Advanced Identification (ADID) Study
McHenry County, Illinois

Final Report

December 1998

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I. Introduction

A. Background and Purpose

Federal regulation of the discharge of dredged or fill material into wetlands or other waters of the United States is authorized under Section 404 of the Clean Water Act. Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers (COE) to require permits for filling activities and provides the U.S. Environmental Protection Agency (USEPA) with oversight and veto authority. Part 230.80 within the 404(b)(1) Guidelines authorizes the USEPA and the COE to identify in advance of specific permit requests, aquatic sites which will be considered as areas generally unsuitable for disposal of dredged or fill material. This process is called an Advanced Identification or ADID. Under the ADID process identification of an area as generally unsuitable for fill does not prohibit applications for permits to fill in these areas. Therefore, the ADID designation of unsuitability is advisory, not regulatory. In the McHenry County ADID project, designations of unsuitability were applied to certain sites, including *wetlands, lakes*, and *streams*, exhibiting exceptionally high quality biological and habitat functions. This designation lets a potential applicant know in advance that a proposal to fill such a site is not likely to be consistent with the 404(b)(1) Guidelines and the USEPA will probably request permit denial.

It is important to emphasize that the McHenry County ADID attempted to identify wetlands or other waters of the U.S. of exceptionally high functional value. These sites were determined to be unsuitable for filling activities based on consideration of the 404 (b)(1) Guidelines. It also is important to note the following: ***no determination regarding suitability/unsuitability has been made for any of the wetlands or other waters of the U.S. <u>not</u> identified in this study***.

ADID also allows for the identification of other sites that provide important functions requiring special protection, although some modifications may be allowed. In the McHenry County ADID project, this type of "high functional value" designation was applied to certain wetlands that provide important stormwater storage and water quality protection benefits.

In general, a goal of the ADID process is to shorten permit processing time and to provide some level of predictability to the 404 regulatory program. Not only does an ADID have value to the federal regulatory program, it also can provide information which can be used by state and local governments to aid in zoning, permitting, or land acquisition decisions. Another goal of ADID is to provide information to agencies, landowners, and private citizens interested in restoration or acquisition of aquatic sites.

Historically, wetland protection measures in McHenry County have included federal regulations, several local government ordinances, and acquisitions by government agencies, primarily the McHenry County Conservation District and the Illinois Department of Natural Resources (IDNR). However, with the rapid pace of urban development, particularly in the last decade, unacceptable loss and/or degradation of wetlands have continued to occur in the county.

The ADID study described in this report is a cooperative effort between federal, state, and local agencies to inventory, evaluate, and map high quality wetland resources in the county. From the federal perspective, the primary purpose of this ADID study is to designate wetlands or other waters of the United States which are unsuitable for discharge of dredged or fill material. From the local perspective, the purposes of ADID are to improve the overall protection mechanism for wetlands via improved local regulation, improved predictability in the permitting process, identification of potential mitigation/restoration sites, and identification of potential sites for acquisition. These purposes will be described in greater detail later in this report.

B. Physical Setting - Wetlands, Lakes, and Streams in McHenry County

McHenry County possesses an abundance of wetland types in a variety of physical settings. Predominant wetland types include palustrine, lacustrine, and riverine systems. Palustrine wetlands are found in a wide variety of geographic settings and terrains in the county and include marshes, bogs, fens, wet prairies, forested wetlands, and ponds. Lacustrine wetlands are less common. They are found mostly in eastern portions of the county and are exemplified by the wetlands of the Chain O' Lakes - Fox River. High quality rivers and streams, and associated riverine wetlands, are common. In fact, McHenry County has some of the highest quality stream ecosystems in Illinois, as exemplified by the Kishwaukee River and its tributaries.

An inventory developed as part of this project identifies nearly 42,000 acres of wetland (including lakes) in the county, representing approximately 11 percent of the total land area. While it is difficult to determine how the current wetland acreage compares to pre-settlement conditions, it is clear that substantial areas of wetland have been lost and that most remaining wetlands have been degraded. Historically, probably the most significant causes of wetland and stream degradation in the county were draining and channelization for agricultural purposes. In the more recent past, degradation has been caused primarily by urban development activities, including isolated filling, excavation, draining, construction site erosion, and discharge of untreated stormwater runoff.

Despite these continuing disturbances, wetlands, lakes, and streams offer considerable benefits to the residents of McHenry County. To the casual observer, wetlands and stream corridors enhance natural aesthetics and serve as buffers between adjacent developments. These areas comprise a substantial percentage of the public open space within the county and offer recreational opportunities such as hiking, cross country skiing, and nature study. The diverse ecosystems within wetlands offer necessary habitat for wildlife and plant communities, including many threatened and endangered species. Wetlands in the county are critical in controlling flooding and in protecting hydrologic cycle functions such as groundwater recharge, flow attenuation, and maintenance of baseflows. Wetlands also are crucial to the protection of water quality in the county's many lakes and streams. In particular, wetlands stabilize shorelines and serve as effective filtering and settling devices for sediments, toxic pollutants, and nutrients.

The rivers and streams of McHenry County are worthy of special attention. They represent some of the highest quality ecosystems in the State of Illinois. In fact, in contrast to most of the other counties in northeastern Illinois, most McHenry county streams and rivers are still classified as "unique" or "highly valued" based on the biotic integrity of their fish and other aquatic communities.

C. Related Activities

A countywide stormwater management plan has been adopted by the McHenry County Stormwater Committee (MCSC). The *McHenry County Comprehensive Stormwater Management Plan* concluded that existing state and federal regulations alone, particularly the Corps of Engineers Section 404 regulations, do not meet the MCSC stream and wetland protection goals and objectives. The Plan also concluded that the Corps' resources for enforcement are limited. The Plan recommended that stream and wetland protection be incorporated in the countywide ordinance. The Plan further called for:

- **#** protection of all wetland functions;
- **#** mitigation for all significant wetland disturbances;
- **#** mitigation for all stream modifications;
- **#** buffer protection for all waterbodies and wetlands;
- **#** and setbacks along all waterbodies and wetlands.

Protection of wetlands and streams is an important priority for several local governments within the county. For example, the communities of Algonquin, Crystal Lake, Huntley, Lake in the Hills, and Woodstock have incorporated stream and/or wetland protection provisions into their local development ordinances.

Acquisition and restoration of stream corridors and wetlands has been a priority of the McHenry County Conservation District (MCCD). Further, MCCD has been a regional leader in the assessment of habitat quality and biodiversity of its aquatic systems.

Another related activity is the Special Area Management Planning (SAMP) project in the Chain O' Lakes - Fox River area. The SAMP project identified wetland protection as one of the essential priorities of the Chain O' Lakes - Fox River area.

D. Procedure

Project Scope of Work

The scope of work for the ADID project consisted of the following tasks:

1. Form and Coordinate Technical Advisory Committee (TAC) and Planning and Policy Committee (PPC)
2. Identify, Develop, and Map Existing Wetlands Database
3. Develop McHenry County Objectives and Strategy for Wetland Protection and Management
4. Develop and Document Wetland Evaluation Methodology.
5. Collect Background Data and Incorporate into Geographic Information System (GIS) Database
6. Apply Screening Methodology to Identify Wetlands for Field Inspection
7. Field Inspection
8. Determine and Map Final (draft) ADID Sites for Public Review
9. Final Reporting and Mapping
10. Develop Public Education/Technical Assistance Materials
11. Produce Final ADID Product on CD-ROM and Develop Customized GIS Interface for Display, Query, and Mapping.
12. Conduct Workshop

Technical Advisory Committee (TAC)

A technical advisory committee (TAC) was formed soon after the initiation of the project. Its principal role was to advise project staff on technical issues, particularly the development of evaluation methodologies for wetlands, lakes, and streams. TAC members also contributed substantial time evaluating wetlands, both in the office and the field. The TAC consisted of the following invited agencies and organizations:

U.S. Environmental Protection Agency, Region 5
U.S. Army Corps of Engineers, Chicago District
U.S. Department of the Interior, Fish and Wildlife Service, Chicago-Metro Wetlands Office
USDA, Natural Resources Conservation Service, Chicago Metro Urban and Community Assistance Office
USDA, Natural Resources Conservation Service, McHenry County Office
Illinois Department of Natural Resources, Division of Natural Heritage
Illinois Department of Natural Resources, Division of Impact Analysis

McHenry County Department of Planning and Development/McHenry County Stormwater Committee
McHenry County Conservation District
McHenry County Soil and Water Conservation District
Fox Waterway Agency
Northeastern Illinois Planning Commission

Planning and Policy Committee (PPC)

A Planning and Policy Committee also was formed early in the project. Its principal role was to advise project staff on policy, particularly the determination of wetland functions important to McHenry County and the development of a wetland protection and management strategy. The PPC included all of the members of the TAC as well as members of the following organizations:

Homebuilders Association of Greater Chicago
Illinois Audubon Society, McHenry County Chapter
Illinois Environmental Protection Agency
Land Foundation of McHenry County
McHenry County Board
McHenry County Defenders
McHenry County Farm Bureau
McHenry County Municipal Association
McHenry County Realtors Association
McHenry County Stormwater Committee
Openlands Project

PPC members were asked to identify the goals and interests of their respective agencies with respect to wetland protection in McHenry County. Some of the identified objectives included designation of high quality sites for regulation, acquisition, and management; protection of stormwater, water quality, and habitat functions; and identification of criteria for wetland protection and mitigation, including input to a countywide stormwater ordinance.

There was considerable discussion regarding the determination of wetland functions and values. The committee recommended that the following functions be considered and evaluated: biological/habitat functions; water quality mitigation functions; stormwater storage functions; and groundwater functions. These functions were evaluated and refined by the TAC before a final list was agreed upon. (See discussion under the Wetland Evaluation Methodology Chapter.)

The PPC also advised the project team on the designation of high quality wetlands. After considerable discussion and several iterations, the following designations were agreed to.

High Quality Habitat Sites: Wetlands, lakes and streams were identified as having high quality wildlife habitat, high floristic quality, or high quality aquatic habitat based on the methodology that is described later in this report. These high quality habitat sites are considered

"irreplaceable" and unmitigatable based on the fact that the complex biological systems and functions that these sites support cannot be successfully recreated within a reasonable time frame using existing restoration or creation methods.

High Functional Value Wetlands: These are wetlands that were identified as providing very important water quality and stormwater storage benefits to McHenry County. A site was identified as being of high functional value if it met three of the four criteria for water quality/stormwater storage functions, or if it met one or more of the criteria for water quality/stormwater storage functions and was located in a critical position with regard to the watershed/landscape.

The PPC also advised the project team on the development of a protection and management strategy for wetlands, streams, and lakes. This strategy, presented in Chapter II, identified four principal elements:

- education,
- regulations/best management practices,
- acquisition, and
- restoration.

II Wetland Protection and Management Strategy

A. Purpose and Background

The purpose of this wetland protection and management strategy is to utilize the ADID results in the most effective way to further the goals of wetland protection and restoration in McHenry County. This was accomplished by working with the TAC and PPC to develop a countywide strategy for wetland protection.

The PPC provided recommendations for a strategy early in the project. In particular, it identified the initial elements of a wetland protection and management strategy that follow. These subsequently were used by the project team in methodology and strategy development and refined into a final strategy.

- Evaluate wetland functions as they relate to watershed and land use
- Identify high functional quality wetland and water resources and what steps are necessary to protect them
- Consider issues of wetland complexes and water source for high quality wetlands
- Identify potential restoration sites and develop guidance for voluntary restoration
- Consider mitigation banking options
- Develop BMPs to protect wetland functions
- Develop guidance for tailoring local wetland protection ordinances
- Develop guidance for local governments regarding ADID information and public education
- Develop guidance regarding wetlands and stormwater management
- Develop recreational access guidelines (e.g., trails)

The first three elements were addressed in the process of identifying and evaluating wetland functions. The remaining recommended elements can be lumped into the four general categories of education, regulations/best management practices, acquisition, and restoration. Recommended strategies for each of these components are described in the remainder of this chapter.

B. Education

The project scope of work and the McHenry County *McHenry County Comprehensive Stormwater Management Plan* recognized the critical importance of education to achieve wetland protection objectives. Education should address, at a minimum, the following wetland topics: wetland functions and values, the need for improved protection strategies, and restoration opportunities. Education initiatives should be targeted to local governments as well as members of the public. Education ideally will lead to increased support for effective ordinance, acquisition, and restoration programs and will increase interest in volunteer programs.

Important education objectives were accomplished in the development of an ADID brochure for McHenry County. These included:

- # summarizing results of ADID functional evaluations and the countywide wetland inventory;
- # characterizing, in non-technical terms, critical wetland functions and rationale for increased protection and restoration;
- # describing appropriate, county-based protection and restoration strategies and BMPs; and
- # describing appropriate wetland protection roles for private citizens and interest groups.

C. Regulations/Best Management Practices

There are several relevant regulatory components of the McHenry County ADID. The first is its use in the context of a countywide "stormwater" ordinance being developed by the McHenry County Stormwater Committee (MCSC). The *McHenry County Comprehensive Stormwater Management Plan* concluded that the protection of wetlands and streams provided by Army Corps of Engineers Section 404 regulations does not meet the MCSC goals and objectives and that Corps' resources for enforcement are limited. The Plan recommended that stream and wetland protection be incorporated in the countywide ordinance. The Plan further called for:

- # protection of all wetland functions;
- # mitigation for all significant wetland disturbances;
- # mitigation for all stream modifications;
- # buffers protection for all waterbodies and wetlands;
- # and setbacks along all waterbodies and wetlands.

Another regulatory element of a wetland protection strategy is to develop guidance for tailoring local wetland protection ordinances. For example, some areas of the county with exceptional wetland characteristics (e.g., fens) may need to adopt special protections to protect certain unique functions.

Finally, the ADID results regarding high quality habitats and high functional value wetlands have been provided to the Corps of Engineers, Chicago District. The Corps, as it did in Lake County, intends to utilize this information in making decisions under the Section 404 program. In particular, the Corps has indicated that it will exert discretionary authority over ADID high quality habitats and high functional value wetlands. In simple terms, this means that modifications to such high quality wetlands generally will require individual permits, thereby allowing for public review and input. ADID information might also be utilized by the Corps, and permit applicants, in evaluating appropriate locations for offsite mitigation or mitigation banks.

Implementation Considerations for McHenry County Wetland and Stream Protection Regulations

In order to optimize the strengths of existing regulatory programs and to minimize financial burdens on local government, the development and implementation of local regulations for wetland and stream protection should meet the following conditions.

1) Local regulations should complement, but not duplicate, existing regulations of the Army Corps of Engineers and the Illinois Department of Natural Resources.

2) Regulations should be implementable without the need for substantial additional local staff or financial resources.

The recommended approach for developing a local regulatory program is to utilize the authority and capabilities of the McHenry County Stormwater Committee, as recommended in the *Comprehensive Stormwater Management Plan*. Language should be developed for inclusion in the countywide ordinance that is being developed with the assistance of a consultant. This approach ultimately will require the support of the Stormwater Management Planning Committee and its Technical Advisory Committee. The principal strengths of this approach are 1) the development of uniform, minimum standards that will apply countywide and 2) a ready mechanism for effective coordination with the Corps of Engineers and other resource and regulatory agencies on routine permitting matters.

Another option that could be considered to achieve local wetland protection in the county is to update the ordinances of unincorporated McHenry County and individual communities. Several communities already have updated their ordinances to include stream and wetland protection provisions based on NIPC model ordinances. This approach would involve revisions to zoning and subdivision ordinances. However, this approach would be less efficient to implement than the countywide ordinance approach, requiring each community to invest resources to determine and adopt appropriate ordinance changes. It also likely would result in standards and criteria that vary significantly among communities. While individual communities are encouraged to investigate improvements to their ordinances, particularly those necessary to address unusual local circumstances (e.g., in topography or drainage), this community-by-community approach should be considered a “fall-back” position if the resources and staff are not found to implement a comprehensive countywide ordinance in a timely manner.

The resource agencies participating in the ADID project have indicated their willingness to provide significant technical expertise in developing specific ordinance language. Such language could be derived from NIPC's *Model Stream and Wetland Protection Ordinance* and/or existing local ordinances, such as the countywide ordinance of Lake County. Ordinance language would be tailored to McHenry County circumstances, particularly the objectives of the *Comprehensive Stormwater Management Plan*, and would reflect the information on high quality wetland and stream resources provided by the ADID project.

Recommended Ordinance Provisions

Following are specific recommendations for ordinance provisions that are intended to meet the previously stated objectives of the *McHenry County Comprehensive Stormwater Management Plan* and the conditions for feasible implementation.

First, the existing draft countywide ordinance does include some protections for wetland and stream resources. These protections and some recommended improvements are listed below.

1) A buffer requirement. To make this provision effective, it is essential that existing ordinance language be revised to require native/natural vegetation in the buffer.

2) Depressional storage volumes are protected.

3) Runoff pretreatment is required before discharge to any wetland. The requirement to treat 0.5 inch of runoff should be increased to adequately treat runoff from high-impervious land uses. A recommended alternative is to store and treat runoff from a 2-year storm event before discharge to a wetland.

Second, additional protections should be added to the draft ordinance to address *Stormwater Management Plan* and ADID objectives.

1) Additional protection of wetland functions is recommended, particularly to address those wetland disturbances and wetland functions (e.g., stormwater storage) that are not typically addressed by Corps of Engineers regulations. Several specific protections are needed.

- Protections should be added for activities not regulated by the Corps, particularly vegetation removal and impoundment of wetlands.
- High quality habitats, including wetlands, lakes, and streams as identified by ADID criteria, should be protected to the highest degree. Development impacts essentially should be prohibited in these critical areas.
- Wetlands designated high functional value for water quality and stormwater functions also should receive special protection. Simple, objective criteria should be specified for avoidance and mitigation of such wetlands.
- The water quality and stormwater functions of all other wetlands also should be protected. Criteria should be specified for where and how mitigation would be required.
- A setback should be protected for all wetlands, streams, and lakes. Development in a setback would be limited to compatible, non-structural uses (e.g., lawns, trails, traditional landscaping).

Protection of wetland functions could be accomplished in a countywide or local ordinance in a manner similar to the protection of floodplain/floodway functions. For example, existing State rules (as specified in the IDNR/NIPC *Model Floodplain Ordinance*) prohibit non-appropriate uses in the floodway. Avoidance of high quality wetlands is an analogous approach. Similarly, the *Model Floodplain Ordinance* specifies criteria for stream channel mitigation where

disturbances cannot be avoided. A similar approach could be used for mitigation of wetland stormwater and water quality functions.

An alternative technique to incorporate wetland protections into the countywide or local ordinances is a zoning overlay approach, such as embodied in the NIPC *Model Stream and Wetland Protection Ordinance*. In this approach, all wetlands to be protected are identified on a referenced zoning overlay map. ADID final maps could be readily tailored to McHenry County's needs.

2) Additional protection of stream functions is recommended. Several specific protections are needed.

- **#** Criteria should be added for channel modifications, including onstream impoundments. Stream channel modifications generally should be discouraged, unless their principal purpose is to improve natural hydrologic/habitat/water quality functions.
- **#** Requirements should be specified for environmental mitigation for all stream channel modifications.
- **#** Appropriate uses of the floodway should be restricted to compatible activities. In particular, uses such as new treatment plants, garages and sheds, parking lots, and roadways parallel to a stream course should be prohibited.

These provisions could be readily amended into the floodplain management section of the draft countywide ordinance.

3) Use of wetlands for stormwater detention should be discouraged. Because usage for stormwater detention often conflicts with protection of natural wetland functions, the countywide ordinance should explicitly prohibit the conversion of wetlands to detention basins, except in cases where the wetland is highly degraded and its function can be enhanced.

This provision can be readily incorporated into the stormwater management provisions of the draft countywide ordinance or local ordinances.

The preceding recommendations leave the principal responsibility for assessing and enforcing the habitat-related provisions of wetland and stream protection to the Corps of Engineers through the Section 404 program. The remaining provisions generally can be interpreted and enforced by municipal and county staff (i.e., engineers and planners) without having to hire special expertise to address complex ecologic functions. Further, as previously indicated, several resource agencies -- including the U.S. Fish and Wildlife Service, the Natural Resources Conservation Service, and the McHenry County Soil and Water Conservation District -- have committed to assisting the County in implementing these regulations.

D. Acquisition

The ADID data base, particularly the identification of high quality habitats and high functional quality wetlands, will be valuable to land acquisition agencies -- park districts, McHenry County Conservation District, Illinois Department of Natural Resources, and local land trusts -- in assessing acquisition priorities. Other information from the ADID data base, including farmed wetlands, wetland complexes, and riparian wetlands, also could be useful in determining acquisition priorities. Finally, it is recommended that recreational access guidelines (e.g., for trails) be implemented to minimize habitat interference with high quality habitats while enhancing public access and awareness.

E. Restoration

In addition to identifying high functional quality wetlands, the ADID data base also will be very useful in identifying lower quality sites with restoration opportunities. The availability of GIS data bases and mapping, particularly in conjunction with other digital data such as soils maps and data on seeps and springs, will greatly facilitate this objective.

Criteria that might be considered for determining desirable wetland restoration sites include:

- size
- land use/ownership
- hydric soils (or categories of hydric soils)
- historical drainage patterns (as identified by NRCS)
- adjacency or proximity to other wetlands, or high quality wetlands
- historic wetland loss within watershed
- adjacency to (or within watershed of) high quality streams

Most of these criteria could be readily evaluated by applying GIS screening technology to the ADID database and other digital databases.

III. Evaluation Methodology

A. Methodology Overview

1. Background

The purpose of the Advanced Identification (ADID) study is to provide information on the wetland, stream, and lake resources in McHenry County. The ADID study can be a tool for making development and resource conservation decisions and should be useful as a planning tool for local governments, land management agencies, and other public and private landowners.

To improve the understanding and ultimately the protection of wetland, stream, and lake resources, it is first important to identify and evaluate the relevant functions that they provide. It also is important to identify those wetland, stream, and lake resources that are particularly important with respect to their quality and functions.

2. Determination of Important Wetland, Stream, and Lake Functions

Federal guidance on conducting ADID studies encourages local entities to tailor wetland evaluations so that functions of local importance are addressed. To that end, wetland functions of particular concern were identified and prioritized by the McHenry County ADID Planning and Policy Committee (PPC). An interagency Technical Advisory Committee (TAC) refined the list to those functions that could realistically be addressed using the available resources. This process led to the identification of two categories of functions: biological/habitat functions and water quality/stormwater storage functions. The individual functions evaluated within these categories are as follows:

Biological/Habitat Functions:

- **#** Wildlife Habitat/Floristic Diversity
- **#** Stream Aquatic Habitat
- **#** Lake Aquatic Habitat

Water Quality/Stormwater Storage Functions:

- **#** Shoreline and Streambank Stabilization
- **#** Sediment and Toxicant Retention
- **#** Nutrient Removal and Transformation
- **#** Stormwater Storage and Hydrologic Stabilization

Several other functions -- including groundwater recharge and discharge, and recreational, aesthetic, cultural, educational, and historic values -- were considered but were not pursued for various reasons. For example, groundwater protection functions could not be effectively evaluated due to lack of consistent data about depths to groundwater and groundwater flow directions in McHenry County.

3. Determination of High Quality and High Value Wetlands

The development of a methodology for identifying high functional quality wetlands in McHenry County relied both on existing wetland evaluation methodologies and the technical expertise of members of the technical advisory committee. The resultant methodology builds on a methodology used in nearby Lake County as well as other documented methodologies, particularly the Wetland Evaluation Technique (WET) manual (Adamus et al., 1987), the Oregon Method (Roth et al., 1993), and the Minnesota manual (U.S. Army Corps of Engineers, 1988).

The methodology had to be designed to do two things: 1) identify the functions that individual wetlands were performing and 2) identify wetlands of such high quality that they merit special consideration for protection strategies. The evaluation of the identified functions for individual wetlands can be very complex and some of the referenced methodologies describe fairly elaborate approaches to perform thorough evaluations. However, because of the large number of wetlands to be considered in McHenry County it was necessary to adopt a simpler evaluation procedure.

Perhaps the most important thing to understand about the approach documented in this report is that it was designed to handle a large number of wetlands (nearly 4000 in McHenry County). This was accomplished by first setting size thresholds to limit the number of wetlands and then performing more thorough evaluations, such as field checks, on those wetlands that appear likely to perform a high level of an important function.

The approach developed by the TAC involved a three-step procedure of Geographic Information System (GIS) screening; aerial photo, map or desk-top evaluation; and field evaluation, as needed. For many functions, this approach includes an assessment of the *opportunity* of an individual wetland to perform a specified function to a significant degree as well as its expected *effectiveness* in performing the function.

Wetlands, lakes and streams were evaluated for the identified functional values and then placed into one of the following categories. The basic rationale for distinguishing among wetlands based on their quality was that wetlands of high quality or high functional value merit special consideration when considering protection, mitigation, and management needs.

1) <u>High Quality Habitat Sites</u>: Wetlands, lakes and streams were identified as having high quality wildlife habitat, high floristic quality, or high quality aquatic habitat based on the

methodology that is described in this report. These high quality habitat sites are considered "irreplaceable" and unmitigatable based on the fact that the complex biological systems and functions that these sites support cannot be successfully recreated within a reasonable time frame using existing mitigation methods.

2) High Functional Value Wetlands: These are wetlands that were identified as providing very important water quality and stormwater storage benefits to McHenry County. A site was identified as being of high functional value if it met three of the four criteria for water quality/stormwater storage functions, or if it met one or more of the criteria for water quality/stormwater storage functions and was located in a critical position with regard to the watershed/landscape.

In evaluating water quality/stormwater storage functions, an intermediate category of wetlands was identified. These are wetlands whose functions were evaluated and which met certain basic criteria but which did not qualify for the "high functional value" rating at the time of evaluation. Their functions are described and recorded in a database and should be considered for watershed planning and mitigation decisions.

3) Other Wetlands: This category includes all wetlands not identified in the two categories above. Wetlands falling into this category generally were smaller wetlands that were not thoroughly evaluated due to project resource constraints; or they were wetlands that were evaluated but did not meet the criteria for high quality or high functional value.

It is important to note that certain wetlands that were not evaluated because of their small size may perform very important functions. For example, many McHenry County fens may not make the minimum 2-acre cut-off for habitat evaluations. Therefore, the "other wetlands" category almost certainly includes some wetlands that are a rare type and provide important functions, but they were not evaluated due to the limitations of this methodology in its ability to thoroughly evaluate large numbers of wetlands.

It also is relevant to note that the thresholds set in McHenry County to evaluate functions and to identify high quality or high functional value wetlands were intended to reflect the caliber of wetlands in the context of other Illinois wetlands. For example, an evaluation of Index of Biotic Integrity (IBI) scores for streams revealed that McHenry County contains a relatively high number of the State's high quality streams. Similarly, the methodology for wetland habitat evaluation reflected the relatively high incidence of identified sites containing threatened and endangered plant and animal species, in comparison to the rest of the State.

B. Wetland, Stream, and Lake Inventories

The ADID evaluation methodology was dependent on the availability of an accurate and comprehensive database describing the wetland, stream, and lake resources of McHenry County as well as other relevant watershed and landscape features. Fortunately, the project was able to utilize several existing digital geospatial databases and several others were created for the project. The key to utilizing this information was geographic information system (GIS) technology provided by the Northeastern Illinois Planning Commission (NIPC). The GIS was used to maintain, overlay, query and display wetland and water resources information collected during the ADID project.

1. Wetland Inventory

The most significant early challenge in the project was the development of an accurate, comprehensive database of wetlands in the county. Two principal existing inventories were considered: the National Wetland Inventory (NWI) developed by the U.S. Fish and Wildlife Service (USFWS) with the assistance of the Illinois Department of Natural Resources in the early 1980s; and the Natural Resources Conservation Service (NRCS) Wetland Inventory that was being completed in McHenry County just as the ADID project began.

It was apparent that neither inventory was adequate alone. The NWI was becoming dated, particularly considering the substantial urban development activity in the county since the early 1980s. The NRCS inventory was judged to be more current (utilizing 1995 aerial photography as its most recent source of information) and more accurate. However, its principal purpose was to identify wetlands in agricultural areas and, therefore, was not complete in urbanized areas. As a consequence, the ADID project team decided that the base wetland inventory would be a combination of the NRCS Wetland Inventory and select wetlands from the NWI. Review and modifications by the ADID Technical Advisory Committee led to further revisions and improvements before the inventory was finalized.

The NRCS Wetland Inventory was developed following the procedures agreed to by the NRCS, USEPA, USFWS, and U.S. Army Corps of Engineers (USACOE) for the "Illinois Wetland Mapping Conventions, June 1994" for identifying wetlands on agricultural land. See Appendix A for the Illinois Mapping Conventions and the methodology for the NRCS wetland inventory in McHenry County. For the ADID project, NRCS agreed to assist in identifying additional wetlands in non-agricultural areas. The NRCS used an off-site procedure including the use of at least 5 years of recent low-altitude Agricultural Stabilization and Conservation Service (ASCS) color slides for identifying wetland signatures, and a base map of NHAPP 1988 aerial photos at a 1" = 660' scale. Additional resources were used to identify wetland signatures including county soil survey maps, climatic data, NWI maps, and long duration flooding data.

When the NRCS completed its work in creating its Wetland Inventory, NIPC's GIS was used to produce map overlays of the inventory at a 1" = 660' scale for overlaying on the NRCS base aerial photos. ADID TAC members then reviewed the inventory for completeness and accuracy and recommended several modifications.

First, the final NRCS Wetland Inventory consisted of two GIS layers, one for both agricultural and non-agricultural areas. NIPC combined these into one GIS layer for the ADID inventory. Adjacent wetlands were reviewed to determine whether they represented one wetland and should be merged.

Second, NRCS excluded some wetlands from their inventory because they already existed in the NWI data base. NIPC printed NWI wetlands on map overlays, and the TAC determined which should be included in the ADID base inventory based on aerial review and additional relevant information.

Finally, NIPC produced a second set of map overlays at a 1" = 2000' scale and select wetlands were reviewed for both their classification and boundary, using NIPC 1995 black and white aerial photos (1" = 2000') and some on-site field verification.

The NRCS wetland inventory included a range of wetland and non-wetland categories. After review of the inventory and discussions in the TAC, it was determined that the following categories would be combined into one wetland (W) category and included in the ADID base inventory: wetland (W), farmed wetland pasture (FWP), and non-inventoried hydric (NIH). Additionally, wetland classifications of artificial wetlands (AW) and non-ag ponds (NAP) were included if they were contiguous with another wetland. Farmed wetlands (FW) were also included in the final inventory, but not merged with the other categories. The resulting ADID classifications are wetland, farmed wetland, and non-wetland. At a later date, a lake class was introduced based on recommendations by the TAC.

The results of the wetland inventory are summarized in the following table. It is notable that the total wetland area of 41,685 acres represents nearly 11 percent of the county.

Wetland Category	Number	Area (acres)	Average Size (acres)
"W" Wetlands	2,518	33,003	13.1
Farmed Wetlands	1,250	3,839	3.1
Lakes	15	3,854	256.9
Large River Polygons (Fox River)	2	1,259	629.5
Total	3,785	41,685	11.0

2. Stream Inventory

The ADID stream layer was based on U.S. EPA's Stream Reach File, Version 3 (1:100,000 scale). This "RF3" file generally provided an accurate and complete inventory of county streams. One minor problem was the occurrence of disconnections or gaps in several stream networks. Based on recommendations from the TAC and using USGS 7.5 minute quadrangles as a base, some missing stream connections were fixed by digitizing them on the GIS. A total of 572 miles of streams were identified, ranging in size from small, unnamed headwaters to large rivers like the Fox and Kishwaukee.

3. Lakes Inventory

As indicated, lakes were identified as a subset of wetlands. Specifically, lakes were distinguished based on a criterion of 20 acres or more of open water. A total of 15 lakes were identified, and they averaged over 250 acres in size.

4. Other Water Resource Coverages

Several other relevant digital coverages were identified and incorporated into the GIS database for use in evaluating wetland, stream, and lake functions. These additional databases included: USGS watershed boundaries, 1996 pre-release version (1:24,000); NIPC's 1990 land use inventory open water category (1:24,000); and FEMA "Q3" floodplain boundaries. Description of the use of these GIS data bases can be found in other sections of the methodology. All of these data layers were overlain with the wetland, stream, and lakes inventories at a USGS 7.5 minute quad scale. These were utilized by TAC members in evaluating wetland functions.

C. Methodology for Biological/Habitat Functions

1. Background

Wetlands provide habitat for a variety of plants and animals. Some species of wildlife are completely dependent on wetlands for food, resting areas, breeding sites, molting grounds, and other life requisites. Other animal species use wetlands for only part of their life cycle. Because so many of our wetlands have been lost, a large number of endangered species are dependent on those that remain. At least one third of the nation's threatened and endangered species depend on wetlands; in Illinois over 40 percent of these species depend on just 2.6 percent of the landscape. Wetlands also include plant communities that have become rare since settlement times.

One of the goals of the McHenry County ADID study is to identify wetlands and deep water habitats which are providing a high degree of biological functions. Any site determined to be of exceptional biological value is considered a high quality habitat wetland and irreplaceable with current technology and understanding. Similarly, streams, lakes, and ponds considered to be providing high quality habitat for aquatic plants and animals are also considered unsuitable for fill. These high quality habitat wetlands and waters cannot be adequately replaced through compensatory mitigation with current technology. Others, while providing these functions, are not considered as irreplaceable, though their functions remain important.

For this effort, biological functions are divided into three categories for evaluation and assessment. These three were: wildlife habitat/floristic quality, streams - aquatic habitat, and ponds/lakes - aquatic habitat. Each of these biological functions was evaluated as described below.

2. Wildlife Habitat and Floristic Quality/Diversity

McHenry County Conservation District (MCCD) maintains a Natural Areas Inventory (MCNAI) for the county. While this inventory includes non-wetland habitats and features, it certainly includes many of the highest quality wetlands in the county. For the MCNAI, aerial photographs (1980) were reviewed for the entire county in 1986, following the methods used for the Illinois Natural Areas Inventory (INAI)(White 1978). For further description of the methodology used, please refer to Appendix B.

It was determined based upon the methodology used, the completeness of the effort, and the field verifications, that any wetland sites listed in the MCNAI are worthy of the "high quality habitat" designation. For mapping purposes, MCNAI wetland sites were hand-matched with wetland polygons on the GIS base map produced by NIPC. Any significant boundary differences were resolved by examination of current aerial photography. All MCNAI wetland sites were checked against current aerials to verify their continued existence.

To ensure that no high quality wetlands worthy of "high quality habitat" designation were overlooked, all remaining wetlands not identified in the MCNAI were evaluated according to the following criteria. These criteria represent a modification of the methods used for the Lake County, Illinois ADID study (Dreher et al., 1992). The criteria represent ecological features which have significant influence on either plant communities or wildlife habitat quality and could be evaluated from aerial photographs. For each criterion a score was assigned ranging from 1 to 4 with 1 being the lowest score and 4 being the highest. For some criteria, there was more than one potential choice that would yield a score of 4. The higher the habitat score, the more likely the site is providing exceptional biological value.

Note that the aerial screening process was done using 1995 aerials, with comparisons to older aerials where needed for clarity. Due to the scale considerations of using 1" = 400' aerials and the NRCS wetland base map, wetlands smaller than 2 acres were not evaluated.

1. Drainage Wetland sites which still exhibit natural drainage patterns, such as non-channelized drainage swales, meandering streams, or are parts of natural lakes or ponds, are considered to be the least disturbed sites and receive the best score. Sites that are visibly tiled or ditched and effectively drained are more disturbed and receive a poorer numerical score.

2. Excavation Wetlands with no evidence of excavation are considered less disturbed and receive the best numerical score while sites which have been excavated receive a poorer score. Excavations do not always contribute to a degradation of wetland functions, but frequently result in lowered water tables and spoil placed in the wetland.

3. Size Wetlands were divided into four size categories with the larger wetlands receiving the best score. The larger a wetland the more likely it is that it contains either high quality plant communities or high quality wildlife habitat. Larger wetlands have a higher likelihood of

containing high quality plant communities due to the fact that interior areas of larger wetlands are buffered from disturbance. Larger wetland areas also provide better wildlife habitat and typically support greater species richness (Brown and Dinsmore, 1986).

4. Physical Intrusions and Barriers Presence of a physical intrusion, such as fill, a berm or spoil pile, a road and railroad embankment, or some other physical barrier results in a lower score. Such a barrier frequently will impede wildlife movements (herptiles) and will result in hydraulic discontinuities. Non-native species frequently colonize such disturbances and result in floristic degradation. A large wetland polygon with a barrier near one edge received a higher score than a smaller polygon with a barrier through the middle.

5. Surrounding Land Use Surrounding land use within 200 feet of each wetland was categorized as either natural vegetation, old field or pasture, farmed, or developed. The less disturbed the surrounding land, the less likely it is for the wetland to be disturbed. Natural or only slightly disturbed landscapes provide good buffers from disturbance and intrusions, and also provide additional wildlife habitat. Wetlands adjacent to land uses such as urban/developed or agriculture (row crops) received a poorer habitat score due to the fact that these land uses typically have an adverse effect on water quality and/or disturb wildlife.

6. Habitat Structure Habitat structure is the most critical factor evaluated during this assessment. Habitat structure is an excellent indicator of wildlife habitat and plant community quality/diversity. However, the habitat structure of a wetland providing high quality wildlife habitat can be quite different from the habitat structure of a site with good native plant communities. Since this part of the evaluation is considered the most important, as it was the only part designed to detect marshes with high quality wildlife habitat structure, a high score from this portion of the evaluation resulted in an automatic field check. The two subsets of habitat structure are vegetative interspersion and plant/open water interspersion. The concepts and interspersion categories used here are based on the work of Golet (1976). These concepts were used in the Lake County ADID and are further explained in the Minnesota Wetland Evaluation Technique (MWET)(USACOE, 1988).

> Vegetative Interspersion Wetlands in McHenry County which have retained a high degree of their pre-settlement vegetation are often made up of several plant communities. These natural communities may include emergent marsh, wet prairie, sedge meadow, calcareous fens, springs and seeps, and forested communities. The presence of three or more communities is a good indicator of a high quality wetland complex. For this evaluation, the vegetative interspersion categories from Golet (1976) and MWET (USACOE, 1988) were used, but with the natural communities used in the MCNAI and INAI. Any wetland unit that had three or more natural communities in any one of the three interspersion categories was considered to be of potential high quality, while sites with only 1 or 2 community types are rated lower. Particular attention was given to areas with a phototone that suggests the presence of a rare community type such as a fen. If the photo-interpretation suggested the presence of such a rare community type, it was automatically included for field investigation.

Plant/Open Water Interspersion The type of wetland habitat that most frequently provides high quality habitat for a variety of wildlife, especially wetland dependant birds, is an emergent hemi-marsh. A hemi-marsh exhibits a high degree of interspersion between open water and vegetation. Many of our state endangered and threatened bird species require this type of marsh for breeding. Wetlands consisting of primarily open water or dominated by dense vegetative growth have lower habitat value and less wildlife species diversity (Weller, 1981). This type of interspersion can be readily assessed using aerial photographs, and those exhibiting the highest degree of interspersion, following the categories of Golet (1976) and MWET (USACOE, 1988) receive the highest score.

These criteria and their numerical scores are summarized in the aerial photo screening sheet at the end of this section.

After the aerial photograph scoring of non-MCNAI wetlands was completed and the data entered into a spreadsheet, the distribution of total scores for the wetland polygons was examined. A graph of these scores revealed a normal distribution. The size and interspersion scores were then weighted by a factor of 2 to emphasize their importance. During the aerial photograph screening process, it became clear based upon our collective experience that these two metrics were most indicative and correlated with true high quality sites (for known sites). A graph of these weighted scores produced a normal distribution with an obvious break between those with a score of <25 and those with a score of >25. This scoring cutoff was then tested both in the field and by review of aerial photographs. This review of selected wetlands with a score of 24 or 25 indicated that this scoring threshold was appropriate and meaningful, given our objectives. Therefore, all wetlands with an aerial photograph score of 25 or above or with an interspersion score of 4 (vegetative or open water) were field investigated.

All of these sites were evaluated following the INAI (White 1978) and MCNAI methods described in Appendix B. This provided a consistent method of analysis with those assessed in the existing MCNAI.

Any wetlands that contained Grade A, B, or C wetland communities, high quality wildlife habitat, or threatened or endangered species were given “high quality habitat” status. Sites were field evaluated by teams of 2 or more during September and October 1996. An individual experienced with NAI methods and plant identification participated on every team. A sample field inventory report form is included at the end of this section.

After these field evaluations were completed, the Technical Advisory Committee (TAC) became aware of known high quality sites that were not identified by our screening process for a variety of reasons. To better ensure that no aquatic resources of high quality were excluded, a final review of all aerial photographs was completed taking advantage of the local knowledge of TAC members. This resulted in an additional group of wetlands being field checked in May 1997.

It also should be noted that when the MCNAI was matched to the polygons on the base map for this study, it included streams. For streams that had an associated riparian wetland, this wetland

was not field checked, if the stream reach was already listed in the INAI or MCNAI as high quality. Thus, some wetlands may be included that do not have high quality plant communities or wildlife habitat *per se*, but whose existence is integral to the high quality nature of the MCNAI designated streams.

In addition, if any portion of a wetland polygon was an MCNAI site or was rated a high quality habitat during the field evaluations, the high quality habitat status was applied to the entire polygon. In some exceptional cases of large acreages with very disparate quality ratings, the polygons were split into separate units. In most cases, however, low quality habitat areas are included within a high quality wetland polygon as they are a part of the wetland likely provide important buffer functions.

Wetlands that scored in the high quality category (see flow chart at end of this section) are considered "irreplaceable." Wetlands evaluated but not designated high quality are placed into a second group or classification. Statements can be made as to the community type present, the grade (D or E), and the wildlife habitat present for the non-high quality wetlands that were field evaluated. For those that were scored from aerials (following the pre-field assessment data sheet), but with scores less than 25, statements can be made regarding the habitat/floristic functions provided based on that score. All grades and total scores are attributes in the database produced by this study, and this will provide information on the functions provided by the non-high quality wetlands. It will also allow reevaluation to assess if management strategies are improving the functional quality of a given wetland.

Aerial Photo Screening Sheet for Biological Functions

General Info/GIS Screen

WETLAND # _____ WETLAND NAME _____
LOCATION INFORMATION: _____
IS ANY PART OF SITE IN MCNAI? Y N IF YES, GRADE _____

(3) SIZE (acres)
(1) < 10 acres
(2) 11-25 acres
(3) 26-49 acres
(4) > 50 acres

NWI DESIGNATION _____

Aerial Photograph Information

1. DRAINAGE
(1) ditched
(2) visible tile drainage
(3) dammed (flow restricted or deep water created)
(4) natural, non-channelized drainage swale
(4) no visible drainage

2. EXCAVATED
(1) > 25% excavated
(2) 11-25% excavated
(3) 5-10% excavated
(4) no visible excavation

4. PHYSICAL INTRUSION AND BARRIERS (in current polygon regardless of previous extent of wetland)
(1) > 10% filled
(2) divided by barrier (*e.g.* road, RR embankment, berm)
(3) < 10% filled
(4) no apparent intrusion

5. SURROUNDING LAND COVER TYPE (predominant or most influential within 200 feet)
(1) developed (urban)
(2) farmed
(3) pasture, old field
(4) natural vegetation, undisturbed

Habitat Assessment

6. VEGETATION INTERSPERSION

(1) monotypic, near white phototone
(2) more than one vegetation type apparent
(3) 2 or more vegetation types present
(4a) category 1
(4b) category 2
(4c) category 3

7. NATURAL OPEN WATER INTERSPERSION

(1) cover category 1 or 8
(2) cover category 2 or 7
(3) cover category 4 or 6
(4) cover category 3 or 5

NOTE: Since the MCNAI system may not give adequate consideration during the field checks to hemi-marshes providing wildlife habitat, a score of 4 on question 6 or 7 will result in an automatic high quality designation if the conditions are verified.

COMMENTS:

Wetland Field Inventory Report Form

WETLAND # _____ WETLAND NAME _____
LOCATION INFO: T._____ R._____ SEC._____ QUAD._____
APPROX. ACREAGE: _____ WATERSHED: _____
NATURAL RESOURCES: (note, put complete species lists on back if needed)

Natural Community	Grade	Quality & Disturbance Description

Rare Plants	Rare Animals

OTHER SIGNIFICANT FEATURES:
GEOLOGICAL:_____
ARCHEOLOGICAL:_____

OTHER:_____
OWNERS:_____
PROTECTION STATUS:_____

MANAGEMENT PROBLEMS AND THREATS:

WILDLIFE HABITAT/FLORISTIC QUALITY-DIVERSITY EVALUATION FLOW CHART

Step	Criteria	Threshold
1. MCNAI	Has wetland already been identified as an undisturbed natural community through inclusion in the MCNAI?	Yes No
	If No 9 If Yes then High Quality	
2. Aerial screen remaining wetlands.	Evaluate wetland according to aerial photo screening sheet for biological functions.	score $ X score < X
	If total score < X or habitat score < Y then NOT High Quality. If total score $ X or if habitat score $ Y then 9	
3. Field evaluation of non-MCNAI sites	Field evaluate sites according to INAI/MCNAI grading system.	Grades A, B, C
	If Grade A, B, C then High Quality If habitat score verified $ Y then High Quality	
	If Grade D, E then NOT High Quality	

3. Streams - Aquatic Habitat

For this study, all stream reaches that were depicted on the base maps, which were derived for the U.S. Geological Survey "RF3" Reach Files, were evaluated. These included primarily perennial streams that would be expected to have a native fish community. Headwater streams, due to their intermittent nature, do not typically have a developed fish community. The purpose was to evaluate and identify streams that provided high quality aquatic habitat that could not be replaced through mitigation efforts. This evaluation of aquatic habitat focuses on the stream itself, regardless of its association with any wetlands.

Since many of the streams and rivers in McHenry County have been sampled, existing data was utilized as much as possible. Also, it was recognized that the Index of Biotic Integrity (IBI)(Karr 1981, Karr et al. 1986) represented an evaluation tool developed to assess the overall health and integrity of a stream using the fish community present as an indicator. For further description of this methodology, please refer to Appendix C.

IBI scores were placed on the map of streams for McHenry County as near the sampling station that generated the score as possible. Stream reaches were numbered according to the DLG data layer from IEPA. Where a single reach had a single IBI score, the match was straight forward. For reaches that had multiple scores, if the scores were similar (within 5 points) or all scores were above the high quality threshold of 41, the scores were averaged and applied to the reach. No instances were encountered where the scores were very dissimilar or where the stream character was known to change significantly within a given reach. In cases where a stream reach had no score, but was sandwiched between two reaches with the same score, the score was applied to the middle reach. If the sandwiched reach was known to be more similar to one adjacent reach than the other, then that score was applied. If no information was known about a reach that was located up or down stream from a reach with a score, the unscored reach remained without an IBI score. In a few cases, IBI scores known to be suspect due to sampling inefficiencies were deleted. Some key reaches without existing data were sampled using an electric seine and IBI scores were calculated to add to the database.

If any stream had an IBI score of 41 or greater based on existing fish data it was classified as high quality. This score of 41 corresponds to Class B (highly valued aquatic resource) streams in the Biological Stream Characterization of Illinois Streams (IEPA, 1989). Streams with IBI scores of 51 or greater are classed A (unique aquatic resource). Streams also were considered high quality if threatened or endangered species were present.

It also was considered that a given stream may have physical habitat structure that resembles a pre-settlement condition and provides excellent fish habitat, but lacks the fish populations due to water quality problems in the past or present. Thus, all streams that did not have an IBI score of 41 or higher and all streams that lacked any fish sampling data were evaluated for physical habitat features according to the criteria that follow and are summarized in the data form at the

end of this section. These criteria are adapted from the Lake County ADID study (Dreher et al. 1992). They are designed to facilitate screening from aerial photographs.

1. Watershed Condition of Reach The conditions in the headwaters of a stream will be a determining factor in the quality of the stream habitat. If the headwaters area is contributing a silt load to the stream this will cover the more desirable habitat substrates in the stream (cobbles, gravel, sand). In addition, the more obvious effect is the contribution of the headwaters to the water quality of the stream. As a practical estimation of the headwaters condition, the contributing watershed visible on the aerial photograph for each reach was evaluated.

2. Stream Channel Configuration It is generally accepted that a stream that maintains a natural channel configuration approximating that of a pre-settlement stream is more likely to provide high quality aquatic habitat. Thus, naturally meandering streams are rated higher than channelized streams.

3. Stream side Vegetation Stream side vegetation is important for in-stream aquatic habitat in two ways. The first relates to water quality and siltation, similar to the headwater conditions. If a streambank is naturally vegetated with forest or wetland vegetation it is less likely to slump, or contribute to siltation and water quality problems. In addition, stream side vegetation provides shade/cover over aquatic habitats. This is an important habitat component for many fish species.

4. Impoundments If a stream has been impounded it is likely that is was converted from a fast flowing system with natural stream morphology and hydraulics to a slow moving system that favors silt deposition. This slower moving system with its associated siltation provides lower quality aquatic habitat. This is due in part to changes in the dissolved oxygen content of the water (Butts and Evans 1978), as well as, other physical parameters.

After this aerial scoring of stream reaches, the distribution of total reach scores was examined graphically. The distribution resembled a very accentuated normal curve, with a pronounced peak at a score of 8. Different score totals were compared with the meaning of each metric and possible scoring combinations that could lead to the total. It was also determined that stream channelization and streamside vegetation were the most important and variable of the four metrics. Therefore, the channelization metric was weighted by a factor of 3 and the streamside vegetation by a factor of 2. In consideration of the scoring possibilities that could lead to a total weighted score of 18, it was determined to be the minimum score for a high quality designation.

It should be noted that comparing IBI scores with aerial photograph assessment scores (for those reaches with IBI data) showed no correlation. Field experience in McHenry County suggests that channelized stream reaches can recover in-stream habitat and consequently the biota, without recovering features visible on aerial photography. The fact remained, however, that a system was needed to evaluate the streams that lacked any fish sampling data on a countywide basis. Thus, it must be emphasized that the aerial photograph assessment of physical habitat features for reaches without IBI scores is, at best, a poor surrogate for actual data on the biota.

Those stream reaches with an IBI greater than 41, or a photo-interpretation score for physical habitat of greater than 18, or threatened or endangered species records (fish or mussels) were considered high quality. (See flow chart at the end of this section.)

Streams Aerial Photograph Assessment of Physical Habitat - Data Form

STREAM REACH# _____ STREAM NAME _____
LOCATION INFO: T._____ R._____ SEC._____ QUAD._____

IBI SCORE: _____ DATE OF MOST RECENT FISH DATA: _____

Aerial Photograph Assessment of Habitat Structure

circle best choice for each metric

1. Watershed Condition of Reach

(1) drained wetland, farming activities apparent
(1) urban development, impervious surfaces prevalent
(2) ditched wetland
(3) excavated or impounded wetland, scrub-shrub, reed canary grass, low quality vegetation
(4) unaltered wetland, pond, lake, native upland vegetation

2. Stream Channel Configuration

(1) > 25% channelized
(2) 6-25% channelized
(3) up to 5% channelized
(4) naturally meandered or essentially unaltered

3. Streamside Vegetation (within 150 feet)

(1) > 50% urban (little natural vegetation, mowed turf present, etc.)
(2) > 50% agricultural
(3) > 50% old field, pasture, shrub-scrub vegetation, reed canary grass
(4) > 50% wetland, floodplain forest, prairie, or other native vegetation

4. Impoundments

(1) > 16% of reach impounded
(2) 6 to 15% of reach impounded
(3) up to 5% of reach impounded
(4) no dams present

***TOTAL SCORE FOR REACH*:_____**

STREAMS AQUATIC HABITAT ASSESSMENT
FLOW CHART

Step	Criteria	Threshold
1. MCCD IBI	Does stream have recent MCCD or IDNR fish sampling data with IBI scores?	Yes No
	If No then step 3. If Yes then 9	
2. IBI score cutoff	Is average IBI score for stream from recent data above 41 or were T & E species present?	score $ 41
		score < 41
	If score $ 41 or T & E present then High Quality If score < 41 then step 3.	
3. Aerial screening of habitat structure	Evaluate stream reach physical habitat using criteria summarized in aerial photograph assessment data form.	score $ X
		score < X
	If score $ X then High Quality If score < X then not High Quality	

4. Lakes/Ponds - Aquatic Habitat

Lakes and ponds with permanent open water provide aquatic habitat that is distinct from that provided by streams and wetlands. For this study lakes and ponds were evaluated for their habitat quality independently of the evaluation of surrounding wetlands or tributary streams. The selected approach focused particularly on evaluation of ponds and lakes for aquatic plant diversity and fish communities, as indicators of the overall aquatic system integrity and health.

The first issue in assessing the aquatic habitat of lakes and ponds was to separate them from wetlands. Based on the types of lakes present in McHenry County, the definition used to separate lacustrine systems in Cowardin et al. (1979) was deemed appropriate. The definition of a lacustrine system includes wetlands and deep water habitats with all three of the following characteristics: 1) situated in a topographic depression; 2) lacking any persistent vegetation; and 3) total area exceeds 20 acres. Similar wetland and deepwater habitats totaling less than 20 acres were included if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth exceeds 6.6 feet (adapted from Cowardin et al. 1979). Thus, any waters of the United States map units designated as Lacustrine on the NWI were evaluated as lakes/ponds.

Most of the lakes and ponds in Illinois are man-made and most of these are stocked periodically with sport fish. The project emphasis was on the identification of the highest quality lakes and ponds in McHenry County in terms of aquatic habitat. Thus, gravel pits, quarry pits, and other excavated lakes were not evaluated. The following lakes were evaluated following the criteria described below and summarized in the data form at the end of this section: Bull Valley Hunt Club, Crystal Lake, Griswold Lake, Island Lake, Lake Defiance, Lake Elizabeth, Lake-in-the-Hills Lake #1, Lake Kilarney, Lily Lake, McCullom Lake, Pistakee Lake (bay only), Silver Lake, Thunderbird Lake, and Wonder Lake. The criteria were designed for field evaluation.

1. Percent shoreline vegetated by natural emergent plants This criterion was included due to the fact that vegetated shorelines are protected from erosion and stabilized. In addition, shoreline vegetation provides shade/cover and provides a littoral zone for aquatic organisms. Thus, lakes with a greater percentage of naturally vegetated shoreline were given a higher score than, for example, manicured lawn shoreline.

2. Abundance/frequency of exotic plant species. This criterion is based on the fact that non-native species such as Eurasian milfoil typically crowd out the native flora, thus reducing the biodiversity of the lake/pond. Lakes with exotic species in abundance receive a lower score than those with little or no invasion by exotics.

3. Abundance/frequency of exotic fish species. This metric is primarily targeted at the problem carp can cause in an aquatic system. Carp are an invasive species that is not only tolerant of poor water quality, but generally makes conditions worse. Their bottom feeding habits increase the

turbidity of the water, thereby reducing light penetration for vegetative growth and sight-feeding fish species. This typically causes an overall decline in the biodiversity of a lake/pond. Lakes with a greater abundance of Carp, compared to the total number of fish sampled, received lower scores.

4. Presence of threatened and endangered species. Consistent with the Lake County ADID study effort, the identification of a state or federally listed species resulted in automatic designation of a lake or pond as high quality aquatic habitat that is unsuitable for filling or dredging.

5. Fish species composition. The IBI was developed for use in evaluating stream fish communities, and has not been modified for use in evaluating the fish fauna of ponds and lakes. The approach here relies on the development of a typical species profile for the glacial lakes and deep marshes characteristic of McHenry County, and then measuring the similarity between the sampled lake and that profile. It is presumed that the profile represents a species composition that would have typified these lakes in their original pre-settlement condition prior to large-scale watershed alterations. Those lakes whose fish communities deviate significantly from the "ideal" profile are presumed to have become degraded from human activity (e.g., land use changes, fish species introductions, chemical applications, etc.), which would eliminate some species and promote the establishment of others. Fish species composition would tend to become skewed toward ubiquitous, tolerant species, representing a loss of value.

There are few, if any, species in the study area that are entirely restricted to lakes and ponds. Rather, the species list developed for the profile includes those "signature" species that tend to reach their greatest abundance or frequency of occurrence in high quality glacial lakes and deep glacial marshes, and which represent a recurring assemblage in such habitats. The list was developed by reviewing existing sampling data from lakes in the study area, and by consulting distribution records and ecological notes from Smith (1979) and Becker (1983). In the case of sport fishes, it was necessary to have reasonable evidence that they were present in significant numbers prior to widespread stocking, whether or not current populations are supplemented or maintained by stocking.

The list consists of 26 species. The index is based on the total number of listed species found at the site being evaluated.

The following list of fishes was used as the characteristic species profile. Latin names follow Robins et al. 1991.

Latin Name	Common Name
Lepisosteus osseus	Longnose gar
Amia calva	Bowfin
Umbra limi	Central mudminnow
Esox americanus	Grass pickerel

Esox lucius	Northern pike
Notropis anogenus	Pugnose shiner
N. heterodon	Blackchin shiner
N. heterolepis	Blacknose shiner
N. hudsonius	Spottail shiner
Opsopoeodus emiliae	Pugnose minnow
Erimyzon sucetta	Lake chubsucker
Ameiurus melas	Black bullhead
A. nebulosis	Brown bullhead
Noturus gyrinus	Tadpole madtom
Fundulus diaphanus	Banded killifish
Fundulus dispar	Starhead topminnow
Labidesthes sicculus	Brook silverside
Micropterus salmoides	Largemouth bass
Lepomis gibbosus	Pumpkinseed
Lepomis gulosis	Warmouth
Pomoxis annularis	White crappie
P. nigromaculatus	Black crappie
Perca flavescens	Yellow perch
Percina caprodes	Logperch
Etheostoma exile	Iowa darter
Etheostoma microperca	Least darter

6. Richness and diversity of aquatic plant community. As with wetlands, the richness and diversity of plant species present in a lake is indicative of a more natural system than a lake dominated by a few common species. There is, however, a limited number of vascular plant species that occur in the deeper water habitats of lakes and ponds, and all are considered conservative to this habitat (see Native Mean C in Appendix D). For this evaluation, the list of plant species that occur in lakes and ponds in McHenry County was assembled based on the information in Swink and Wilhelm (1994). This list includes 50 total species, with three non-native species (see Appendix D). A review of all available existing aquatic plant data from the lakes of McHenry County revealed that for a system generally regarded as a high quality, natural lake ecosystem, one could expect approximately 14 or more native aquatic plant species. Review of the existing, though scant, data from other lakes resulted in the scoring summarized in the given in the lakes data form. This approach is based on the rationale that a lake with a higher number of native aquatic plant species will provide better aquatic habitat for fish, birds and other animals, as well as, being of higher floristic quality.

Lakes and ponds with a total field assessment score greater than or equal to 18, or with identified threatened or endangered species, will be considered high quality lakes. Lakes and ponds with a score of less than 18 have a certain level of biological function that can be described based on that score. The score and a description of all lakes evaluated is part of the database and has been distributed to the lake owners/managers. Finally, lakes or ponds that were artificial in origin or

too small to be classified as lacustrine will not be evaluated and thus placed in our third category. This third category will include golf course ponds, gravel pit lakes, quarry lakes, farm ponds, etc. (See flow chart at the end of this section.)

Lakes Field Assessment Data Form

LAKE NAME: _____ WETLAND #: _____
LAKE TYPE (impoundment, natural, natural but controlled, excavated, etc): _____

LOCATION : T _____ R _____ SEC _____ QUAD _____

APPROXIMATE ACREAGE: _____ WATERSHED _____
(*Circle best choice for each metric*)

1. PERCENT SHORELINE VEGETATED BY NATIVE EMERGENT PLANTS.

   (1) < 10% (2) 11-25% (3) 25-50% (4) 50-100%

2. ABUNDANCE/FREQUENCY OF EXOTIC PLANT SPECIES (*e.g.* Eurasian milfoil).

   (0) abundant (2) moderate (3) rare (4) none

3. ABUNDANCE/FREQUENCY OF EXOTIC/PROBLEMATIC FISH (*e.g.* carp).

   (0) abundant (>25%) (2) moderate (10-25%) (3) rare (1-10%) (4) none (0%)

4. PRESENCE OF THREATENED AND ENDANGERED SPECIES (fish or plant).

   Yes - automatic High Quality No - no score for this criterion

5. NUMBER OF CHARACTERISTIC FISH SPECIES PRESENT.

   (1) < 6 (2) 6-10 (3) 11-14 (4) > 14

6. RICHNESS OF AQUATIC PLANT COMMUNITY.

   (0) No floating, floating-emergent, or submergent vegetation present.
   (1) Only non-native species present OR only 1 species present.
   (2) < 5 native species of aquatic vegetation present.
   (3) 5-8 native aquatic species present.
   (4) >8 native aquatic species present.

TOTAL SCORE FOR LAKE: _____

LAKES/PONDS AQUATIC HABITAT ASSESSMENT
FLOW CHART

Step	Criteria	Threshold
1. Lake/Pond versus wetland	Is polygon designated with Lacustrine category on NWI?	Yes No
	If No then evaluate under wetlands or streams methodology.	
	If Yes then 9	
2. Screen artificial lakes/ponds	Is lake/pond known to be man-made through excavation (*e.g.* golf course, gravel pit, etc)?.	Yes No
	If Yes then no further evaluation.	
	If No then 9	
3. Evaluate natural lakes/ponds in field	Evaluate lakes/ponds in the field according to the criteria given in the Lakes Field Assessment Data Form.	Score $ X Score < X
	If score $ X or T & E present then High Quality	
	If score < X then not High Quality	

D. Methodology for Water Quality and Stormwater Storage Functions

1. Overview of Approach

The evaluation methodology described below is intended to identify wetland characteristics that provide important water quality mitigation and stormwater management functions. The premise for this evaluation is that, in addition to their well-known value as natural habitats, wetlands provide important societal and environmental benefits to adjacent and downstream areas -- specifically the natural filtering and transforming of pollutants in runoff water, the stabilization of erosive shorelines and streambanks, and the reduction of flooding by storing stormwater.

In identifying these wetland benefits, it should not be misconstrued that wetlands are intended to single-handedly mitigate the effects of upstream development and adjacent disturbances. Wetlands can provide the identified benefits in a sustainable fashion only if they are not overloaded. It is critical, in addition to preserving these natural functions of wetlands, that best management practices be applied to development activities to minimize their hydrologic and water quality impacts.

In assessing water quality and stormwater functions, the evaluation methodology distinguishes three categories of wetlands. By their very nature, all wetlands provide some level of water quality and stormwater functions. As an initial step, this methodology identifies wetlands that provide more substantial benefits and designates these as "significant value" wetlands. The methodology next identifies those wetlands that provide "high functional value." Such wetlands are considered to be particularly important because of their position within the landscape or watershed and/or their size. By distinguishing between different levels of wetland functional value, more effective strategies for wetland protection can be designed and implemented.

Determining High Functional Value Wetlands

High functional value is intended to indicate that a wetland provides exceptionally important benefits or functions worthy of extraordinary protection and management considerations. As previously discussed, high quality habitat wetlands generally are considered irreplaceable and unmitigatable. Irreplaceability is generally more difficult to claim for most water quality and stormwater storage functions, however. It has been demonstrated that with proper site selection, design, and long-term management these functions often can be replaced, and even enhanced. A notable example is the documented sediment and nutrient removal in restored and created wetlands at the Des Plaines River Wetlands Demonstration Project in Lake County.

Consequently, the high functional value designation for water quality and stormwater control functions is not equivalent to the "high quality" designation for habitat functions. The following procedure was utilized for determining high value for the water quality and stormwater functions.

If a wetland met either of the following conditions it was considered a high functional value wetland for water quality and/or stormwater functions.

Condition 1: The existence of a combination of water quality and stormwater functions in an individual wetland generally is indicative of greater value than if only one significant function is present. Further, replacement of multiple functions is generally more difficult than replacing an individual function. For example, stormwater storage value is principally related to the size and outlet characteristics of the wetland, whereas effective nutrient removal also requires the presence of appropriate wetland soils and vegetation. Based on these considerations, a wetland was considered to have high functional value if it met the "significant value" criteria for three of a possible four water quality and stormwater storage functions. This approach is consistent with the methodology utilized for the Lake County ADID project.

If a wetland qualified as a high functional value wetland under condition 1, then condition 2 did not need to be checked. Otherwise, condition 2 was evaluated for any wetland that met the "significant value" criterion for any one of the four water quality or stormwater functions, as described below.

Condition 2: If it can be shown that any one function is critical due to a wetland's size or its location in the landscape with respect to downstream or adjacent resources, this wetland should be considered to have high functional value. A wetland's place in the landscape, or a watershed, often is critical to establishing its value in providing certain functions. For example, stormwater storage and flow dissipation functions are critical to prevent hydrologic destabilization and erosion in downstream channels. Similarly, nutrient removal is critical upstream of a sensitive lake. If a wetland which provides either of these functions is destroyed and replaced at some other location, even in the same watershed, these benefits may be substantially reduced or lost and the local resource will be impaired. Further, the timing of mitigation is critical. A created wetland may take an extended period of time to reach a high level of performance, particularly for functions such as nutrient removal which depend on the presence of an abundant wetland plant community. In the interim between destruction of the original wetland function and replacement of this function in a mitigation wetland, considerable environmental damage may result.

To assess condition 2, additional criteria have been established for each water quality and stormwater storage function. These criteria establish a wetland's value with respect to its position in the landscape or watershed, and/or its size. These criteria are used to elevate a wetland to the high functional value category after it first meets the basic criteria for significant value for one or more individual functions.

Because this methodology considers the location of a wetland with respect to downstream or adjacent high quality habitats, procedurally this required that water quality functions were evaluated after habitat function determinations were completed. Further, if a particular wetland was determined to be a high quality habitat, no further assessment (i.e., field checking) was done to verify whether it may have been of high functional value for water quality or stormwater

functions. The rationale for this decision considered the limited project resources and the fact that a high quality habitat was the highest designation possible and, correspondingly, would afford the highest level of protection.

2. Overview of Water Quality Mitigation Functions

Wetlands are widely known to provide valuable water quality mitigation functions that protect adjacent or downstream waterbodies. Based on a review of several references, particularly the Wetland Evaluation Technique (WET) manual (Adamus et al., 1987), the Oregon Method (Roth et al., 1993), and the Minnesota manual (U.S. Army Corps of Engineers, 1988), several water quality mitigation functions are considered to be important in McHenry County. These functions include the ability of wetlands to provide for:

- shoreline and streambank stabilization,
- sediment and toxicant retention, and
- nutrient removal and transformation.

Other water quality mitigation functions of wetlands, such as the protection of groundwater recharge areas, were considered for evaluation. However, it was concluded that these evaluations generally would require detailed site-specific data, beyond the capabilities of this ADID project, for accurate assessments to be performed.

The evaluation and quantification of the selected functions in individual wetlands can be very complex and the referenced methodologies describe fairly elaborate approaches to perform thorough evaluations. However, because of the large number of wetlands to be considered, it is necessary to adopt a simpler evaluation procedure. The approach described in this report and endorsed by the ADID TAC involves an integrated procedure incorporating GIS screening; aerial photo/map evaluation; and field evaluation, as needed. Due to project budgetary constraints, field evaluation was done only for wetlands that were determined to meet preliminary criteria for high functional value. The methodology includes an assessment of the *opportunity* of an individual wetland to perform a specified function to a significant degree as well as its expected *effectiveness* in performing the function.

3. Shoreline/Streambank Stabilization

This function is derived from the WET function of "sediment stabilization" which is defined as the ability to bind soil and dissipate erosive forces (Adamus et al., 1987). This function is similar to the "shoreline anchoring" function described in the Minnesota Wetland Evaluation Methodology (U.S. Army Corps of Engineers, 1988). Shoreline/streambank stabilization is provided by wetland vegetation along the shore of a lake or the bank of a stream or river. Stabilization prevents the erosion of the shore or bank and also stabilizes accumulated bottom sediments. Stabilization is provided both by the soil-binding capability of the root system as well as the capacity of erect, emergent, or floating-leaved vegetation to dissipate the erosive forces of waves or currents.

Significant Value Determination

The first step is to determine whether a given wetland has a significant opportunity to perform shoreline or bank stabilization. This opportunity is based on the presence of potentially erosive forces in an erodible environment. The recommended method is adapted from WET. It is assumed that there is a significant potential to perform the function of shoreline/streambank stabilization if there is the presence of flowing water, such as in a perennial stream, or there is open water, as in a lake or pond.

The U.S. Army Corps of Engineer's regulatory definition of a headwater stream, which is a stream with an average annual flow of at least 5 cubic feet per second (cfs), was chosen as the cutoff for determining the presence of flowing water. In McHenry County, a stream with a natural flow of 5 cfs will typically have a drainage area of about 7 square miles. It is assumed in this interpretation that wetlands have less opportunity to perform bank stabilization in small, intermittent headwater streams. A determination of headwater stream status is facilitated by a file of headwater locations which is maintained by the Corps. The Corps' criterion for headwater is a watershed areas less than 7.1 square miles. Where Corps determinations were unavailable, an estimated cutoff was determined by overlaying watershed boundaries over the wetland/stream inventory.

The presence of open water was determined by screening for open water bodies identified in the Northeastern Illinois Planning Commission (NIPC) 1990 Land Use Inventory. Such waterbodies are typically a minimum of 2.5 acres in size, which generally corresponds to widths of at least 100 feet. The selection of a minimum open water size was based on the need for shoreline stabilization. It is assumed that very small, non-flowing water bodies (e.g., narrower than 100 feet) will be less susceptible to shoreline erosion due to minimal opportunity for wave buildup. Therefore the opportunity, or need, for shoreline stabilization is low.

Screening to determine adjacency (i.e., touching) between a wetland and a mapped stream or open waterbody was implemented by querying the NIPC GIS. Recognizing inherent horizontal accuracy limitations of certain databases, this query actually identified wetlands within roughly 150' of a stream (from USGS 1:100,000 hydrology file) or pond/lake (from NIPC's land use inventory). If the GIS screen indicated adjacency, it was subsequently verified from aerial photos.

In addition to checking for adjacency to streams or waterbodies, it was determined that the presence of stabilizing wetland vegetation must occur for a length of at least 500 feet along a streambank or lake shore to qualify as a "significant" function. This determination was made by reviewing quad-scale GIS maps and/or aerial photos, as appropriate.

Effectiveness in performing shoreline and bank stabilization is a function of the width of stabilizing vegetation present. WET references a width of at least 20 feet of erect vegetation. The selected methodology adopted this width for lacustrine shoreline environments. However, the selected methodology adopted a minimum width of erect vegetation of 10 feet for riverine environments. This decision was based on actual observations and experience in northeastern Illinois where relatively narrow widths of wetland vegetation appear to be quite effective in providing streambank stabilization.

WET indicates that one of the following vegetation conditions must be present for this function to be supported at a high level: presence of erect vegetation (greater than 20 foot width), presence of forest of scrub-shrub, or good water and vegetation interspersion. It indicates that riverine and contiguous palustrine wetlands will never be rated low by these criteria and that most palustrine wetlands with some open water will be rated high.

An initial evaluation of effectiveness based on vegetation width was performed using information from GIS maps. However, the information available on GIS maps was not adequate by itself and was supplemented by a review of aerial photos. Further, field evaluations were performed to verify high functional value wetlands.

After performing screening based on GIS mapping, aerial photographs (1 inch = 400 feet) were analyzed to check the above criteria. Certain types of wetland environments, including lacustrine wetlands (i.e., lakes) with manicured shorelines, artificial excavated ponds with steep sides (e.g., detention basins), and channelized or artificially armored stream channels, were immediately excluded from further consideration based on review of aerials. In most cases these types of "man-made" environments won't have riparian wetland vegetation and even if riparian wetlands are present it is likely that the waterbody could benefit from restorative modifications. Aerial photo interpretation also was used to detect the presence of obvious Reed Canary Grass borders. If shallow-rooted Reed Canary Grass is prevalent in a riparian zone, field experience indicates that shoreline stabilization is problematic (see below). Reed Canary Grass is readily detectable as a light-colored monotone on aerials made in dormant seasons.

High Functional Value Determination

A wetland was determined to provide high functional value if it met the significant value criteria described above and it bordered a high functional value lake or stream. The rationale for this approach is that high functional value lake and stream habitats are highly dependent on stable, non-eroding shoreline/streambank environments. Therefore, the sustainability of these habitats is greatly enhanced if stabilizing riparian wetlands are present.

The determination of wetland adjacency to a high quality stream or lake was determined using the GIS as a screen, as described previously.

As indicated previously, field checking was performed to verify the characteristics of potential high functional value wetlands. Field checking for this function was used principally to verify that vegetatively stabilized conditions were actually present. The field check verified whether the bank or shoreline was experiencing excessive erosion, whether the width criteria specified above were met, and whether the riparian wetland plant community consisted of species likely to provide long-term soil stabilization. Field evaluation was particularly important in identifying situations where the streambank or lake shore may have been vegetated by undesirable, invasive species that were not providing effective stabilization. For example, there are several common trees and shrubs which shade out understory vegetation, resulting in barren soil during the non-growing season. There also are grasses and groundcovers, such as Reed Canary Grass, that are shallow-rooted and generally are ineffective at stabilizing erosive streambanks and shorelines. Field evaluators considered the guidance of the DuPage County Department of Environmental Concerns which has identified the following plants as undesirable in riparian zones: Box Elder, Common and Glossy Buckthorn, Multiflora Rose, Tartarian Honeysuckle, Reed Canary Grass, and Garlic Mustard (Rust Environment and Infrastructure, 1995). If field checking indicated that the riparian plant community was dominated by undesirable non-natives, experience indicates that it would be unlikely that stabilized conditions exist and, therefore, it was assumed that the high functional value condition was not met.

This methodology is summarized in the following data sheet.

Shoreline/Streambank Stabilization Data Sheet

Shoreline/Streambank Stabilization Candidate: (potentially adjacent to open water or perennial stream based on GIS screen)

Map/Aerial Check:

1) Is wetland adjacent to an open water body or perennial stream (~7mi^2 or larger watershed) for at least 500 feet:

based on GIS map?	Yes	No	Unclear
If unclear, based on aerial photo?	Yes	No	

(**If no, STOP)**

1a) Is wetland adjacent to high quality habitat function lake or stream for at least 500 feet (for HQ determination):

based on GIS map?	Yes	No	Unclear
If unclear, based on aerial photo?	Yes	No	

2) If yes to #1, is the majority of the wetland buffer length vegetated in reed canary grass, based on aerial photo interpretation? Yes No

(If yes, STOP)

3) If no to #2, is the wetland buffer at least 20 ft. wide along lake shoreline (from aerial photo)?
Yes No

4) Or, is the wetland buffer at least 10 ft wide along a streambank (from aerial photo)?
Yes No

(If no to #3 and #4, STOP)

<u>If yes to #3 or #4, a significant stabilization function is provided</u>.
Mark the appropriate box on the table at the top of the sheet.

High Functional Value Determination: (potentially adjacent to a HQ lake or stream based on GIS screen)

5) Are #3 <u>or</u> #4 (basic function) <u>and</u> #1a answered yes? Yes No

(If no, STOP)

<u>If yes, then a field check is needed.</u>

Check the field check needed box and the HQ candidate box at the top of the sheet.

Field Check:

6) If yes to #5, is the majority of the buffer length composed of erect vegetation, or forest of scrub-shrub, or good water and vegetation interspersion along lake or stream in a stable environment?

Yes No

<u>If yes to #6, a high value stabilization function is provided.</u>
Mark the HQ verified box on the table at the top of the sheet.

4. Sediment/Toxicant Retention

WET defines this function as the ability to trap or retain on a net annual basis inorganic sediments and/or chemical substances generally toxic to aquatic life. Wetlands are widely noted for their ability to perform this function. The value of an individual wetland in performing sediment/toxicant retention is related to its size and other physical characteristics as well as the presence of potential contaminant sources upstream. Sediment/toxicant retention involves primarily physical, but also chemical and biological, mechanisms. Water entering a wetland, either as stormwater runoff or as streamflow, generally slows due to ponding. Particles in the water have an opportunity to settle due to slower velocities and the trapping effects of wetland vegetation. Trapped sediments, often contaminated with toxicants such as heavy metals, are then subject to biological processes such as plant uptake. The sediments also may be altered chemically, resulting in the immobilization of constituents, or conversion to less toxic forms.

Significant Value Determination

The procedure for evaluating wetlands for the sediment/toxicant retention function started with a screening step. All other things being equal, it is arguable that a large wetland is more valuable than a small wetland in providing this function because it is capable of retaining a greater quantity of sediment and toxicants. Considering this factor, and the large number of wetlands in the county, wetlands smaller than 5 acres were not further evaluated for this function. To verify the appropriateness of this 5 acre cutoff, a GIS screen was run on the completed NRCS wetland inventory. It indicated nearly 70 percent of the non-farmed wetlands in the county were less than 5 acres in size but these wetlands constituted only about seven percent of the total wetland acreage. In other words, exclusion of wetlands less that 5 acres greatly reduced the evaluation workload without a significant reduction in the wetland acreage considered.

The GIS screen did not include farmed wetlands (FWs in the NRCS McHenry County inventory). Farmed wetlands are, by definition, usually farmed, which precludes the establishment of wetland vegetation. Without wetland vegetation, and with the disturbances associated farming activities (e.g., pesticide applications, plowing, and drainage), sediment and toxicant retention capabilities will be less than in non-farmed wetlands.

The next step in the methodology was an evaluation of the opportunity to perform the function of sediment/toxicant retention. It is assumed in this methodology, as in WET, that there is a high opportunity for sediment/toxicant retention if the upstream watershed contains significant nonpoint and/or point sources of sediment or toxicants. Examples of sources include row crops, construction activities, commercial developments, and wastewater discharges. These types of conditions are almost always present in McHenry County wetland watersheds.

The next step in evaluating wetlands for sediment/toxicant retention was a determination of effectiveness. A wetland was considered effective at providing sediment/toxicant retention if it met one of the following conditions (derived from WET): the wetland had no defined low-flow outlet, a constricted outlet, or was impounded; the wetland was vegetated with erect, persistent vegetation in a depositional environment; or there was actual evidence of sediment accretion. (Similarly, the Oregon Method requires evidence of occasional flooding or ponding.) In contrast, a wetland was assumed to be relatively ineffective at providing sediment/toxicant retention if it was tilled; it was channelized and infrequently inundated; or if prevailing current velocities exceeded suspension thresholds of sediment. Based on these factors, farmed wetlands were excluded from further consideration for this function. While it was agreed that many farmed wetlands perform as depositional zones for the surrounding landscape, their sediment removal functions would likely be compromised by tillage and drainage activities.

In some cases, such as for an impounded wetland, interpretation of aerial photographs was adequate to make this determination. However, as discussed below, field checking was necessary to verify high functional value wetlands.

High Functional Value Determination

A wetland was determined to provide high functional value if it was upstream of a high quality habitat lake, stream, or non-riparian wetland, and the wetland was greater than 10 acres in size. The rationale for this approach is that high quality lake, stream, and wetland habitats are highly dependent on clear, uncontaminated water sources. Therefore, upstream wetlands that provide a sediment/toxicant retention function are, cumulatively, critical to the protection of these highly valued resources. The "non-riparian" distinction was made for high quality wetlands based on the argument that riparian wetlands (e.g., in a floodplain) would receive less benefit than depressional wetlands. The rationale is that depressional wetlands routinely receive surface runoff from upstream sources whereas riparian wetlands generally receive surface flow only during flood conditions. Therefore, they would benefit less from upstream wetlands providing this function.

The use of a 10 acre cutoff size (versus a 5 acre cutoff) was intended to further distinguish significant functions from highly valued functions.

Field checking was required to verify high functional value wetlands. The field check considered the following criteria: the wetland has no defined low-flow outlet, a constricted outlet, or is impounded; the wetland is vegetated with erect, persistent vegetation in a depositional environment; or there is actual evidence of sediment accretion. It was generally understood that most McHenry County wetlands lie in depressional or depositional environments and would meet these criteria.

This methodology is summarized in the following data sheet.

Sediment/Toxicant Retention Data Sheet

Sediment/Toxicant Retention Candidate: (GIS screen determines that W wetland is > 5 acres)

A significant sediment/toxicant retention function is assumed to be provided.

High Functional Value Determination: (wetland is > 10 acres based on GIS screen)

Map Evaluation:

1) Is the wetland upstream of a high quality habitat lake, stream, or non-riparian wetland:

based on GIS map?	Yes	No	Unclear
If unclear, based on aerial/soils map/HA?	Yes	No	

(If no, STOP)

If yes, a field check is needed.

Check the field check needed box and the HQ candidate box at the top of the sheet.

Field Check:

2) Does wetland meet any of the following conditions:

a) No outlet, constricted outlet, or impounded?	Yes	No
b) Vegetated with erect, persistent vegetation in a depositional environment?	Yes	No
c) Evidence of sediment accretion present?	Yes	No
d) Evidence of occasional flooding or ponding?	Yes	No

If yes to any of #2a through #2d, a high value sediment retention function is provided.

Mark the HQ verified box on the table at the top of the sheet.

5. Nutrient Removal/Transformation

WET defines nutrient removal/transformation as the retention or transformation of inorganic phosphorus and/or nitrogen into their organic forms, or the transformation of nitrogen into its gaseous form, on either a net annual basis or during the growing season. This function is similar in many respects to sediment/toxicant retention. However, while sediment/toxicant retention is considered to be of substantial value to all downstream waterbodies and wetlands, nutrient removal/transformation is assumed to be of particular value in McHenry County only if the wetland in question is upstream or adjacent to a lake, impoundment, or a high quality habitat wetland. This distinction is made because of the serious eutrophication effects of excess nutrients on impounded waters. High nutrient loading also has been associated with reduced diversity in wetland plant communities and the predominance of less desirable species.

The impact of nutrients on flowing waters is less significant due to a lower propensity to develop problems related to excess vegetation, particularly algae. This is due, in part, to the flushing effects of flowing water. In this regard, it is important to note that the entire Fox River system is considered to be an impoundment that is subject to eutrophication impacts because of the Chain O'Lakes and the series of low-head dams downstream.

Significant Value Determination

The procedure for evaluating wetlands relative to this function started with a GIS screening step to eliminate from further evaluation all wetlands smaller than 5 acres. All other things being equal, it is arguable that a large wetland is more valuable than a small wetland in providing this function because it is capable of removing or transforming a greater quantity of nutrients. By eliminating all wetlands smaller than 5 acres from consideration, a more manageable number could be evaluated in greater detail. The appropriateness of a 5 acre cutoff was documented in the discussion of the sediment/toxicant retention function.

The preceding GIS screen excluded farmed wetlands (FWs in the NRCS McHenry County inventory). Farmed wetlands are, by definition, usually farmed, which precludes the regular establishment of wetland vegetation. Without wetland vegetation, and with the disturbances associated with farming activities (e.g., fertilizer applications, plowing, and drainage), nutrient removal/transformation capabilities would be seriously compromised.

The second step in this evaluation was a determination of the opportunity of a wetland to perform the nutrient removal/transformation function to a significant degree. Initially, a check was made to determine that the wetland was in the palustrine or riverine category. Wetlands that are strictly lacustrine (i.e., a narrow band at the edge of a lake or pond) without substantial adjacent palustrine areas were excluded from consideration. The rationale was that lacustrine wetlands primarily transform or recycle nutrients internally within the lake, thereby providing relatively

little nutrient removal benefit. Palustrine wetlands which extend beyond the periphery of a lake, on the other hand, may be very effective in controlling the input of nutrients and their related adverse impacts on a lake. This distinction was made by evaluating GIS maps and/or aerial photographs.

Opportunity to remove or transform nutrients also is judged on the basis of the presence of potential point or nonpoint sources of nutrients in the upstream watershed, as recommended in WET. Just as for sediment and toxicants, it is assumed that virtually all wetlands in McHenry County lie downstream of significant potential nutrient sources.

Another criterion used to judge whether there was significant opportunity, or benefit, for nutrient removal/transformation was the presence of a lake/impoundment or high quality habitat wetland downstream of the wetland that would benefit from this function. The definition of a lake or impoundment was based on the Illinois Department of Natural Resources criterion of at least six acres in size. Waterbodies less than six acres are defined as ponds.

It also was necessary to show that the wetland was hydrologically connected and upstream of the lake or high biological function wetland. Hydrologic connection was determined by checking mapped surface water features from the GIS maps and verified using county soils maps or USGS Hydrologic Atlas Series maps in situations of uncertainty.

The final step in this evaluation was the interpretation of wetland effectiveness in providing nutrient mitigation functions. Two criteria were considered based on WET. To be effective in removing or transforming nutrients, a wetland should have no outlet, a constricted outlet, or be impounded; or it should be vegetated with woody, floating-leaved, or persistent emergent vegetation in a low velocity environment. WET adds that sediment retention is often, but not always, accompanied by nutrient retention. These conditions were evaluated on a preliminary basis using aerial photos. Verification of high functional value required a field check, as described below.

High Functional Value Determination

A wetland was determined to provide high functional value for nutrient removal if it met the preceding criteria and was upstream of a high quality habitat lake/impoundment or non-riparian wetland, and was larger than 10 acres in size. The rationale for these criteria begins with the understanding that wetlands or lakes supporting high quality habitats are highly dependent on upstream water sources that are relatively low in nutrient content (i.e., to avoid eutrophication and to preserve floristic quality). Therefore, upstream wetlands that provide a significant nutrient removal/transformation function are, cumulatively, critical to the protection of these highly quality lake and wetland habitats. The proximity of the upstream wetland to the high quality lake or wetland is not that important due to the relatively short flow times which exist at the watershed scales found in McHenry County (typically less than one day between any upstream wetland and a downstream lake or wetland).

The use of a 10 acre cutoff size (versus a 5 acre cutoff) was intended to further distinguish significant functions from highly valued functions.

Field checking was performed to verify high functional value wetlands. The field check considered the following criteria: a wetland should have no outlet, a constricted outlet, or be impounded; or it should be vegetated with woody, floating-leaved, or persistent emergent vegetation in a low velocity environment. Most McHenry County wetlands, excepting hillside fens, for example, would meet these effectiveness criteria.

This methodology is summarized in the following data sheet.

Nutrient Removal/Transformation Data Sheet

Nutrient Removal/Transformation Candidate: (GIS screen determines that W wetland is > 5 acres)

Map Evaluation:

1) Is wetland upstream of a lake/impoundment (> 6 acres) or high biological function value non-riparian wetland (see countywide map):

based on GIS map?	Yes	No	Unclear
If unclear, based on aerial/soils map/HA?	Yes	No	

(If no, STOP)

1a) Is the wetland upstream of a high biological function value lake or non-riparian wetland based on aerial/soils map/HA map (for HQ determination, see below)?

Yes No

2) If yes to #1, is wetland palustrine or riverine (i.e., not a narrow lacustrine buffer) (from aerials and/or NWI)? Yes No

(If no, STOP)

<u>If yes, a significant nutrient removal/transformation function is provided.</u>
Mark the appropriate box on the table at the top of the sheet.

High Functional Value Determination: (wetland is > 10 acres based on GIS screen)

Map Evaluation:

3) Are #1a and #2 yes? Yes No

(If no, STOP)

<u>If yes, then a field check is needed.</u>
Check the field check needed box and the HQ candidate box at the top of the sheet.

Field Check:

4) If yes to #3, does wetland meet either of the following conditions:

a) No outlet, constricted outlet, or impounded? Yes No

b) Vegetated with woody, floating leaved, or persistent emergent vegetation in a low velocity environment? Yes No

(If no to both, STOP)

<u>If yes to either #4a or #4b, a high value nutrient removal function is provided.</u>
Mark the HQ verified box on the table at the top of the sheet.

6. Stormwater Storage/Hydrologic Stabilization Function

Background

The value of wetlands for controlling flooding and stabilizing streamflows is widely recognized. Wetlands serve as natural water storage areas during periods of high runoff and streamflow. Riparian or floodplain wetlands temporarily store runoff, reducing peak streamflows. Depressional wetlands typically hold runoff for longer periods of time as water slowly discharges through constricted outlets, infiltrates into the ground, and evaporates. By altering both the timing and total volume of runoff, such wetlands can dramatically reduce flood flows, stabilize flow variations, and supplement baseflows in receiving streams.

Certain functions of stormwater storage in wetlands are replaceable in the sense that storage volume in one location can be reproduced by excavation or impoundment in another location. However, certain stormwater functions may be more difficult to replace. The location of the storage, for example, is critical. Wetland storage immediately upstream of a developed area is more valuable for flood prevention than a similar quantity of storage downstream of the development. The nature of stormwater storage in wetlands, particularly as it relates to the complex interrelationships between evaporation, groundwater recharge and discharge, and surface outflow, also is critical because it affects both hydrologic (e.g., runoff volume and timing) and hydraulic (e.g., runoff rate) functions. In particular, organic wetland soils have been shown to literally soak up runoff water and release it slowly over time. For these reasons, wetland storage typically cannot be effectively replaced with simple manmade structures, such as stormwater detention basins, that are designed to deal with only hydraulic functions.

Significant Value Determination

The determination of whether a wetland provides a significant stormwater storage function considered the wetland area, location of the wetland relative to regulatory floodplains, and its potential to retain stormwater. The assessment procedure for these factors is described below.

The area of a wetland is a good indicator of the relative storage volume of the wetland. In general, the larger the area of the wetland the more runoff it will be able to store, infiltrate, and evaporate. Consistent with the rationale presented for the sediment removal and nutrient transformation functions, all wetlands smaller than five acres were excluded from further consideration for the significant value determination for stormwater storage. The five acre determination was made using the GIS as a screening tool.

Unlike the methodologies used for sediment and nutrient removal, farmed wetlands (FWs in the NRCS McHenry County inventory) were included as candidates for the stormwater storage significant value determination, as long as the wetland functioned to retain stormwater. The lack

of wetland vegetation in a farmed wetland was considered to have relatively little effect on the stormwater storage function.

It was assumed that most wetlands which fall primarily within a regulatory, riverine floodplain are freely drained to a stream or other waterbody. Since such wetlands only temporarily store runoff during runoff events, it was argued that their storage generally is not as beneficial as storage in non-riverine depressional wetlands. Depressional wetlands, as described above, retain water for longer periods of time and, thereby, tend to be more effective in preserving beneficial hydrologic conditions. Based on this reasoning, if at least 50 percent of the area of a wetland was within a regulatory, riverine floodplain (as identified on Federal Emergency Management Agency (FEMA) floodplain maps), it was be considered a floodplain wetland and was not considered further for the stormwater storage function.

The determination of floodplain versus non-floodplain wetlands was made utilizing the GIS as a screening tool. However, because FEMA floodplains include some isolated, non-riverine depressions, additional checking of GIS maps was necessary to avoid excluding these depressions.

The final step was to determine whether the wetland had significant potential to retain stormwater. The criteria for this determination were that the wetland lay in a depression with either no surface outlet or a constricted outlet, or the wetland was impounded. Based on a general familiarity with McHenry County wetlands, it is known that most non-floodplain wetlands would meet this criterion. One known exception is hillside seeps (e.g., fens). A preliminary determination was made using U.S. Geological Survey Hydrologic Atlas (HA) series maps that identified non-riparian depressions that were inundated during the flood of record. Aerial photographs also could be reviewed to provide evidence of ponding.

High Functional Value Determination

After some deliberation, it was concluded that it would be difficult to accurately determine the relative importance of individual stormwater storage wetlands in preventing localized flooding and stormwater drainage problems, unless in-depth, site specific evaluations were performed. Also, it was observed that there was considerable similarity between the functional assessment methodologies for sediment/toxicant retention and stormwater storage. As a consequence, the wetlands that would meet the high functional value criteria for sediment retention would include most of the previously identified stormwater storage wetlands. In consideration of these factors, it was concluded that a separate high functional value methodology would not be developed for the stormwater storage function.

While a wetland could not meet the high functional value distinction for stormwater storage alone, it could be considered a high functional value wetland value if it provided significant values for three of the four water quality/stormwater functions (i.e., condition 1 as previously

described). Under this circumstance, a field check was necessary to verify that the wetland lay in a depression with either no surface outlet or a constricted outlet, or was impounded.

This methodology is summarized in the following data sheet.

Stormwater Storage/Hydrologic Stabilization Data Sheet

Stormwater Storage/Hydrologic Stabilization Candidate: (GIS screen determines that W or FW wetland is > 5 acres and at least 50% outside floodplain)

1) Or if wetland is predominantly in floodplain, is wetland a non-riverine depression?
Yes No

If yes to GIS screen or #1, a significant stormwater storage/hydrologic stabilization function is provided.

Field Check (for Alternative High Quality, if necessary):

1) Does wetland meet any of the following conditions:
No outlet, constricted outlet, or impounded? Yes No

(If no, STOP)

If yes the stormwater storage/hydrologic stabilization field criterion is met.

IV. Evaluation Results

A. High Quality Habitats

Based on the methodology used in this project, it was determined that 154 wetlands totaling 17,489 acres met the criteria for high quality habitats. While 154 wetlands is only about four percent of the total number of wetlands in the county, the area of the wetlands meeting the high quality designation represents about 42 percent of the county's entire wetland area, and about 53 percent of the area of "W" wetlands. Most of the high quality wetlands tended to be large parcels, averaging 114 acres in size in comparison to the average wetland size of 11 acres.

Of the high quality habitat wetlands, nearly half (74) are McHenry County Natural Area Inventory (MCNAI) sites.

Of the 15 lakes inventoried in the ADID study, seven were determined to be high quality. These included Crystal, Defiance, Elizabeth, Griswold, Kilarney, Lac Louette, and Lily lakes.

A total of 572 miles of stream were evaluated. One hundred seventy (170) miles, or nearly 30 percent, were designated high quality. Interestingly, high quality stream segments were found on 18 different named streams and rivers scattered throughout the county.

B. High Functional Value Wetlands

A total of 274 wetlands met the criteria for high value for stormwater and water quality functions. Their area totaled 8,292 acres, or nearly 20 percent of the total wetland acreage, and their average size of 30 acres was nearly three times larger than the average wetland size.

C. Summary

While a relatively small number of wetlands -- about 11 percent -- were designated high quality or high functional value, these wetlands represent over 60 percent of the total wetland acreage in the county.

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Appendices

Appendix A: Methodology for Wetland Inventory

Labels on 1988 Aerial Photograph Base Maps:

Colors:

- Black: old (1988) inventory
- Purple: 1995 inventory using mapping conventions and "non-inventory" conventions on "undeveloped land."
- Green: 1995 inventory for USEPA using "non-inventory" conventions on "developed" land.

Labels:

AG LAYER: covers agricultural and non-agricultural lands in areas that are not "developed"

"NI": (on agricultural areas) means there was some conflict that didn't allow them to make a call, needs to be field checked. (marked as a polygon, will be digitized for USEPA as NIH or NIHI.)

"aw": water surrounded by non-hydric soils or man-made soils.
- if on NWI, an "X" put on base map, and polygon NOT digitized.
- if not on NWI, is put on quad sheets to be digitized.

"fw" & "fwp": put on quad sheets to be digitized in every case.

"w": - will be digitized for USEPA as NIH or NIHI

"NIH" & "NIHI": Indicates non-agricultural land in undeveloped areas, polygon based on hydric soils or soils with hydric inclusions. (Will be added to digital layer in every case.)

"DEVELOPED" LAYER: covers land in "developed" areas

"GT": like "NI" but on non-agricultural land, needs to be field checked. Also used for quarries with changing boundaries. (marked as a point, on digital layer)

"NIH": means it was "w" on the old inventory, and remains on the newest available aerial photography.
- if NWI classification is "ow" (or "ub"), polygon is not digitized.
- if NWI classification is not "ow" (or "ub"), is put on quad sheets to be digitized.

"nap": means non-agricultural pond, if not on NWI, is put on quad sheets to be digitized. (Equivalent to "aw" or "w" but new on this round of review. Some inconsistency across county, however. It may show up on the agricultural layer as well.)

Appendix B: McHenry County Natural Areas Inventory Methodology

McHenry County Conservation District (MCCD) maintains a Natural Areas Inventory for the county. While this inventory includes non-wetland habitats and features, it certainly includes many of the highest quality wetlands in the county. For this inventory, aerial photographs (1980) were reviewed for the entire county in 1986, following the methods used for the Illinois Natural Areas Inventory (INAI)(White 1978).

Maps and aerials were systematically examined for the entire county to identify potential natural areas and conversely to determine what land had no significant potential for natural area status. Generally, the aerials were searched for areas of natural vegetation that had not been cropped, pastured, or developed as urban land. Natural prairies and wetlands often have irregular boundaries. Straight boundaries usually indicate that the area may be fenced and grazed. Undisturbed prairie and wetlands often persist in irregularly shaped patches that coincide with soil that cannot be cultivated or grazed. If a prairie or wetland is isolated in cropland, with no open water source, and there is no livestock land leading to it, there is a relatively high probability that it has not been grazed. Parallel lines in a prairie or wetland may indicate past cultivation or mowing. The lines are caused by differences in vegetation along furrows or along ruts or gouges caused by mowing. The lines may persist for many years after the disturbance, and they do not necessarily indicate that the prairie is too disturbed to qualify as a natural area. Mowing may have little lasting effect on a prairie, but ruts in a wetland may persist for years. On aerial photographs currently cultivated or mowed areas in a prairie or wetland are clear, bright, whitish areas, usually with sharp, straight lines. The mowed or plowed areas have a light tone because they reflect sunlight better than undisturbed grass. Closely grazed grassland has an even gray tone. In contrast, an area with tall graminoids or forbs has a coarser and more textured appearance, with greater variability in tones. Heavily grazed areas have whitish patches of bare soils or thin, light lines from livestock trails. Trampled areas are most prominent along fences, at gates, in fence corners, and around areas that provide feed, water, or shelter. These general aerial photograph interpretation guidelines were used to identify natural communities such as prairies and wetlands that were relatively undisturbed. The general premise for the natural areas inventories is to locate communities that show the most natural pre-settlement character and the least anthropogenic disturbance.

From this aerial screening, sites were identified as candidates for natural area status. Field inspections were conducted by MCCD staff and sites were rated as Grade A, B, C, D, or E following the INAI evaluation system (White 1978). This system is designed to rate communities based on their relative degree of disturbance, with those sites thought to most closely resemble pre-settlement communities given the highest grade (A). Any sites assessed by MCCD staff as grade A, B, or C were included in the McHenry County Natural Areas Inventory (MCNAI). In addition, any sites with observed state or federally threatened or endangered species were included in the MCNAI.

The grading system is based on that of the INAI (White 1978). The grades are summarized as follows:

Grade A:	Relatively stable or undisturbed communities.
Grade B:	Late successional or lightly disturbed communities.
Grade C:	Mid-successional or moderately to heavily disturbed communities.
Grade D:	Early successional or severely disturbed communities.
Grade E:	Very early successional or very severely disturbed communities.

Appendix 22 of the Illinois Natural Areas Inventory Technical Report (White 1978) gives examples and explanations of each grade. The structure and composition of the vegetation was assessed and graded through field inspections. If an area was a floristically diverse plant community of **native** species, showing little if any invasion by exotics and appropriate community structure, then it would be Grade A. If the area was generally dominated by native species with good species diversity and relatively intact community structure, but with some invasion by introduced species it would be Grade B. If the area still has good native species diversity, but is showing considerable invasion by non-natives and/or unbalanced community structure it would be Grade C. Grade D areas are showing remnant areas of native vegetation, but have become largely dominated by exotics and show little native community structure. Grade E areas then, would be the most disturbed and likely totally dominated by introduced species. If a site had threatened or endangered wildlife, it was included in the MCNAI. Grade E areas then, would be the most disturbed and likely totally dominated by introduced species. If a site had threatened or endangered wildlife, it was included in the MCNAI.

Appendix C: Index of Biotic Integrity (IBI)

(Karr, 1981; Karr et al., 1986)

IBI assesses the health of a fish community using twelve fish community metrics. It was designed to include a range of attributes of fish assemblages. Its twelve metrics fall into three broad categories: species composition, trophic composition, and fish abundance and condition. Data are obtained for each of these metrics at a given site and evaluated in light of what might be expected at an unimpacted or relatively unimpacted site located in a similar geographic region and on a stream of comparable size. A number rating is then assigned to each metric based on whether its evaluation deviates strongly from, deviates somewhat from, or approximates expectations. The sum of the twelve ratings yields an overall site score. The strength of IBI is its ability to integrate information from individual, population, community, zoogeographic, and ecosystem levels into a single ecologically based index of the quality of a water resource (Karr 1981, Karr et al. 1986, IEPA 1989).

Each of the twelve metrics is scored as a 1, 3, or 5, with a possible score of 60 for sites of exceptional quality. Expectations and scoring vary with stream size and region. IBI has been adapted and modified for use on Illinois streams by IEPA (1989). MCCD and IDNR have sampled many streams in McHenry County and have calculated IBI scores. The sampling involved various methods and levels of effort. Methods used by MCCD and IDNR included backpack electric shocking, seining, electric seining, and boat electro-fishing.

Appendix D: Aquatic Plant Species Known from McHenry County Lakes

FLORISTIC QUALITY DATA		NATIVE	94.0%	ADVENTIVE	6.0%
47	NATIVE SPECIES	0 Tree	0.0%	0 Tree	0.0%
50	Total Species	0 Shrub	0.0%	0 Shrub	0.0%
7.94	NATIVE MEAN C	0 W-Vine	0.0%	0 W-Vine	0.0%
7.46	W/Adventives	0 H-Vine	0.0%	0 H-Vine	0.0%
54.41	NATIVE FQI	41 P-Forb	82.0%	2 P-Forb	4.0%
52.75	W/Adventives	0 B-Forb	0.0%	0 B-Forb	0.0%
-5.0	NATIVE MEAN W	6 A-Forb	12.0%	1 A-Forb	2.0%
-5.0	W/Adventives	0 P-Grass	0.0%	0 P-Grass	0.0%
AVG: OBL. WETLAND		0 A-Grass	0.0%	0 A-Grass	0.0%
		0 P-Sedge	0.0%	0 P-Sedge	0.0%
		0 A-Sedge	0.0%	0 A-Sedge	0.0%
		0 Cryptogam	0.0%		

C	SCIENTIFIC NAME	W	WETNESS	PHYSIOG.	COMMON NAME
10	Brasenia schreberi	-5	OBL	Nt P-FORB	WATER SHIELD
5	Ceratophyllum demersum	-5	OBL	Nt P-FORB	HORNWORT, COONTAIL
5	Elodea canadensis	-5	OBL	Nt P-FORB	COMMON WATERWEED
8	Heteranthera dubia	-5	OBL	Nt P-FORB	WATER STAR GRASS
5	Lemna minor	-5	OBL	Nt A-FORB	SMALL DUCKWEED
7	Lemna trisulca	-5	OBL	Nt A-FORB	FORKED DUCKWEED
7	Myriophyllum exalbescens	-5	OBL	Nt P-FORB	SPIKED WATER MILFOIL
10	Myriophyllum heterophyllum	-5	OBL	Nt P-FORB	VARIOUS-LEAVED WATER MILFOIL
*	MYRIOPHYLLUM SPICATUM	-5	OBL	Ad P-FORB	EUROPEAN WATER MILFOIL
10	Myriophyllum verticillatum pectinatum	-5	OBL	Nt P-FORB	WHORLED WATER MILFOIL
6	Najas flexilis	-5	OBL	Nt A-FORB	SLENDER NAIAD
*	NAJAS MARINA	-5	OBL	Ad A-FORB	SPINY NAIAD
7	Nuphar advena	-5	OBL	Nt P-FORB	YELLOW POND LILY
8	Nuphar variegatum	-5	OBL	Nt P-FORB	BULLHEAD LILY
7	Nymphaea tuberosa	-5	OBL	Nt P-FORB	WHITE WATER LILY
4	Polygonum amphibium stipulaceum	-5	OBL	Nt P-FORB	WATER KNOTWEED
4	Polygonum coccineum	-5	OBL	Nt P-FORB	WATER HEARTSEASE
10	Pontederia cordata	-5	OBL	Nt P-FORB	PICKEREL WEED
10	Potamogeton amplifolius	-5	OBL	Nt P-FORB	LARGE-LEAVED PONDWEED
*	POTAMOGETON CRISPUS	-5	OBL	Ad P-FORB	BEGINNER'S PONDWEED
9	Potamogeton diversifolius	-5	OBL	Nt P-FORB	WATERTHREAD PONDWEED
7	Potamogeton foliosus	-5	OBL	Nt P-FORB	LEAFY PONDWEED
10	Potamogeton friesii	-5	OBL	Nt P-FORB	FRIES'S PONDWEED
8	Potamogeton gramineus	-5	OBL	Nt P-FORB	GRASS-LEAVED PONDWEED
7	Potamogeton illinoensis	-5	OBL	Nt P-FORB	ILLINOIS PONDWEED
7	Potamogeton natans	-5	OBL	Nt P-FORB	COMMON PONDWEED
7	Potamogeton nodosus	-5	OBL	Nt P-FORB	LONG-LEAVED PONDWEED
5	Potamogeton pectinatus	-5	OBL	Nt P-FORB	SAGO PONDWEED
10	Potamogeton praelongus	-5	OBL	Nt P-FORB	WHITE-STEMMED PONDWEED
7	Potamogeton pusillus	-5	OBL	Nt P-FORB	SMALL PONDWEED
10	Potamogeton richardsonii	-5	OBL	Nt P-FORB	RICHARDSON'S PONDWEED
10	Potamogeton robbinsii	-5	OBL	Nt P-FORB	FERN PONDWEED
10	Potamogeton vaseyi	-5	OBL	Nt P-FORB	VASEY'S PONDWEED
8	Potamogeton zosteriformis	-5	OBL	Nt P-FORB	FLAT-STEMMED PONDWEED
7	Ranunculus flabellaris	-5	OBL	Nt P-FORB	YELLOW WATER CROWFOOT
8	Ranunculus longirostris	-5	OBL	Nt P-FORB	WHITE WATER CROWFOOT
7	Sagittaria brevirostra	-5	OBL	Nt P-FORB	SHORT-BEAKED ARROWHEAD
9	Sagittaria graminea	-5	OBL	Nt P-FORB	GRASS-LEAVED ARROWHEAD
4	Sagittaria latifolia	-5	OBL	Nt P-FORB	COMMON ARROWHEAD
10	Sagittaria rigida	-5	OBL	Nt P-FORB	STIFF ARROWHEAD
10	Sparganium minimum	-5	OBL	Nt P-FORB	SMALL BUR REED
7	Spirodela polyrhiza	-5	OBL	Nt A-FORB	GREAT DUCKWEED
10	Utricularia cornuta	-5	OBL	Nt A-FORB	HORNED BLADDERWORT
10	Utricularia gibba	-5	OBL	Nt P-FORB	HUMPED BLADDERWORT
10	Utricularia intermedia	-5	OBL	Nt P-FORB	FLAT-LEAVED BLADDERWORT
10	Utricularia minor	-5	OBL	Nt P-FORB	SMALL BLADDERWORT
9	Utricularia vulgaris	-5	OBL	Nt P-FORB	GREAT BLADDERWORT
7	Vallisneria americana	-5	OBL	Nt P-FORB	EEL GRASS
7	Wolffia columbiana	-5	OBL	Nt A-FORB	AMERICAN WATER MEAL
10	Zannichellia palustris	-5	OBL	Nt P-FORB	HORNED PONDWEED