Using Landscape-Level Wetland Assessment to Aid in Local Management of Wetlands for Lake County, Illinois

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INTRODUCTION

The Lake County Stormwater Management Commission (SMC) is a planning and regulatory agency that coordinates stormwater management activities on a county-wide basis. The SMC staff provide technical assistance, local knowledge and problem-solving skills to coordinate the stormwater activities of over 50 local jurisdictions to enhance water quality, reduce flood damages, mitigate flood hazards, and restore/enhance the natural drainage system. Wetlands are an important, natural component of the county's stormwater management system. On August 14, 2001, Lake County amended its Watershed Development Ordinance (WDO) to regulate development of isolated waters and wetlands. The amendment was in response to the Supreme Court's January 9, 2001, decision in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* that most isolated waters and wetlands could no longer be regulated under the federal Clean Water Act. "Isolated Waters of Lake County" (IWLC) are defined as "All waters such as lakes, ponds, streams (including intermittent streams), farmed wetlands, and wetlands that are not under U. S. Army Corps of Engineers jurisdiction" (WDO, as amended 2015, Appendix A).

Suloway and Hubbell (1994) estimate that Lake County has lost 40 to 50 percent of the wetlands that existed prior to European settlement; losses primarily were due to drainage for agriculture and conversion to urban land uses. Isolated wetlands and waters account for approximately 44 percent of waters and wetlands within the county by number and comprise about 15 percent of its total land area (SMC unpublished GIS data). In comparison, the Illinois Department of Natural Resources (Levin et al. 2002) estimates that isolated wetlands comprise about 12 percent of the state's wetland resources. The loss of wetlands and the important functions they provide have resulted in a higher risk of flooding, surface water quality degradation, and wildlife habitat deterioration. Recognizing these losses, Lake County has adopted a "no net loss" wetland policy and set a goal for a "net gain" of wetland function (WDO, as amended 2015). How does an agency, community or even individual landowner decide the best place(s) to restore or preserve wetlands as a means toward achieving the "no-net-loss" policy and objective of a "net gain" of wetland function? With funding support from a U.S. Environmental Protection Agency Wetland Program Development Grant (WPDG), the Lake County Wetland Restoration and Preservation Plan (the "WRAPP") is a county-wide planning effort to help address that question. The goal of the WRAPP is to provide a wide audience of end-users with decision-making support to help prioritize wetland restoration and preservation efforts. A major component of doing this is to predict wetland and water body functionality.

The WRAPP identifies the type and functions (services) of mapped wetland and water resources in Lake County for both existing and pre-settlement conditions. It also identifies locations of potentially restorable wetlands (PRWs) and will include an on-line decision support tool (DST) to help users prioritize restoration and preservation opportunities based on acreage, wetland function or functional loss. This will allow the user to make informed decisions on wetland restoration and preservation options targeted to user-specific goals and objectives. The SMC is using a landscape-level assessment approach in a county-wide WRAPP to help local governments manage the county's wetlands.

In this article, we use several terms that may have been defined differently by others. For our WRAPP, "restoration" refers to the re-establishment of wetlands in areas where they previously existed but were altered by drainage activities or landscape modifications. "Preservation" refers to actions taken to maintain the size and functions of an existing wetland or water body. "Wetland function" is a general term referring to the various services that wetlands provide, for example, wetlands can store flood water, protect and enhance water quality, provide fish and wildlife habitat, and provide recreational opportunities and aesthetic benefits for communities. "Functional assessment" determines the functions (services) a wetland (or water body) provides and predicts or measures how well it performs each function.

SUBJECT AREA

Located in the northeast corner of Illinois, Lake County is bordered by Cook County on the south; McHenry County on the west; Kenosha County, Wisconsin, on the north; and

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Lake Michigan on the east. The county covers approximately 301,435 acres or about 471 square miles (not including Lake Michigan water surface area) (Calsyn 2005). Geographically, Lake County drains via four major watersheds (Figure 1). Historically rich in wetlands left behind when the last glaciers retreated about 10,000 years ago, the SMC WRAPP Geographic Information System (WRAPP-GIS) data estimates, based on the large extent of mapped hydric soils, that 96,700 acres (32% of the county) were wetlands and waters prior to European settlement in the early 1800s. The WRAAPP-GIS data indicates that approximately 59,730 acres are presently wetlands and waters, representing about 20 percent of the county's landscape.

DEVELOPING A COUNTY-WIDE WETLAND RESTORATION AND PRESERVATION PLAN

Because a major objective of the WRAPP is to predict wetland and water body functionality, various supporting characteristics needed to be added to the County's existing wetland and water body database. SMC assessed functions of wetlands and water bodies using a five-step process.

Step 1: Enhance the existing Lake County Geographic Information System (GIS) database to refine wetland and water body shapes (polygons) and develop a pre-settlement (i.e., historic) database.

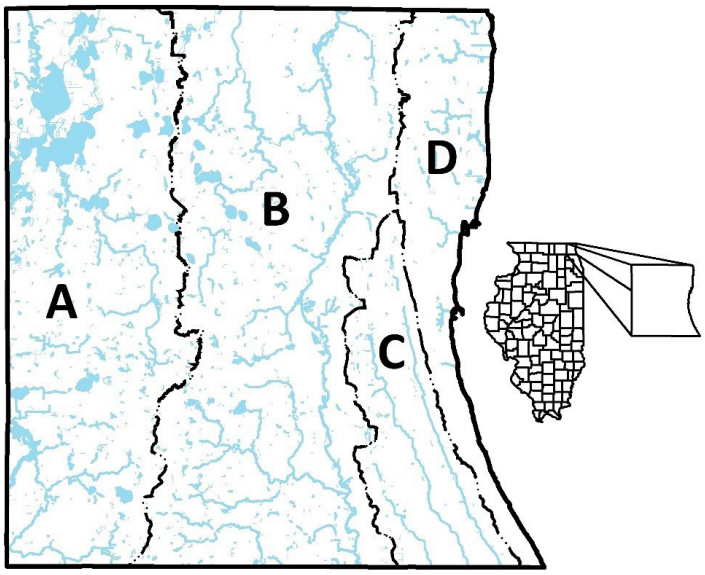
Step 2: Encode each existing and historic wetland and water body using nationally-accepted methods and standards for basic classification attributes (i.e., system, class, subclass, water regime, and special modifiers per the Federal Geographic Data Committee 2013) and hydrogeomorphic attributes related to landscape position, landform, water body type, and water movement. Combined, these classification attributes greatly expand the functionality of the wetlands database, creating an "enhanced" county-wide wetland and water body inventory.

Step 3: Develop preliminary criteria for determining the functionality of wetlands and water bodies using GIS-based data and qualitatively rate the level to which each class provides the given function (i.e., high, moderate, low, or not applicable).

Step 4: Conduct field studies of representative wetlands/water bodies to verify assumptions on the preliminary functional assessments and refine the functional ratings developed in Step 3.

Step 5: Perform a GIS-based assessment of the refined functions (flood water storage, water quality enhancement, wildlife habitat, etc.) for each wetland and water body in the existing and historic databases.

FIGURE 1. Major watersheds in Lake County, Illinois: (A) Fox River, (B) Des Plaines River, (C) North Branch Chicago River, and (D) Lake Michigan.



Technical Advisory Group

To increase the accuracy and relevance of the WRAPP, SMC assembled a 13-member Technical Advisory Group (TAG) comprised of local and regional wetland professionals, engineers, planners, and cartographers (e.g., Illinois-based specialists in the fields of wetland science, hydrology, water quality, soil science, biology/ecology, and information technology/GIS) who voluntarily provided local and regional expert advice and technical guidance during all phases of the WRAPP planning effort.

The TAG involvement included the following tasks achieved through a series of office meetings and field studies:

- Identification of potential end users of the WRAPP and guidance on plan development to meet user needs;
- Input on wetland/water body classification using Hydrogeomorphic (HGM) descriptors and National Wetlands Inventory (NWI) attributes;
- Selection of wetland/water body functions to be assessed;
- Review and tailoring correlations for functional assessment criteria and associated significance ratings to local conditions in Lake County;
- Selection of representative wetland and water body types (e.g., emergent, forested, lake, stream, etc.) for field study;
- Input on the field methodology developed specifically for assessment of various functions in the selected representative wetlands; and
- Input on design and implementation of the on-line decision support tool.

Update and Enhance GIS Datasets
Early in the process, SMC decided to use the best GIS data available for the WRAPP, as that would be important when evaluating functional capabilities. WRAPP development involved aggregating existing geographic data and incorporating additional data sources into the GIS, as practicable.

Existing Wetland Mapping. For the WRAPP, SMC generated a county-wide inventory of existing wetlands and water bodies, termed the Existing Wetland Inventory for Lake County (EWI-LC), using the pre-existing Lake County Wetland Inventory (LCWI) as a base. The LCWI, originally developed in 1992 and updated in 2002, mapped wetlands and water bodies within the county in greater detail than the NWI mapping (i.e., LCWI at map scale 1:12,000 vs. NWI at 1:24,000). The impetus for the original LCWI was the under-representation of Lake County wetlands in the NWI. By way of comparison, the LCWI contains roughly twice the number of wetland and water body polygons as the NWI mapping.

Using the LCWI as a base, SMC captured additional changes in wetland and water body coverage from 2002 through 2015. This primarily involved removing developed wetland areas and adding areas that may support wetlands. Figure 2 reflects a representative sequence of the process of wetland polygon mapping and enhancement. The 2002 LCWI polygon "base" layer (A) was overlaid with the Lake County "building and edge of pavement planimetric" layer (B). Areas of intersection (C) were used to flag potential areas for wetland polygon enhancement (D) for the EWI-LC. For a limited number of sites where existing data were unclear or uncertain, SMC staff conducted field inspections to confirm wetland presence. While the EWI-LC provides an outstanding county-wide base layer for the WRAPP, it is not a comprehen-

FIGURE 2. Polygon mapping and enhancement process: (A) base wetland layer (2002 LCWI mapping), (B) planimetric layer, (C) overlay of planimetric layer (red) on base wetland layer, and (D) EWI-LC wetland mapping reflecting wetlands remaining post-development as of 2014.

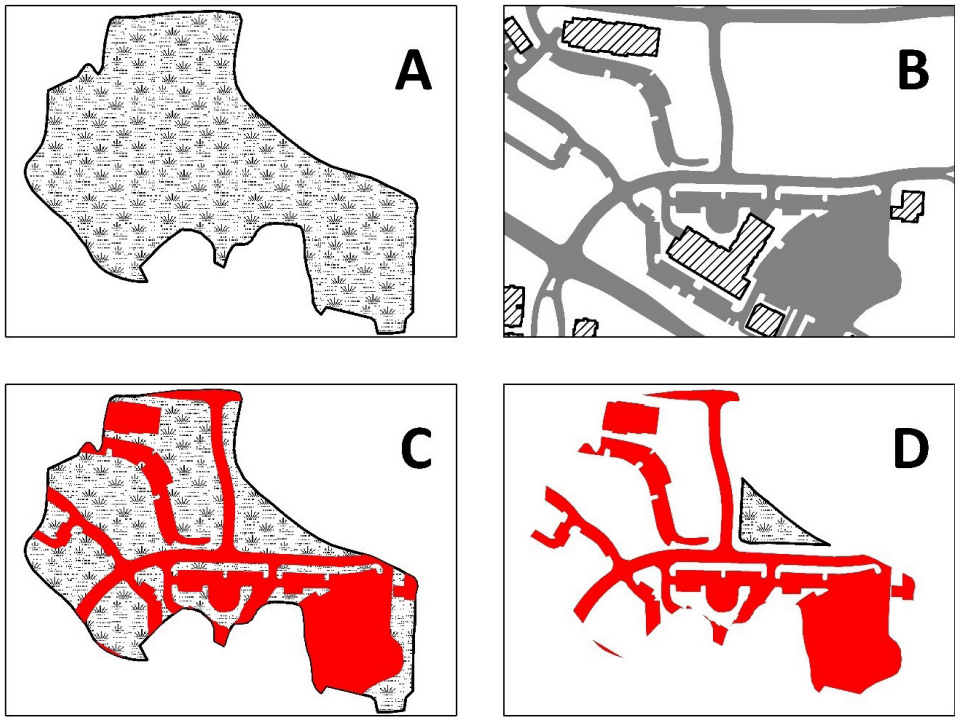
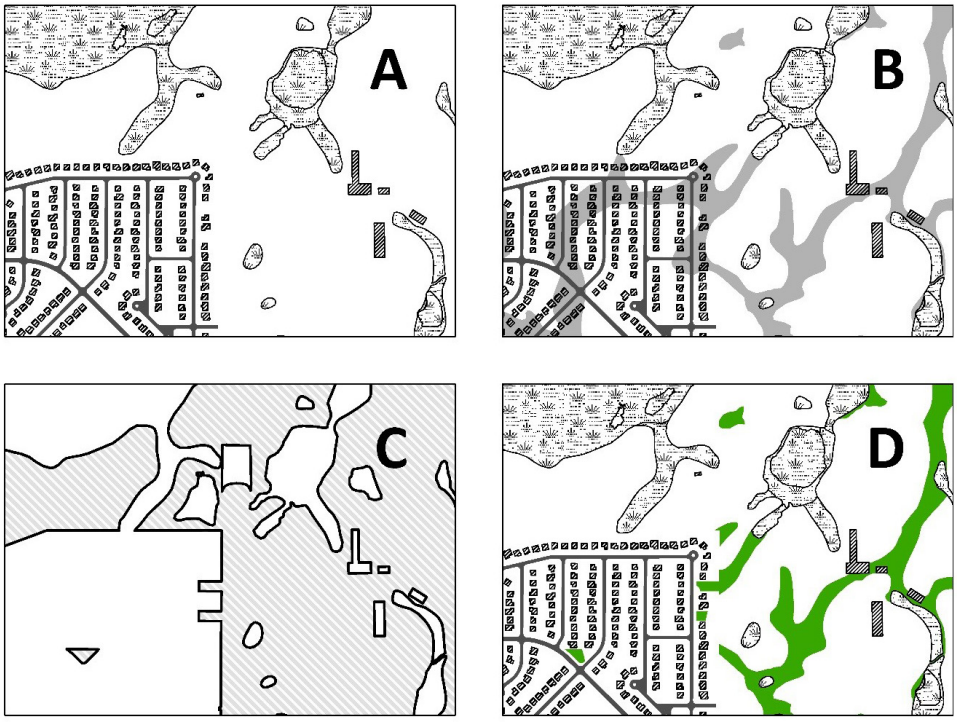


FIGURE 3. Potentially restorable wetlands (PRW) mapping process (representative sequence): (A) mapped EWI-LC and developed footprint, (B) HWI-LC areas not already mapped as wetland (gray), (C) locations not suited to potential wetland restoration (white), and (D) PRW sites (green).



sive wetland mapping effort and should not be construed as a substitute for site-specific wetland delineations required for regulatory permitting purposes.

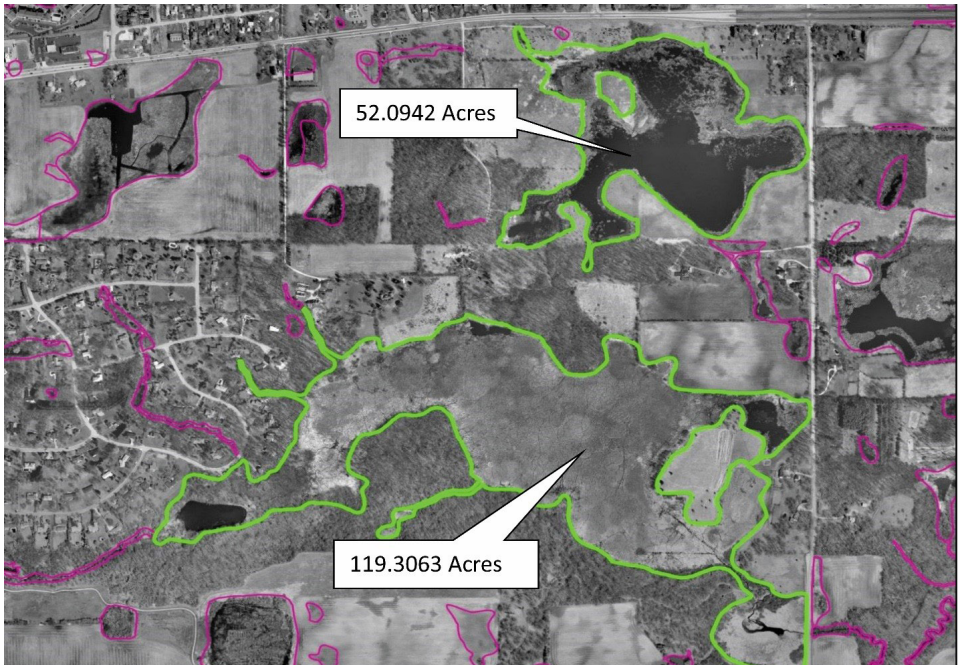
Historic Wetland Mapping. SMC also mapped historic wetlands—those present prior to European settlement of the county. The database for historic wetlands of Lake County (HWI-LC) is based on 1) soil survey data from the USDA Natural Resource Conservation Service (NRCS), 2) historic vegetation information derived from Government Land Office Survey (GLO) plat maps created between 1832 and 1840 (Bowles and McBride 2005; LCGIS 2003; Moran 1978) and local Lake County Forest Preserve mapping (Westerman not dated), and 3) USGS topographic maps from the early 1900s. The soils data were relied upon more heavily, with the historic vegetation and topographic maps used to address gaps in the classification of wetland type. Recognizing that interpretation of source data involved various assumptions, the HWI-LC dataset reflects a best-approximation of wetland presence and extent in pre-settlement times.

Potentially Restorable Wetlands. Potentially restorable wetlands (PRWs) refer to those areas with predominantly wet soils (i.e., USDA hydric soil units) that were not mapped as wetlands on the LCWI as updated in 2002 and have not been converted to urban land use. Figure 3 shows a representative sequence of the process of mapping PRWs. Starting with the EWI-LC polygons and land use layers, SMC added HWI-LC polygons, then clipped out areas not suited to potential wetland restoration to filter the HWI-LC layer and identify PRW sites. Most of the county's PRWs occur on land drained by subsurface tiles or surface ditches for agricultural purposes.

Classification. The updated 2002 LCWI only reflects coarse distinctions between wetland types: artificial wetlands, farmed wetlands, and wetland (Figure 4). The LCWI dataset provides no information on the classification, hydrogeomorphology, or function of each wetland polygon. What is the structural composition of wetlands? What is their hydrologic regime? What functions do the wetlands perform and at what level of performance? To answer those and other questions required enhancement of the datasets.

SMC classified all LCWI polygons using both the Cowardin classification system and hydrogeomorphic descriptors. The process began by "starting with what you know"—correlating the classifications from the NWI maps and data from the *Advanced Identification Study (ADID) for Lake County, Illinois* (Dreher et al. 1992) with the county's wetland/water body polygons and filling in any remaining 'gaps.' The ADID study identified 203 high-quality wetland sites and commented that "[t]he 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."

FIGURE 4. Example of wetlands from the 2002 Lake County Wetland Inventory. The two polygons outlined in green are clearly different, with each being mapped in hydric soils based on soil survey data (Paschke and Alexander 1970; Calsyn 2005). However, the LCWI dataset only reflects a size difference. Looking at the aerial image, one sees distinct physical differences between the two polygons. Most notably, the lower polygon has more vegetation coverage than the upper polygon, which has a greater component of open water.



The SMC classified each historic and existing wetland (or water body) polygon according to the U.S. Fish and Wildlife Service's official classification system for wetlands and deepwater habitats (FGDC 2013, adapted from Cowardin et al. 1979). For each polygon, SMC expanded on the Cowardin descriptors by adding hydrogeomorphic descriptors for landscape position, landform, water flow path, and waterbody type ("LLWW descriptors" from Tiner 2011a) that focus on abiotic properties that are key to predicting wetland functions. To do this, SMC interpreted available map information, consulted aerial photographs, and, in some cases, conducted field checks.

TABLE 1. Summary of Functions Assessed for the WRAPP.

Carbon Sequestration The ability of a wetland to store carbon and help reduce greenhouse gases, slowing climate change. Wetlands with deep organic soils (not ditched, drained, or farmed) support this function at a high level, as do areas of aquatic bed. Woody wetlands (e.g., forested, scrub-shrub, and mixes of those types) that are flooded or saturated seasonally or longer also have high functionality as woody plants can store a large mass of carbon above-ground.
Flood Water Storage The ability of a wetland or water body to store water and delay downstream flooding and/or lower flood heights, which helps minimize flood-related injury and property damage. Except for slope wetlands located outside of mapped flood hazard areas (e.g., seeps/springs on ravines), most wetlands perform this function to some degree.
Native Fish Habitat* Wetlands and water bodies in this category are predicted to provide spawning, nursery, foraging, refuge and/or cover habitat for at least some portion of the native Lake County fishes' life cycle during most or all years.
Nutrient Transformation (P-focus*) This function relates to the transformation of phosphorus (P), as this is the limiting nutrient for many water quality concerns within Lake County. All wetlands perform this function to some degree, and size is not a factor in the ability to perform the function, although it is a factor in the degree, as larger wetlands typically have greater capacity. Vegetated wetlands on the wetter end of the spectrum (e.g., flooded seasonally or longer) perform this function at a high level.
Sediment and Other Particulate Retention The ability of a wetland or water body to retain sediment that would otherwise move downstream and build up in rivers, streams, lakes, or ponds. This function supports improved water quality by capturing sediment particles and any nutrients or heavy metals bonded to them. All wetlands perform this function to some degree; however, vegetation is a key factor to higher functionality because plants slow the water down, which allows sediment to settle out. Water depth also is a key factor.
Shoreline/Streambank Stabilization The ability of wetlands to protect shorelines from erosion by wave action and cutting by stream currents. Vegetation and width of the flanking wetland are primary characteristics for a high rating, with wider bands of vegetation providing more protection than narrower bands.
Stream Baseflow Maintenance The ability of a wetland or water body to source water that sustains base flow levels in streams. This function is especially critical during dry periods and is an important aspect in supporting aquatic life.
Stream Shading High vegetation along streams and rivers can provide shading, which helps regulate the water temperature. Cooler water temperatures decrease the solubility of many chemicals, which reduces the toxic stress on aquatic organisms and increases the significance of the fish and amphibian habitat wetland functions. Forested or scrub-shrub headwater wetlands and forested wetlands within 50 feet of streams or rivers provide this function at the highest level.
Unique Wetland Resources Wetlands and water bodies identified in this category are considered unique on a global (e.g., RAMSAR), state or local level. They perform biological and/or stormwater management functions at an exceptional level. Many of these wetlands/water bodies contain a wide variety of fauna and flora, including threatened or endangered species in some locations.
Waterfowl Habitat The ability of a wetland or water body to provide habitat for waterfowl (e.g., ducks, geese, swans). Wetlands designated as important for waterfowl are generally those used for nesting, feeding or reproduction.
Wetland-Dependent Bird Habitat, Other This function attempts to capture the wetland types and water bodies that provide desired habitat for a variety of wading birds, shorebirds and songbirds (e.g., herons, bitterns, sandpipers, yellow-headed blackbirds). Aquatic beds, island wetlands, and emergent and scrub-shrub wetlands that are seasonally to semi-permanently flooded or are intermittently exposed provide this function at a high level for a wide diversity of bird species that nest, feed and reproduce in these wetland types.
Wildlife Movement Corridors* This function emphasizes connectivity that enables movement of mammals, birds, and insects between wetland environments, so accessibility and proximity are key. Vegetated corridors increase a wetland's ability to provide habitat because a larger pool of species can access and use the wetland.
Woodland Amphibian Habitat* This function assesses a wetland's suitability to provide breeding habitat specifically for woodland amphibians (e.g., spotted salamanders, wood frog). In general, rankings are based on wetland size (2-acre threshold), wetland type, presence/absence of predators, and proximity to other wetlands on the local landscape.
* Denotes functional assessments unique to the Lake County WRAPP.

Develop Criteria for Identifying Wetland Significance for Functions

The WRAPP evaluated 13 functions as summarized in Table 1. By reviewing the literature (Fizzell 2007; MDEQ 2011; Miller et al. 2012; PGE 2014; Tetra Tech 2015; Tiner 2003, 2011b; Tiner et al. 2014) and working with the TAG, the SMC developed correlations to link attributes in the enhanced GIS database to various functions and identify relative significance of performance: high, moderate, low, or not applicable.

S*ignificance* refers to the relative degree to which a mapped wetland/water body polygon performs the indicated function compared to other mapped polygons. As stated by Tetra Tech (2015), "[t]hese rankings are not related to the perceived human value of a wetland function or its benefit to the watershed…. Functional *significance* is only meant as a method to classify and rank wetlands for their ability to perform natural processes. The human *value* of the wetland function and the ecological services that it provides is determined by the goals of regulators and watershed planners."

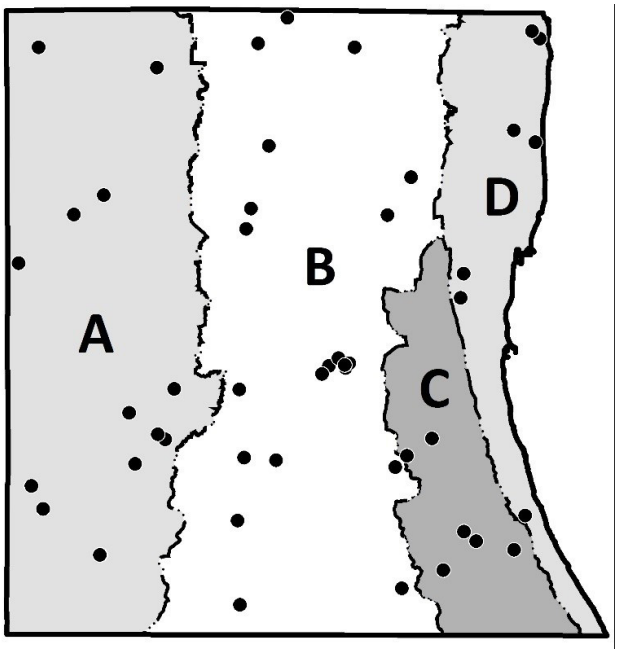
Produce Desktop Assessment for Field Review

After developing the criteria for identify wetlands of significance for different functions, SMC conducted a preliminary assessment of wetland and water body functions for the county. This primarily was a desktop exercise using GIS to qualitatively determine the level to which each wetland or water body polygon performed the various functions based on the correlations.

Field Refinement

SMC conducted field studies on various wetland and waterbody types and used those observations to inform and refine the preliminary functional correlations. SMC worked with the TAG to develop a Wetland Field Check Protocol specifically for the WRAPP and select representative wetland and water body study sites. Assessed sites included a cross-section of wetland/water body types, with emphasis placed on the types with the highest percentage of occurrence in each watershed based on the GIS analysis. The sites selected were located on publicly owned land to allow for easier site access and because of the higher potential for representative sites on public lands to be in a more natural, undisturbed condition than sites on privately owned lands. Each field review had a minimum of two assessors, with at least one person on the team able to identify dominant plant species, understand common wetland plant communities, and basic hydrologic processes affecting wetlands and waters in the Midwest Region, and be acquainted with biological aspects of the aquatic environment (i.e., wildlife habitat).

FIGURE 5. Lake County WRAPP field site locations (indicated by black dots).



A total of 48 field sites were reviewed (Figure 5) during the growing season (typically May through October). The number of sites per watershed was roughly proportional to the number of polygons in the watershed and were selected using a randomization process: Lake Michigan (7), North Branch Chicago River (6), Fox River (14), and Des Plaines River (21).

For each field site, data were recorded on a Wetland Field Check Data Form (see Figure 6). The field check form addressed two main objectives for the WRAPP: 1) to groundtruth the mapped wetland polygon boundaries and NWI and LLWW classification codes and 2) to review and refine the preliminary wetland functional assessment criteria developed by TAG for each of the 13 selected functions. At least one photograph was taken of the site depicting typical features. The field check process ranged from 30 minutes to 2 hours per site.

SMC refined and adjusted the functional assessment rating criteria based on comments in Section 4 of the field form, as warranted. Most changes proposed to the selection criteria document based on field refinement fell into two types of non-substantive changes: 1) changes to the narrative criteria for clarification and consistency and 2) changes to the "Classification Codes" column to ensure selection of polygons in the GIS mirrors the narrative criteria. For example, the following NWI water regimes were added, where appropriate, throughout the selection criteria based on field comments related to the presence of these regimes: seasonally saturated ("B"), continuously saturated ("D"), and seasonally flooded/saturated ("E"). These regimes apply primarily to slope (seep), bog, and fen types. While such wetland types represent a small portion of the polygons in the LCWI, these hydrologic regimes are important for predicting functional significance. Using the refined criteria, SMC performed a final GIS desktop exercise to assign functional assessment ratings to each existing and pre-settlement wetland and water body.

FIGURE 6. The WRAPP field data sheet.

Fig. 6A

Wetland Restoration & Preservation Plan (WRAPP) (6/15/16)

Wetland Field Check Data Form

1: General Information

Watershed: **Sub-watershed:** **Wetland ID:**

Date: **Assessed By:** **GIS/Photo ID #:**

Lat: ° Long: ° Location:

Slope:

Weather Conditions:

Recent (24 hr) Precipitation:

☐ Designated as HQAR or ADID?

Cowardin Classification:

LLWW Classification:

Landscape Position: Landform:

Water Flow Path: Water Body:

Reference Maps: ☐ LCWIe ☐ FEMA ☐ Soils ☐ ADID ☐ Topo ☐ Aerials ☐ Other:

2. Mapping Review/Verification of GIS

☐ Wetland/water body is present and boundary generally matches LCWIe

☐ Wetland/water body is present, but mapped location differs from LCWIe (see field mark-up for revised boundary)

☐ Wetland does NOT appear to be present in mapped location – remove from LCWIe

☐ Mineral soil verified ☐ Organic soil verified

For wetlands/ water bodies confirmed as present:

Cowardin classification from NWI/LCWIe confirmed?
☐ Yes ☐ No

If NO, recommended changes based on observations:

LLWW classification from LCWIe confirmed?
☐ Yes ☐ No

If NO, recommended changes based on observations:

3. Field Observations (check all that apply)

Hydrology: Source	Surface Connectivity	Indicators
☐ Overbank flooding	☐ Within the FEMA 100-yr floodplain	☐ Surface water depth (in):
☐ Depressional flooding/ponding	☐ Within the FEMA 500-yr floodplain	☐ Water table depth (in):
☐ Groundwater (seeps, high water table)	☐ Connected by drainage/stream (incl. ephemeral)	☐ Soil saturation depth (in):
☐ Lake Michigan coastal wetland	☐ Contiguous/adjacent	☐ Water marks height (in):
☐ Surface Runoff	☐ Area discharges to surface water	☐ Drift deposits
☐ Stormwater outfall	☐ Headwaters position	☐ Sediment deposits
☐ Other:	☐ Channelized flow	☐ Water-stained leaves
	☐ Non-channelized flow	☐ Crayfish burrows
		☐ Other:

Wildlife Habitat Features:

☐ Standing snags >12" dbh

☐ Coarse woody debris (10'+ long, 6"+ diam) on ground

☐ Hummocks/tussocks

☐ Woodland amphibian breeding pools/ nursery

☐ Other wetlands within 500 ft

☐ Beach

☐ Shoreline

☐ Mudflat

Canopy:

☐ Most trees <6" dbh or no trees

☐ Most trees between 6-12" dbh, a few >12"

☐ Canopy >6"dbh and many large trees >12" dbh

Connectivity:

☐ No connection to other natural area/open space

☐ Connection with natural area/open space of <10 ac

☐ Connection with natural area/open space 11-25 ac

☐ Connection with natural area/open space 25-50 ac

☐ Connection to open space of 51-100 ac

☐ Connection with open space of >100 ac

Connectivity Interruptions:

0-2 ☐ 3-4 ☐ 5+ ☐

☐ 50+ ft-wide corridor connection

☐ 200+ ft-wide corridor connection

Adjacent Land Use:

Notes:

Additional Observations/Remarks:

Wildlife species (insect, mammal, bird, amphibian), type of observation (scat, direct, track, feather, etc.), other wetlands nearby, hydrologic notes (e.g., flow rate, depth to overtopping channel, average channel width), etc.

Fig. 6B

Wetland Restoration & Preservation Plan (WRAPP)

Wetland ID:_____

Wetland Field Check Data Form

3. Field Observations, Continued (check all that apply)

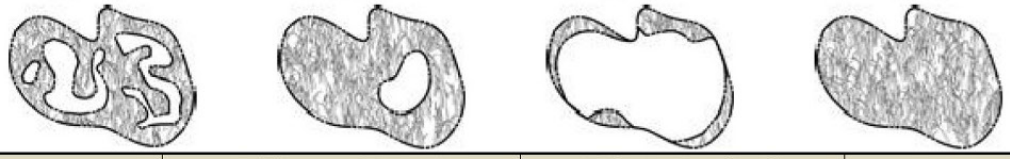
Vegetation: General	Diversity	Plant Strata
Main Plant Community: _____ Secondary Plant Community: _____ ☐ Dense, persistent vegetation ☐ Dense, non-persistent vegetation ☐ Marsh only: <25% cover by vegetation ☐ 25%+ cover by vegetation ☐ ☐ Potential for erosion due to wind fetch, pond or open water area (1+ ac) Littoral Zone Wetland Width: ☐ <10 ft ☐ 10-20 ft ☐ 20+ ft	☐ High (<10% cover by non-natives) ☐ Low (10-50% cover by non-natives) ☐ Dominated by non-natives **Dominant plant species:** **Notable Plant Species:** ☐ Rare plant species known (within past 10 yrs) ☐ Rare plant species observed	☐ Trees (woody, 3"+ dbh) Closed ☐ Sparse ☐ ☐ Sapling/shrub (woody, <3"dbh & >3.3' tall) Dense ☐ Sparse ☐ ☐ Herb (non-woody + woody <3.3' tall) Dense ☐ Sparse ☐ ☐ Graminoids (non-woody, not broadleaf) ☐ Vines

Percent Ground Cover:

☐ Very Sparse (0-10%) ☐ Sparse (11-30%) ☐ Mod. Sparse (31-50%) ☐ Moderate (51-70%) ☐ Mod. Dense (71-90%) ☐ Dense (91-100%)

Interspersion: Select the figure that best represents the degree of interspersion between vegetation and open water during the growing season. Patterned areas represent vegetated areas and white areas represent open water/aquatic bed.

☐ A ☐ B ☐ C ☐ D



Alterations: Evidence of Water Quality Issues	Evidence of Altered Hydrology/Hydrologic Connectivity	Relative Level and Permanence of Disturbance, and Sources	Ground Surface/Vegetation Condition of the Wetland
☐ Dead fish, amphibians ☐ Dredging ☐ Odor ☐ Point-source discharge (NPDES) ☐ Receives agricultural runoff ☐ Stormwater inputs ☐ Sediment deposits on plants ☐ Excess nutrients (algae blooms, macrophytes) ☐ Water discoloration (cloudy, oily sheen) ☐ Road runoff **Notes:**	☐ Drainage (ditches, tiles) ☐ High proportion of open water, dead/dying trees ☐ Water control: weirs, dikes, dams, berms ☐ Beaver dams ☐ Stream channelization ☐ Constricted outlet ☐ Artificial flooding ☐ Overbank flow is NOT severely altered ☐ Overbank flow is severely altered ☐ Overland flow is severely altered	☐ Buffer* disturbance ☐ Wetland disturbance ☐ Recent disturbance (not at equilibrium) ☐ Historic disturbance (at equilibrium) *buffer=50' except HQAR=100' **Relative Percent Disturbance:** Buffer / Wetland ☐ <5% ☐ <5% ☐ 6-25% ☐ 6-25% ☐ 26-50% ☐ 26-50% ☐ 51-75% ☐ 51-75% ☐ 76-95% ☐ 76-95% ☐ >95% ☐ >95%	☐ Filling ☐ Grading ☐ Plowing, disking, tilling ☐ Vehicle tracks, ORVs ☐ Herbicide ☐ Mowing ☐ Soil compaction ☐ Intensive grazing, hooved animals ☐ Human-induced sedimentation or burial ☐ Human-induced erosion or exposure ☐ Clear cutting ☐ Selective cutting

Fig. 6C

Wetland Restoration & Preservation Plan (WRAPP)

Wetland ID:_____

Wetland Field Check Data Form

4: Checklist for Probable Wetland Functions

Use this table to identify functions associated with the wetland or watershed services relevant to your inventory or mapping effort and record appropriate information.

	Function	Ability to Perform Function (H, M, L, or n/a)	Field Observations to Support Function	Recommended Changes to Preliminary Wetland Functional Assessment Criteria Based on Field Observations
Hydrologic	Flood water storage/surface detention			
	Stream baseflow maintenance			
Biodiversity	Native fish habitat			
	Waterfowl habitat			
	Other wetland-dependent bird habitat			
	Woodland amphibian habitat			
	Unique wetland resources			
	Stream Shading			
	Wildlife Movement Corridor (Riparian Habitat)			
Water Quality	Nutrient Transformation (Phosphorus)			
	Sediment and other particulate retention			
	Shoreline/streambank stabilization			
	Carbon Sequestration			

Predicting Wetland and Water Body Functions for Lake County

The enhanced datasets generated by the above process enabled prediction of 13 functions for wetlands and water bodies in Lake County and the relative level to which each function is provided. Using the enhanced datasets, SMC also determined the locations of potentially restorable wetlands (PRWs) and developed an online decision-support tool that interested parties can use. Users can compare functions between wetland classes and assess opportunities for wetland restoration or preservation, depending on site-specific goals.

EXAMPLES OF WRAPP USE

Examples of anticipated stakeholder interest and use of the WRAPP include the following:

- SMC can incorporate WRAPP information into its watershed-based plans to identify potentially restorable wetlands and existing wetlands that provide key stormwater storage, water quality and other high functional services that could be considered for preservation. This would also put SMC in a better position to develop design plans and cost estimates for grant requests to direct limited funds to identified high priority wetland restoration projects.
- Public road agencies can seek off-site mitigation areas or potential wetland mitigation bank sites to meet regulatory requirements for mitigation to offset impacts from road projects in the watershed; municipal and Lake County (unincorporated areas) land use planning jurisdictions may use the WRAPP to identify high priority locations to protect/restore wetlands as green infrastructure to provide ecosystem services such as water quality improvement, aquatic and terrestrial habitat, and stormwater storage to reduce flooding risk by incorporating high priority restoration and preservation sites into updated land use/zoning plans.
- Natural resource/conservation agencies and organizations can seek high priority wetland areas for acquisition and preservation.
- Private landowners can potentially lower their tax burden by legally dedicating high priority wetland restoration-preservation sites on their property in perpetuity under a conservation easement.
- Land development interests can readily identify and avoid existing wetlands wherever possible and adequately replace functional value with mitigation once the functional value is determined.

The WRAPP does not create any additional regulations or natural resource protections, replace the need for site-specific wetland delineations or jurisdictional determinations, or recommend land acquisition or zoning changes. Whether a potentially restorable wetland identified by the WRAPP is viable or not will depend on site-specific characteristics, landowner interest, agency funding/priorities, and other factors.

LIMITATIONS OF THE WRAPP

The WRAPP is a county-wide plan that provides a basic characterization, a preliminary assessment of functions, and a remotely-sensed assessment of wetlands and water bodies in Lake County. As such, it is useful as an initial screening tool for prioritizing wetland restoration and preservation efforts and as an educational resource to help the user better understand the relationships between wetland characteristics and performance of individual functions. However, the WRAPP does not eliminate the need for site-specific assessment prior to developing actual restoration or preservation plans.

Any mapping effort done primarily through remote sensing will inherently have limitations. For example, the LCWI used as the base reference for this plan may have inadvertently omitted certain wetlands due to scale, image interpretation, and map complexity issues. A second limitation is that a large wetland or water body polygon may contain small "inclusions" that are different from the mapped type. For example, a three-acre polygon of emergent wetland may contain a quarter-acre section of scrub-shrub wetland.

Finally, despite efforts at quality control, some errors of interpretation and classification are likely due to the sheer number (about 22,000) of wetland and water body polygons in the Lake County GIS database.

CONCLUSION

The WRAPP will provide a wide audience of end-users with a planning tool that can identify opportunities for restoring and preserving wetlands to maintain and increase wetland functions throughout Lake County. The WRAPP will 1) help direct efforts of voluntary wetland restoration programs, 2) support wetland mitigation efforts by identifying potential mitigation and restoration sites, 3) help target limited resource dollars meant for restoring and preserving wetlands and their functions, 4) strengthen grant and funding requests, and 5) identify critical areas in watershed planning. The WRAPP does not recommend additional regulations, land acquisition, zoning changes, or natural resource protections. The WRAPP tool and datasets do not replace the need for site-specific wetland delineations or jurisdictional determinations. The WRAPP is intended as a tool for various

user groups (e.g., government, development sector, and the public) to aid in decision-making and project management. It enhances the LCWI with a depth of information related to functions of individual wetland areas following nationally-accepted methods and standards. The WRAPP consists of data analysis, a summary report (in preparation at the time of this submittal), and a web-based interactive tool (also in development at the time of this submittal) that can be used by a wide audience for planning purposes. It will aid in identifying wetland restoration and preservation opportunities through objective criteria based on nationally-accepted methods and standards. Whether a potentially restorable wetland identified by the WRAPP is a viable location will depend on site-specific characteristics, landowner interest, agency funding/priorities, and other factors. ■

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