS #

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL19	DATE:	7/11/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	North Branch
STREAM REACH #:	20		
REACH BOUNDARIES UPSTREAM:	culverts at Wadsworth	REACH BOUNDARIES DOWNSTREAM:	fork- start north branch
UPSTREAM GPS#	161	DOWNSTREAM GPS#	155

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
1900	75	09:30:00	RB/KK	Normal	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	2
DEGREE OF BANK EROSION:	2	Types/Locations of High Cases:		DEGREE OF ARMORING:	1
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	4.3	BANK HT RANGE:	from: 3.5	to: 5	
MEAN BANK SLOPE:	.7/1	BANK SLOPE RANGE:	from: .3/1	to: 1/1	
MEAN WATER DEPTH (ft):	.7	WATER DEPTH RANGE:	from: .5	to: 1.1	
TOP MEAN CHAN. WIDTH (ft):	20.6	TOP CHANNEL WIDTH RANGE:	from 14	to: 28	
BOTTOM MEAN CHAN. WIDTH (ft):	9	BOT. CHAN. WIDTH RANGE:	from 7.5	to: 10.5	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %					
None: 0	Grass: 15	Lawn: 5	Wetland: 0		
Trees: 40	Shrub: 30	Rowcrop: 0			

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	☐	☐	☐	☑	☑	

CANOPY (% shaded cov. of channel):	75	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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL19	Bridge	W: 3.5 H: 5 L: 20	Wood

LOCATION/GPS#: 156

NOTES: residential footbridge/ lawned open space

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL19	Culvert	W: 11 H: 8 L:	Concrete

LOCATION/GPS#: 161

NOTES: south side of Wadsworth

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL19	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #: 158

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL19	Steel Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 159

NOTES: right bank- open channel forms behind

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL19	Concrete Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #: 161

NOTES: left bank- armoring/ drains Wadsworth southwest side

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL19	Concrete Pipe	Top: 2	Bottom	Deep:

LOCATION/GPS #: 161

NOTES: under culvert Wadsworth south side

SUSPICIOUS ACTIVITIES:

C. 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:	60	Lawn/Grass:	20	Wetlands:	0
Crops:	0	Shrub/Weeds:	20	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 80

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	20	Sand:	20	Cobble:	10	Silt:	10
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	40

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Low

FILAMENTOUS ALGAE: N/A

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Clear

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☑	☐	☑	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☐	☐

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		295	fork/ begin north branch

GPS #
155

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		296	bridge

GPS #
156

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		297	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		298	debris- log jam

GPS #
157

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		299	open channel

GPS #
158

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		300	drain pipe

GPS #
159

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		301	open channel- behind pipe

GPS #
159

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		302	erosion-left bank

GPS #
160

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		303	drain pipe

GPS #
161

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		304	drain pipe

GPS #
161

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL19	Russell Brunner		305	culvert/ drain pipe

GPS #
161

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL20 | DATE: 7/11/2001

PRIMARY WATERSHED: Bull Creek(LM) | STREAM REACH NAME: North Branch | STREAM REACH #: 21

REACH BOUNDARIES UPSTREAM: culvert at bike path | REACH BOUNDARIES DOWNSTREAM: culverts at Wadsworth

UPSTREAM GPS# 182 | DOWNSTREAM GPS# 162

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
3600	75	12:00:00	RB/KK	Low	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: 2 | BASEFLOW SINUOSITY: 2 | POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 2 | Types/Locations of High Cases: | DEGREE OF ARMORING: 1 | Types/Locations of High Cases:

SEDIMENT ACCUMULATIONS: 1

MEAN BANK HT (ft):	4	BANK HT RANGE:	from: 2	to: 5
MEAN BANK SLOPE:	.8/1	BANK SLOPE RANGE:	from: .5/1	to: 1/1
MEAN WATER DEPTH (ft):	.13	WATER DEPTH RANGE:	from: 0	to: .25
TOP MEAN CHAN. WIDTH (ft):	20.3	TOP CHANNEL WIDTH RANGE:	from 12	to: 29.5
BOTTOM MEAN CHAN. WIDTH (ft):	11.3	BOT. CHAN. WIDTH RANGE:	from 9	to: 15.5
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0

PREDOMINANT BANK VEG. %: None: 0 | Grass: 5 | Lawn: 5 | Wetland: 0 | Trees: 50 | Shrub: 40 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☑ | Other:

CANOPY (% shaded cov. of channel): 80 | 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:

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20 | TYPE: Culvert | SIZE (ft): W: 11 H: 8 L: | MATERIAL: Concrete

LOCATION/GPS#: 162 | NOTES: north side Wadsworth

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20 | TYPE: Bridge | SIZE (ft): W: 11 H: 5.5 L: 25 | MATERIAL: Wood/Steel

LOCATION/GPS#: 165 | NOTES: residential

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20 | TYPE: Culvert | SIZE (ft): W: 12.5 H: 7.5 L: | MATERIAL: Steel

LOCATION/GPS#
168

NOTES:

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20
TYPE: Culvert
SIZE (ft): W: 7 H: L:
MATERIAL: Steel

LOCATION/GPS#
172

NOTES:

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20
TYPE: Culvert
SIZE (ft): W: 4 H: L:
MATERIAL: Concrete

LOCATION/GPS#
172

NOTES:
low water/ no water

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20
TYPE: Culvert
SIZE (ft): W: 4 H: L:
MATERIAL: Concrete

LOCATION/GPS#
173

NOTES:
pool of water

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20
TYPE: Culvert
SIZE (ft): W: 6 H: 6.5 L:
MATERIAL: Concrete

LOCATION/GPS#
174

NOTES:
concrete bank- residential

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20
TYPE: Culvert
SIZE (ft): W: 6 H: L:
MATERIAL: Steel

LOCATION/GPS#
175

NOTES:
armoring

HYDRAULIC STRUCTURES:

LAKE CO ID: BL20
TYPE: Culvert
SIZE (ft): W: 10 H: 8 L: 0
MATERIAL: Concrete

LOCATION/GPS#
182

NOTES:
bike path

POINT DISCHARGE:

LAKE CO ID: BL20
TYPE: Swale/Open Channel
SIZE (ft): Top: 2 Bottom Deep:
LOCATION/GPS # 162

NOTES:
next to culver

POINT DISCHARGE:

LAKE CO ID: BL20
TYPE: Swale/Open Channel
SIZE (ft): Top: 3 Bottom Deep:
LOCATION/GPS # 163

NOTES:
right bank

POINT DISCHARGE:

LAKE CO ID: BL20
TYPE: Steel Pipe
SIZE (ft): Top: 3 Bottom Deep: 0

LOCATION/GPS #
164

NOTES:
right bank- creating channel 2ft

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Plastic Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS #
165

NOTES:
left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Concrete Pipe	Top: 1 Bottom Deep:

LOCATION/GPS #
169

NOTES:
over culvert

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Swale/Open Channel	Top: 1 Bottom Deep:

LOCATION/GPS #
170

NOTES:
left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Swale/Open Channel	Top: 1.5 Bottom Deep:

LOCATION/GPS #
173

NOTES:
left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Plastic Pipe	Top: 0.5 Bottom Deep:

LOCATION/GPS #
175

NOTES:
left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Swale/Open Channel	Top: 1 Bottom Deep:

LOCATION/GPS #
176

NOTES:
left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Plastic Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS #
177

NOTES:
right bank-residential armoring

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Concrete Pipe	Top: 2 Bottom Deep:

NOTES:	LOCATION/GPS # 178

left bank-residential armoring

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Swale/Open Channel	Top: 0.5 Bottom Deep:

NOTES:	LOCATION/GPS # 179

left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Swale/Open Channel	Top: 2 Bottom Deep:

NOTES:	LOCATION/GPS # 180

right bank- pipe at end

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL20	Steel Pipe	Top: 3 Bottom Deep:

NOTES:	LOCATION/GPS # 181

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	70
	Recreational:	0	Commercial Industrial:	0
	Residential:	30	Other	0
	Other Description:			

VEGETATION %						
	Forest:	40	Lawn/Grass:	30	Wetlands:	0
	Crops:	0	Shrub/Weeds:	30	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 70

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
	Gravel:	20	Sand:	10	Cobble:	30	Silt: 20
	Concrete:	5	Organic Matter:	0	Boulder:	5	Claypan: 10

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	High
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	Low
FILAMENTOUS ALGAE:	Low

GREASE/OIL IN WATER COLUMN: ☐ GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: High

WATER COLOR: Clear COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☑	☐	☑	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☑	☐

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		306	culvert (downstream)

GPS #
162

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		307	open channel

GPS #
162

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		308	open channel

GPS #
163

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		309	pipe/ open channel

GPS #
164

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		310	bridge

GPS #
165

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		311	drain pipe

GPS #
166

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		312	erosion

GPS #
167

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		313	culvert/ armoring

GPS #
168

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		314	drain pipe

GPS #
169

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		315	open channel

GPS #
170

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		316	debris (downstream)

GPS #
171

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		317	culverts x2

GPS #
172

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		318	culvert

GPS #
173

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		319	open channel

GPS #
173

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		320	culvert

GPS #
174

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		321	culvert

GPS #
175

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		322	drain pipe

GPS #
175

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		323	open channel

GPS #
176

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		324	drain pipe and armoring- right bank

GPS #
177

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		325	drain pipe

GPS #
178

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		326	drain pipe

GPS #
179

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		327	open channel

GPS #
180

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		328	open pipes/ open channel

GPS #
181

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL20	Russell Brunner		329	culvert at bike path

GPS #
182

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL21 | DATE: 7/11/2001

PRIMARY WATERSHED: Bull Creek(LM) | STREAM REACH NAME: North Branch | STREAM REACH #: 22

REACH BOUNDARIES UPSTREAM: culvert at 33rd St.

REACH BOUNDARIES DOWNSTREAM: culvert at bike path

UPSTREAM GPS# 193 | DOWNSTREAM GPS# 183

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
3500	90	12:30:00	RB/KK	Low	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: 3 | BASEFLOW SINUOSITY: 3 | POOL/RIFFLE DEVELOPMENT: 0

DEGREE OF BANK EROSION: 2 | Types/Locations of High Cases: photos | DEGREE OF ARMORING: 1 | Types/Locations of High Cases:

SEDIMENT ACCUMULATIONS: 1

MEAN BANK HT (ft):	1.5	BANK HT RANGE:	from: 1.5	to: 1.5
MEAN BANK SLOPE:	.5/1	BANK SLOPE RANGE:	from: .5/1	to: .5/1
MEAN WATER DEPTH (ft):	0	WATER DEPTH RANGE:	from: 0	to: 0
TOP MEAN CHAN. WIDTH (ft):	12	TOP CHANNEL WIDTH RANGE:	from 9.5	to: 14.5
BOTTOM MEAN CHAN. WIDTH (ft):	6.25	BOT. CHAN. WIDTH RANGE:	from 4.5	to: 8
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0

PREDOMINANT BANK VEG. %: None: 0 | Grass: 20 | Lawn: 10 | Wetland: 0 | Trees: 40 | Shrub: 30 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☑ | Other:

CANOPY (% shaded cov. of channel): 0 | 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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL21	Culvert	10	8	0	Concrete

LOCATION/GPS#: 183

NOTES: west end of bike path culvert

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL21	Bridge	2	3	14	Wood

LOCATION/GPS#: 188

NOTES: residential

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL21	Culvert	7.5			Concrete

LOCATION/GPS#	NOTES:
193	south side 33rd St.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL21	Plastic Pipe	Top: 0.75	Bottom	Deep:

LOCATION/GPS # 184

NOTES: forms open channel

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL21	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS # 185

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL21	Swale/Open Channel	Top: 3	Bottom	Deep:

LOCATION/GPS # 186

NOTES: left bank- 1 ft pipe acting as culvert

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL21	Plastic Pipe	Top: 0.5	Bottom	Deep:

LOCATION/GPS # 187

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL21	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS # 191

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL21	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS # 192

NOTES: left bank

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	70
	Recreational:	0	Commercial Industrial:	0
	Residential:	30	Other	0
	Other Description:			

VEGETATION %						
	Forest:	40	Lawn/Grass:	20	Wetlands:	0
	Crops:	0	Shrub/Weeds:	40	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 80

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	20	Sand:	20	Cobble:	30	Silt:	10
Concrete:	0	Organic Matter:	0	Boulder:	10	Claypan:	10

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Low

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑	Pools Over 28" Deep: ☐	Macrophytes: ☐	Logs: ☑	COMMENTS (Instream Cover for Fish):
Overhanging Veg: ☑	Rootwads: ☑	Boulders: ☑	Backwaters: ☐	

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		330	culverts at bike path, noth of Wadsworth

GPS # 183

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		331	open channel/ drain pipe

GPS #
184

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		332	plastic pipe

GPS #
185

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		334	open channel with culvert?

GPS #
186

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		335	drain pipe

GPS #
187

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		336	bridge

GPS #
188

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		337	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		338	debris

GPS #
189

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		339	armoring

GPS #
190

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		340	drain pipe x2

GPS #
191

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		341	drain pipe

GPS #
192

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL21	Russell Brunner		342	culvert

GPS #
193

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL22	DATE:	7/12/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	North Branch
STREAM REACH #:	23		
REACH BOUNDARIES UPSTREAM:	culvert at Lewis	REACH BOUNDARIES DOWNSTREAM:	culvert at 33rd St.
UPSTREAM GPS#	198	DOWNSTREAM GPS#	194

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
1200	75	10:00:00	RB/KK	Low	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	1
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):	3	BANK HT RANGE:	from: 1	to: 5.5	
MEAN BANK SLOPE:	.5/1	BANK SLOPE RANGE:	from: .25/1	to: .75/1	
MEAN WATER DEPTH (ft):	.16	WATER DEPTH RANGE:	from: 0	to: .5	
TOP MEAN CHAN. WIDTH (ft):	9.5	TOP CHANNEL WIDTH RANGE:	from 5	to: 14.5	
BOTTOM MEAN CHAN. WIDTH (ft):	3.5	BOT. CHAN. WIDTH RANGE:	from 1.5	to: 5	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %	None:	Grass:	Lawn:	Wetland:
	0	30	0	10
	Trees:	Shrub:	Rowcrop:	
	40	20	0	

PREDOMINANT TREE/SHRUB	Willows	Box Elder	Honeysuckle	Buckthorn	Hardwoods	Other:
	✔			✔	✔	

CANOPY (% shaded cov. of channel):	60	BEAVER ACTIVITY: ☐	# OF DAMS:
INSTREAM DEBRIS LOAD:	Fail	OVERBANK DEBRIS LOAD:	Pass

COMMENTS:

IMPOUNDED: ✔ MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL22	Culvert	7.5	0		Concrete

LOCATION/GPS#: 194

NOTES: north side of 33rd St.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL22	Culvert	7			Concrete

LOCATION/GPS#: 195

NOTES: east side of Lebanon

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL22	Culvert	7			Concrete

LOCATION/GPS#	NOTES:
195	west side of Lebanon

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	8 H:	L:	MATERIAL:
BL22	Culvert				Concrete

LOCATION/GPS#	NOTES:
198	east side of Lewis

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL22	Plastic Pipe	Top: 1	Bottom	Deep:

LOCATION/GPS #	NOTES:
197	right bank- commercial

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %

Agricultural:	0	Vacant/Open Space:	60
Recreational:	0	Commercial Industrial:	5
Residential:	35	Other	0
Other Description:			

VEGETATION %

Forest:	20	Lawn/Grass:	30	Wetlands:	30
Crops:	0	Shrub/Weeds:	20	Other:	0
Other Description:					

WIDTH OF VEGETATED BUFFER: 65

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	20	Sand:	5	Cobble:	40	Silt:	30
Concrete:	0	Organic Matter:	0	Boulder:	5	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	Moderate
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	Moderate
FILAMENTOUS ALGAE:	N/A

GREASE/OIL IN WATER COLUMN: ☐ **GREASE/OIL IN SEDIMENT:** ☐

TURBIDITY: Low

WATER COLOR: Clear **COMMENTS:**

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☐	☐	☐	☑	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☐	☑	☐

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL22	Russell Brunner		343	culvert

GPS # 194

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL22	Russell Brunner		344	culvert

GPS # 195

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL22	Russell Brunner		345	culvert

GPS #
195

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL22	Russell Brunner		346	debris (downstream)

GPS #
196

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL22	Russell Brunner		347	drain pipe

GPS #
197

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL22	Russell Brunner		348	culvert

GPS #
198

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL23	DATE:	7/12/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	North Branch
STREAM REACH #:	24		
REACH BOUNDARIES UPSTREAM:	culvert at golf course	REACH BOUNDARIES DOWNSTREAM:	culvert at Lewis
UPSTREAM GPS#	210	DOWNSTREAM GPS#	199

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
3600	75	11:00:00	RB/KK	Low	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	1	Types/Locations of High Cases:		DEGREE OF ARMORING:	0
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	1.16	BANK HT RANGE:	from: 1	to: 1.5	
MEAN BANK SLOPE:	.7/1	BANK SLOPE RANGE:	from: .5/1	to: 1/1	
MEAN WATER DEPTH (ft):	.45	WATER DEPTH RANGE:	from: .1	to: 1	
TOP MEAN CHAN. WIDTH (ft):	4.6	TOP CHANNEL WIDTH RANGE:	from 4	to: 5	
BOTTOM MEAN CHAN. WIDTH (ft):	2.8	BOT. CHAN. WIDTH RANGE:	from 2	to: 3.5	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %	None: 0	Grass: 0	Lawn: 0	Wetland: 70	
	Trees: 10	Shrub: 20	Rowcrop: 0		

PREDOMINANT TREE/SHRUB	Willows ☑	Box Elder ☐	Honeysuckle ☐	Buckthorn ☑	Hardwoods ☐	Other:

CANOPY (% shaded cov. of channel):	50	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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL23	Culvert	8			Concrete

LOCATION/GPS#: 199

NOTES: west side of Lewis

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL23	Bridge	10	3	120	Wood

LOCATION/GPS#: 201

NOTES: golf course bridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL23	Bridge	3.5	3	80	Wood

LOCATION/GPS#	NOTES:
202	golf course footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL23	Culvert		1			Plastic

LOCATION/GPS#	NOTES:
204	right bank- golf course retention pond

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL23	Culvert		4			Concrete

LOCATION/GPS#	NOTES:
210	end at golf course- wetland

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL23	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #	NOTES:
200	right bank- two small forks

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL23	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS #	NOTES:
203	left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL23	Plastic Pipe	Top: 0.25	Bottom	Deep:

LOCATION/GPS #	NOTES:
205	left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL23	Swale/Open Channel	Top: 2	Bottom	Deep:

LOCATION/GPS #	NOTES:
205	left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL23	Swale/Open Channel	Top: 1	Bottom	Deep:

LOCATION/GPS #	NOTES:
208	left bank

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	0
	Recreational:	100	Commercial Industrial:	0
	Residential:	0	Other	0

Other Description:

VEGETATION %					
Forest:	10	Lawn/Grass:	10	Wetlands:	50
Crops:	0	Shrub/Weeds:	30	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 100

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
Gravel:	20	Sand:	10	Cobble:	20	Silt:	40
Concrete:	0	Organic Matter:	0	Boulder:	0	Claypan:	10

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:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:
☐	☐	☐	☑

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☐	☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		349	culvert

GPS #
199

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		350	open channel

GPS #
200

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		351	bridge

GPS #
201

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		352	bridge

GPS #
202

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		353	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		354	open channel

GPS #
203

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		355	culvert

GPS #
204

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		356	drain pipe/ open channel

GPS #
205

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		357	bridge

GPS #
206

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		358	bridge

GPS #
207

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		359	open channel

GPS #
208

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		360	bridge

GPS #
209

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL23	Russell Brunner		361	culvert

GPS #
210

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL24	DATE:	7/12/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	North Branch
STREAM REACH #:	25		
REACH BOUNDARIES UPSTREAM:	end of channel vegetated	REACH BOUNDARIES DOWNSTREAM:	south fork from previous reach
UPSTREAM GPS#	218	DOWNSTREAM GPS#	211

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2000	85	14:00:00	RB/KK	Low	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:	1	BASEFLOW SINUOSITY:	1	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	1	Types/Locations of High Cases:		DEGREE OF ARMORING:	0
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	2	BANK HT RANGE:	from: 1.5	to: 2.5	
MEAN BANK SLOPE:	.7/1	BANK SLOPE RANGE:	from: .5/1	to: .8/1	
MEAN WATER DEPTH (ft):	.05	WATER DEPTH RANGE:	from: 0	to: .15	
TOP MEAN CHAN. WIDTH (ft):	6.3	TOP CHANNEL WIDTH RANGE:	from 5	to: 8.5	
BOTTOM MEAN CHAN. WIDTH (ft):	3.16	BOT. CHAN. WIDTH RANGE:	from 2.5	to: 4	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %	None: 0	Grass: 20	Lawn: 10	Wetland: 20	
	Trees: 10	Shrub: 40	Rowcrop: 0		

PREDOMINANT TREE/SHRUB	Willows ☑	Box Elder ☐	Honeysuckle ☐	Buckthorn ☑	Hardwoods ☐	Other:

CANOPY (% shaded cov. of channel):	40	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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL24	Culvert	2.5			Concrete

LOCATION/GPS# 212

NOTES: under dirt road

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL24	Culvert	2.5		0	Concrete

LOCATION/GPS# 212

NOTES: under dirt road

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL24	Culvert	2.5			Concrete

LOCATION/GPS#	NOTES:
212	under dirt road

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL24	Culvert		2		0	Steel

LOCATION/GPS#	NOTES:
213	under dirt road

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL24	Bridge		4	2	11	Wood

LOCATION/GPS#	NOTES:
214	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL24	Culvert		6			Concrete

LOCATION/GPS#	NOTES:
215	west side of Lewis

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL24	Culvert		1.5	0	0	Concrete

LOCATION/GPS#	NOTES:
216	into junk yard

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL24	Culvert		1.5	0	0	Concrete

LOCATION/GPS#	NOTES:
217	through junk yard

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL24	Plastic Pipe	Top: 0.5	Bottom	Deep:

LOCATION/GPS #	NOTES:
216	left of culvert

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL24	Concrete Pipe	Top: 0.5	Bottom	Deep:

LOCATION/GPS #	NOTES:
216	right of culvert

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	40
	Recreational:	0	Commercial Industrial:	20
	Residential:	40	Other	0
	Other Description:			

VEGETATION %						
	Forest:	10	Lawn/Grass:	30	Wetlands:	20
	Crops:	0	Shrub/Weeds:	40	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 20

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %

Gravel:	30	Sand:	5	Cobble:	40	Silt	10
Concrete:	10	Organic Matter:	0	Boulder:	0	Claypan:	5

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Low

FILAMENTOUS ALGAE: N/A

GREASE/OIL IN WATER COLUMN: ☐

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Clear

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:
☑	☐	☐	☑

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☑	☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		362	south branch of fork

GPS # 211

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		363	culverts x 3

GPS #
212

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		364	culvert

GPS #
213

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		365	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		366	bridge

GPS #
214

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		367	culvert

GPS #
215

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		368	culvert and drain pipes

GPS #
216

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		369	drain pipe and debris (tires)

GPS #
217

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL24	Russell Brunner		370	vegetation- end reach

GPS #
218

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL25	DATE:	7/13/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	27th St. Trib
STREAM REACH #:	26		
REACH BOUNDARIES UPSTREAM:	end channel- vegetated	REACH BOUNDARIES DOWNSTREAM:	north fork at Wadsworth
UPSTREAM GPS#	227	DOWNSTREAM GPS#	220

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2000	90	08:30:00	RB/KK	Low	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	1
DEGREE OF BANK EROSION:	2	Types/Locations of High Cases:		DEGREE OF ARMORING:	1
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	2.6	BANK HT RANGE:	from: 1.5	to: 4	
MEAN BANK SLOPE:	.75/1	BANK SLOPE RANGE:	from: .5/1	to: 1/1	
MEAN WATER DEPTH (ft):	.03	WATER DEPTH RANGE:	from: 0	to: .1	
TOP MEAN CHAN. WIDTH (ft):	16	TOP CHANNEL WIDTH RANGE:	from 8.5	to: 31	
BOTTOM MEAN CHAN. WIDTH (ft):	8.6	BOT. CHAN. WIDTH RANGE:	from 3	to: 17	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %: None: 10 Grass: 10 Lawn: 0 Wetland: 0 Trees: 40 Shrub: 40 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ✔ Box Elder ☐ Honeysuckle ☐ Buckthorn ✔ Hardwoods ✔ Other:

CANOPY (% shaded cov. of channel): 85 BEAVER ACTIVITY: ☐ # OF DAMS:

INSTREAM DEBRIS LOAD: Fail OVERBANK DEBRIS LOAD: Pass

COMMENTS:

IMPOUNDED: ☐ MID-STREAM BARS _ISLANDS: ☐

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL25	Culvert	3			Steel

LOCATION/GPS#: 224

NOTES: residential street

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL25	Culvert	3			Steel

LOCATION/GPS#: 225

NOTES: armoring/ residential street

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL25	Culvert	3			Steel

LOCATION/GPS#	NOTES:
226	east side of Gabriel/ armoring

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL25	Swale/Open Channel	Top: 3 Bottom Deep:

LOCATION/GPS #: 222

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL25	Clay Pipe	Top: 0.25 Bottom Deep:

LOCATION/GPS #: 223

NOTES: left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):
BL25	Swale/Open Channel	Top: 2 Bottom Deep:

LOCATION/GPS #: 227

NOTES: drains from south on Gabriel

SUSPICIOUS ACTIVITIES:

C. 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:	30	Lawn/Grass:	20	Wetlands:	10
	Crops:	0	Shrub/Weeds:	40	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 50

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %								
	Gravel:	10	Sand:	20	Cobble:	30	Silt:	30
	Concrete:	0	Organic Matter:	0	Boulder:	5	Claypan:	5

SUBSTRATE STABILITY OF ENTIRE CHANNEL:	Moderate
SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL:	Moderate
FILAMENTOUS ALGAE:	N/A

GREASE/OIL IN WATER COLUMN: ☐ GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Moderate

WATER COLOR: Brown COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☑	☐	☑	

Overhanging Veg:	Rootwads:	Boulders:	Backwaters:
☑	☑	☑	☑

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		371	start 27th St. Trib.- fork near Wadsworth

GPS # 220

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		372	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		373	debris

GPS #
221

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		374	open channel

GPS #
222

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		375	drain pipe

GPS #
223

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		376	culvert

GPS #
224

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		377	culvert

GPS #
225

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		378	culvert

GPS #
226

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL25	Russell Brunner		379	vegetated end reach

GPS #
227

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL): BL26

DATE: 7/13/2001

PRIMARY WATERSHED: Bull Creek(LM)

STREAM REACH NAME: 27th St. Trib

STREAM REACH #: 27

REACH BOUNDARIES UPSTREAM: culvert at 33rd St.

REACH BOUNDARIES DOWNSTREAM: fork right from previous reach

UPSTREAM GPS# 233

DOWNSTREAM GPS# 228

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2000	78	09:30:00	RB/KK	Low	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: 2

BASEFLOW SINUOSITY: 2

POOL/RIFFLE DEVELOPMENT: 1

DEGREE OF BANK EROSION: 2

Types/Locations of High Cases: photos

DEGREE OF ARMORING: 2

Types/Locations of High Cases: photos

SEDIMENT ACCUMULATIONS: 2

MEAN BANK HT (ft):	4.6	BANK HT RANGE:	from: 3.5	to: 6
MEAN BANK SLOPE:	.9/1	BANK SLOPE RANGE:	from: .75/1	to: 1/1
MEAN WATER DEPTH (ft):	.66	WATER DEPTH RANGE:	from: .25	to: 1
TOP MEAN CHAN. WIDTH (ft):	20.3	TOP CHANNEL WIDTH RANGE:	from 17	to: 24
BOTTOM MEAN CHAN. WIDTH (ft):	12.1	BOT. CHAN. WIDTH RANGE:	from 9.5	to: 14.5
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0

PREDOMINANT BANK VEG. %: None: 20, Grass: 10, Lawn: 0, Wetland: 0, Trees: 40, Shrub: 30, Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ Box Elder ☐ Honeysuckle ☐ Buckthorn ☑ Hardwoods ☑ Other:

CANOPY (% shaded cov. of channel): 70

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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL26	Bridge	5		30	Wood

LOCATION/GPS#: 230

NOTES: fallen residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL26	Bridge	4	3	20	Wood

LOCATION/GPS#: 231

NOTES: residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL26	Bridge	4	4	12	Wood

LOCATION/GPS#	NOTES:
231	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL26	Bridge	W: 4 H: 4 L: 12	Wood

LOCATION/GPS#	NOTES:
231	residential footbridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	MATERIAL:
BL26	Culvert	W: 6.5 H: 7 L: 0	Concrete

LOCATION/GPS#	NOTES:
233	south side of 33rd St.

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL26	Plastic Pipe	Top: 0.25 Bottom Deep:	230

NOTES: right bank residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL26	Plastic Pipe	Top: 1.25 Bottom Deep:	230

NOTES: right bank residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL26	Plastic Pipe	Top: 0.5 Bottom Deep:	231

NOTES: left bank residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL26	Concrete Pipe	Top: 0.75 Bottom Deep:	231

NOTES: left bank residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL26	Swale/Open Channel	Top: 1.5 Bottom Deep:	232

NOTES: left bank residential

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):	LOCATION/GPS #
BL26	Swale/Open Channel	Top: 1.5 Bottom Deep:	233

NOTES: right bank- draining 33rd St. from west

SUSPICIOUS ACTIVITIES:

C. 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:	50	Lawn/Grass:	20	Wetlands:	0
	Crops:	0	Shrub/Weeds:	30	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 60

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
	Gravel:	20	Sand:	20	Cobble:	40	Silt 5
	Concrete:	0	Organic Matter:	0	Boulder:	5	Claypan: 10

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: Moderate

WATER COLOR: Brown **COMMENTS:**

E. INSTREAM COVER FOR FISH

Undercut Banks:	Pools Over 28" Deep:	Macrophytes:	Logs:	COMMENTS (Instream Cover for Fish):
☑	☐	☐	☑	
Overhanging Veg:	**Rootwads:**	**Boulders:**	**Backwaters:**	
☑	☑	☑	☐	

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		381	fork at beginning of reach

GPS #
228

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		382	residential use of vegetation as armoring

GPS #
229

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		383	armoring

GPS #
229

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		384	bridge

GPS #
230

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		385	drain pipes

GPS #
230

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		386	bridge

GPS #
231

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		387	bridges x2

GPS #
231

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		388	drain pipe

GPS #
231

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner			

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		390	erosion

GPS #
232

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		391	open channel

GPS #
232

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		392	open channel

GPS #
233

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL26	Russell Brunner		393	culvert at 33rd street

GPS #
233

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL27	DATE:	7/13/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	27th St. Trib
STREAM REACH #:	28		
REACH BOUNDARIES UPSTREAM:	culvert at 31st St.	REACH BOUNDARIES DOWNSTREAM:	culverts at 33rd St.
UPSTREAM GPS#	245	DOWNSTREAM GPS#	234

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2000	80	01:30:00	RB/KK	Low	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	2
DEGREE OF BANK EROSION:	3	Types/Locations of High Cases: see photos		DEGREE OF ARMORING:	1
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	1				

MEAN BANK HT (ft):	4.125	BANK HT RANGE:	from: 2	to: 8	
MEAN BANK SLOPE:	.65/1	BANK SLOPE RANGE:	from: .3/1	to: 1/1	
MEAN WATER DEPTH (ft):	.45	WATER DEPTH RANGE:	from: .1	to: .75	
TOP MEAN CHAN. WIDTH (ft):	17.5	TOP CHANNEL WIDTH RANGE:	from 15.5	to: 21	
BOTTOM MEAN CHAN. WIDTH (ft):	11.8	BOT. CHAN. WIDTH RANGE:	from 9.5	to: 16	
MEAN VELOCITY (ft/s):	0	VELOCITY RANGE:	from: 0	to: 0	

PREDOMINANT BANK VEG. %: None: 35 Grass: 10 Lawn: 0 Wetland: 0 Trees: 35 Shrub: 20 Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☐ Box Elder ☐ Honeysuckle ☐ Buckthorn ☑ Hardwoods ☑ Other:

CANOPY (% shaded cov. of channel):	75	BEAVER ACTIVITY: ☐	# OF DAMS:
INSTREAM DEBRIS LOAD:	Fail	OVERBANK DEBRIS LOAD:	Pass

COMMENTS:

IMPOUNDED: ☐ MID-STREAM BARS _ISLANDS: ☑

EST. MANNINGS n: Right Overbank: Instream: Left Overbank:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL27	Culvert	6.5	7		Concrete

LOCATION/GPS#: 234

NOTES: north side of 33rd St.

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL27	Bridge	6	4	23	Wood

LOCATION/GPS#: 243

NOTES: residential- debris under bridge

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL27	Culvert	6	7		Concrete

LOCATION/GPS#	NOTES:
245	steam continues underground

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL27	Concrete Pipe	Top:	1	Bottom	Deep: 0

LOCATION/GPS # 235

NOTES: left bank- erosion

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL27	Concrete Pipe	Top:	0.75	Bottom	Deep: 0

LOCATION/GPS # 236

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL27	Swale/Open Channel	Top:	3	Bottom	Deep:

LOCATION/GPS # 240

NOTES: right bank- backwaters

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL27	Concrete Pipe	Top:	3	Bottom	Deep:

LOCATION/GPS # 241

NOTES: left bank- sewer drain

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL27	Swale/Open Channel	Top:	1.5	Bottom	Deep:

LOCATION/GPS # 242

NOTES: right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL27	Concrete Pipe	Top:	0.75	Bottom	Deep: 0

LOCATION/GPS # 242

NOTES: right bank- makes open channel

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL27	Concrete Pipe	Top:	1	Bottom	Deep:

LOCATION/GPS # 245

NOTES: in culvert

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	70
	Recreational:	0	Commercial Industrial:	0
	Residential:	30	Other	0

Other Description:

VEGETATION %					
Forest:	40	Lawn/Grass:	30	Wetlands:	0
Crops:	0	Shrub/Weeds:	30	Other:	0

Other Description:

WIDTH OF VEGETATED BUFFER: 100

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %							
Gravel:	30	Sand:	20	Cobble:	20	Silt:	20
Concrete:	5	Organic Matter:	0	Boulder:	5	Claypan:	0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: High

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: Low

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☑

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Moderate

WATER COLOR: Brown

COMMENTS:

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑

Pools Over 28" Deep: ☑

Macrophytes: ☐

Logs: ☑

Overhanging Veg: ☐

Rootwads: ☑

Boulders: ☑

Backwaters: ☐

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		393	culvert at 33rd St.

GPS #
234

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		394	drain pipe

GPS #
235

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		395	drain pipe

GPS #
236

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		396	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		397	debris (downstream)

GPS #
237

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		398	erosion- left bank

GPS #
238

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		399	debris

GPS #
239

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		400	open channel

GPS #
240

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		401	drain pipe

GPS #
241

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		402	open channel

GPS #
242

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		403	drain pipe

GPS #
242

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		404	bridge

GPS #
243

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		405	erosion- left bank/ debris

GPS #
244

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		406	culvert at park- city stormwater outfall

GPS #
245

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL27	Russell Brunner		407	drain pipe in culvert

GPS #
245

Bull Creek/Dead River (Lake Michigan) - Main Table

LAKE CO ID (FL):	BL28	DATE:	7/16/2001
PRIMARY WATERSHED:	Bull Creek(LM)	STREAM REACH NAME:	27th St. Trib
STREAM REACH #:	29		

REACH BOUNDARIES UPSTREAM: culvert- stream continues from underground

REACH BOUNDARIES DOWNSTREAM: begin in wetland

UPSTREAM GPS# 258 | DOWNSTREAM GPS# 246

LENGTH (ft):	TEMP. (F):	TIME:	INVESTIG.:	STREAM STAGE:	RECENT RAIN:	RAIN (in):
2700	90	11:00:00	RB/KK	Normal	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:	2	BASEFLOW SINUOSITY:	2	POOL/RIFFLE DEVELOPMENT:	2
DEGREE OF BANK EROSION:	2	Types/Locations of High Cases: photos		DEGREE OF ARMORING:	1
Types/Locations of High Cases:					
SEDIMENT ACCUMULATIONS:	2				

MEAN BANK HT (ft):	1.8	BANK HT RANGE:	from: 1.5	to: 2	
MEAN BANK SLOPE:	.42/1	BANK SLOPE RANGE:	from: .25/1	to: .5/1	
MEAN WATER DEPTH (ft):	.33	WATER DEPTH RANGE:	from: .25	to: .5	
TOP MEAN CHAN. WIDTH (ft):	8.5	TOP CHANNEL WIDTH RANGE:	from 4.5	to: 14.5	
BOTTOM MEAN CHAN. WIDTH (ft):	5.1	BOT. CHAN. WIDTH RANGE:	from 3	to: 9	
MEAN VELOCITY (ft/s):	20/216	VELOCITY RANGE:	from: 0	to: 20/216	

PREDOMINANT BANK VEG. %: None: 0 | Grass: 20 | Lawn: 15 | Wetland: 25 | Trees: 20 | Shrub: 20 | Rowcrop: 0

PREDOMINANT TREE/SHRUB: Willows ☑ | Box Elder ☐ | Honeysuckle ☐ | Buckthorn ☑ | Hardwoods ☐ | Other:

CANOPY (% shaded cov. of channel): 40 | 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:

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL28	Culvert	2			Steel

LOCATION/GPS# 253

NOTES: under trail

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL28	Culvert	2			Steel

LOCATION/GPS# 253

NOTES: under trail

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft): W:	H:	L:	MATERIAL:
BL28	Culvert	2			Steel

LOCATION/GPS#	NOTES:
253	under trail

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL28	Culvert		2			Steel

LOCATION/GPS#	NOTES:
253	under trail

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL28	Culvert		2			Steel

LOCATION/GPS#	NOTES:
253	under trail

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL28	Culvert		2			Concrete

LOCATION/GPS#	NOTES:
255	at Sheridan

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL28	Culvert		3			Concrete

LOCATION/GPS#	NOTES:
255	at Sheridan

HYDRAULIC STRUCTURES:

LAKE CO ID:	TYPE:	SIZE (ft):	W:	H:	L:	MATERIAL:
BL28	Culvert		5.5	5		Concrete

LOCATION/GPS#	NOTES:
258	continues from underground

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL28	Swale/Open Channel	Top:	6	Bottom	Deep:

LOCATION/GPS #	NOTES:
247	right bank- draining wetlands

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL28	Swale/Open Channel	Top:	2	Bottom	Deep:

LOCATION/GPS #	NOTES:
248	right bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL28	Swale/Open Channel	Top:	1	Bottom	Deep:

LOCATION/GPS #	NOTES:
250	left bank

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):			
BL28	Swale/Open Channel	Top:	0.25	Bottom	Deep:

NOTES:	LOCATION/GPS # 251
left bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL28	Steel Pipe	Top: 1	Bottom	Deep:

NOTES:	LOCATION/GPS # 252
right bank- draining trail	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL28	Concrete Pipe	Top: 1	Bottom	Deep:

NOTES:	LOCATION/GPS # 255
at Sheridan culvert	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL28	Concrete Pipe	Top: 1.5	Bottom	Deep:

NOTES:	LOCATION/GPS # 255
at Sheridan culvert	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL28	Concrete Pipe	Top: 3	Bottom	Deep:

NOTES:	LOCATION/GPS # 256
right bank	

POINT DISCHARGE:

LAKE CO ID:	TYPE:	SIZE (ft):		
BL28	Concrete Pipe	Top: 1	Bottom	Deep:

NOTES:	LOCATION/GPS # 257
right bank	

SUSPICIOUS ACTIVITIES:

C. RIPARIAN CORRIDOR/FLOODPLAIN

DOMINANT LAND USE %				
	Agricultural:	0	Vacant/Open Space:	50
	Recreational:	30	Commercial Industrial:	0
	Residential:	20	Other	0
	Other Description:			

VEGETATION %						
	Forest:	20	Lawn/Grass:	20	Wetlands:	30
	Crops:	0	Shrub/Weeds:	30	Other:	0
	Other Description:					

WIDTH OF VEGETATED BUFFER: 50

COMMENTS (Riparian Corridor/Floodplain):

D. SUBSTRATE AND WATER QUALITY

SUBSTRATE COMPOSITION %	Gravel:	5	Sand:	40	Cobble:	10	Silt	40

Concrete: 0 | Organic Matter: 0 | Boulder: 5 | Claypan: 0

SUBSTRATE STABILITY OF ENTIRE CHANNEL: Low

SUBSTRATE EMBEDEDDNESS OF ENTIRE CHANNEL: High

FILAMENTOUS ALGAE: Low

GREASE/OIL IN WATER COLUMN: ☑

GREASE/OIL IN SEDIMENT: ☐

TURBIDITY: Low

WATER COLOR: Brown

COMMENTS: water is clear- walking through sediment increases turbidity

E. INSTREAM COVER FOR FISH

Undercut Banks: ☑ | Pools Over 28" Deep: ☐ | Macrophytes: ☐ | Logs: ☑

Overhanging Veg: ☑ | Rootwads: ☑ | Boulders: ☑ | Backwaters: ☑

COMMENTS (Instream Cover for Fish):

F. 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:

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		411	debris

GPS # 249

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		412	open channel

GPS #
250

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		413	oepn channel

GPS #
251

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		414	drain pipe

GPS #
252

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		415	culverts x5

GPS #
253

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		416	culverts x5 (south end)

GPS #
253

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		417	debris- log jam

GPS #
254

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		418	culverts/ drain pipes at Sheridan

GPS #
255

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		419	drain pipes

GPS #
256

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		420	drain pipe

GPS #
257

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		421	representative reach photo

GPS #

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		422	erosion

GPS #
258

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		408	begin reach- wetland

GPS #
246

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		409	open channel

GPS #
247

PHOTO TABLE:

LAKE CO ID:	PHOTOGRAPHER:	ROLL #:	PHOTO #:	PHOTO DESCRIPTION:
BL28	Russell Brunner		410	open channel

GPS #
248

references

references

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SUGGESTED RESOURCES & ORGANIZATIONS

Planning / Watershed Planning / Low Impact Development

Chicago Metropolitan Agency for Planning (CMAP) / Northeastern Illinois Planning Commission (NIPC) www.cmap.org/ www.nipc.org

Center for Watershed Protection, www.cwp.org

Low Impact Development (LID) Center, www.lowinpactdevelopment.org

Green Roofs

Greenroofs.com, www.greenroofs.com

Green Roofs for Healthy Cities, www.greenroofs.com

Pennsylvania State University, Center for Green Roof Research, hortweb.cas.psu.edu/research/greenroofcenter

Rain Gardens

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

Rain Gardens of West Michigan, www.raingardens.org

Porous Pavement

Paveloc Industries, Inc., www.paveloc.com

Unilock Ltd., www.unilock.com

Landscaping and Lawn Maintenance

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

EPA, www.epa.gov/glnpo/greenacre

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

Floodproofing

Illinois Association for Floodplain and Stormwater Management, www.illinoisfloods.org

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