THE CONSERVATION FOUNDATION

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LOWER DUPAGE RIVER WATERSHED PLAN

TECHNICAL REPORT

June 2011

A NOT-FOR-PROFIT LAND AND WATERSHED PROTECTION ORGANIZATION

Photo by Ed Meehan

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List of Abbreviations

AUID – Assessment Unit Identification
B-MAG – Basinwide Area Management Advisory Group
BMP – Best Management Practice
CARL – Conservation And Recreation Lands
CMAP – Chicago Metropolitan Agency for Planning
CREP – Conservation Reserve Enhancement Program
CRP – Conservation Reserve Program
CWP – Center for Watershed Protection
DDT – dichlorodiphenyltrichloroethane
EMC – Event Mean Concentration
FCMP – Fish Contaminant Monitoring Program
fIBI – fish Index of Biotic Integrity
FPDDC – Forest Preserve District of DuPage County
FSA – Farm Service Agency
FWS – Fish and Wildlife Service
GIS – Geographic Information System
HOA – Homeowners Association
HUC – Hydrologic Unit Code
IBI – Index of Biotic Integrity
IDNR – Illinois Department of Natural Resources
IEPA – Illinois Environmental protection Agency
INAI – Illinois Natural Areas Inventory
MS4 – Municipal Separate Strom Sewer
NPDES – National Pollutant Discharge Elimination System
NPS – Nonpoint Source
NRCS – Natural Resource Conservation Service
NWI – National Wetlands Inventory
PCB – Polychlorinated biphenyl
PSA – Public Service Announcement
QHEI – Qualitative Habitat Evaluation Index
SF – Subsurface Flow
SSIP – Strategic Subwatershed Identification Process
STEPL – Spreadsheet Tool for Estimation of Pollutant Load
STP – Sewage Treatment Plant
SWCD – Soil and Water Conservation District
TCF – The Conservation Foundation
TMDLs – Total Maximum Daily Loads
TSS – Total Suspended Solids
USA – Unified Stream Assessment
USDA – United States Department of Agriculture
U.S. EPA – United States Environmental Protection Agency
USGS – United States Geological Service
USLE – Universal Soil Loss Equation
USSR – Unified Subwatershed and Site Assessment
VF – Vertical Flow
WASCB – Water and Sediment Control Basin
WRC – Water Reclamation Center
WRP – Wetlands Reserve Program
WWTP – Wastewater Treatment Plant

1. Introduction

1.1 Purpose

The Lower DuPage River Watershed Plan serves as a first step in addressing water quality impairments and preventing further degradation within the watershed. This plan identifies stakeholders, problems, solutions and funding sources to improve water quality within the Lower DuPage River watershed.

1.2 Watershed Overview and Location

The DuPage River, consisting of the East and West Branches as well as the mainstem Lower DuPage, is the largest tributary to the Des Plaines River Basin, covering 353 square miles. The Lower DuPage River watershed covers 168 square miles and encompasses portions of 13 municipalities. The majority of the watershed is within Will County, although portions of the watershed are also in DuPage, Grundy, and Kendall Counties, as shown in Figure 1-1. There are 166 stream miles within the watershed.

This watershed is unique in that it is not a true headwater stream; the Lower DuPage begins at the joining of two other rivers. The Upper DuPage River watershed, that of the East and West Branches combined, is highly urbanized and therefore exerts great influence over the downstream water quality of the Lower DuPage. The watershed is also unique in that the Illinois Environmental Protection Agency (IEPA) includes a portion of the Illinois and Michigan Canal, a manmade canal originally built for the transport of goods from Lake Michigan to the Mississippi River, as a part of the watershed.

The Lower DuPage River begins at the confluence of the East and West Branches DuPage River, at the border of DuPage and Wheatland Townships on public properties owned by the Naperville Park District and the Forest Preserve District of Will County, called the DuPage River Confluence Preserve. The river travels southwest through portions of Naperville and Bolingbrook before joining with Spring Brook east of Plainfield Naperville Road and north of Boughton Road in Naperville. The Lily Cache is another major tributary of the Lower DuPage, originating in Darien and Woodridge and flowing southwest through Bolingbrook and Plainfield before meeting the main stem in Joliet, north of Caton Farm Road and west of Interstate 55. Mink Creek is a tributary located in the middle section of the watershed, originating in unincorporated Will County, flowing through portions of Romeoville and Rockdale before flowing into the Lily Cache in Plainfield, north of Joliet Road (Route 30) and west of Interstate 55.

Rock Run Creek is the tributary south of Mink Creek, originates in Crest Hill and flows southwest through Joliet and

Figure 1-1: Location map showing the Lower DuPage River watershed in north east Illinois.

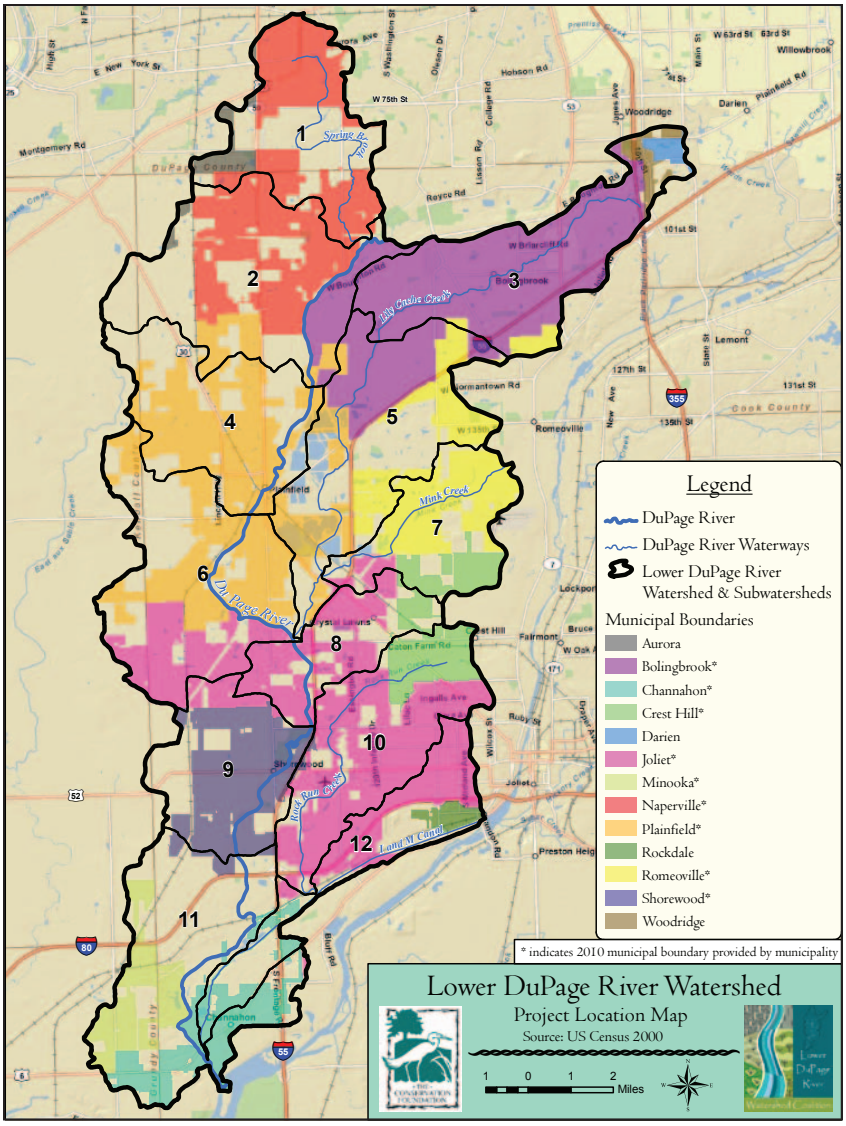


Figure 1-2: The Lower DuPage River Watershed divided into 12 subwatersheds and with municipal areas shown.

unincorporated Will County before meeting the Illinois and Michigan Canal, south of Mound Road and east of Interstate 55 in unincorporated Will County. The portion of the Illinois and Michigan Canal that is within the Lower DuPage River watershed originates where the Canal separates from the Des Plaines River in Joliet, east of Brandon Road and south of Railroad Street (Route 6) and follows southwest through portions of Joliet, Channahon and unincorporated Will County before flowing into the main stem.

South of where the Lily Cache flows into the main stem, the river flows south through portions of Joliet, Shorewood, Channahon, Minooka and unincorporated Will County before flowing into the Des Plaines River north of Walnut Lane and east of the Illinois and Michigan Canal Trail near the border of Kendall and Will Counties in the Illinois Department of Natural Resources' (IDNR) Illinois and Michigan Canal State Park. The Channahon Dam is located 0.5 miles upstream from the confluence. Another dam within the watershed is the Hammel Woods Dam in the Hammel Woods Forest Preserve in Shorewood.

There are many other smaller tributaries, which by incorporating natural drainage divides, are the basis for the 12 subwatersheds, as shown in Figure 1-2. The creation of the subwatersheds was done in order to separate the watershed into more manageable units and to better identify specific impairments. The subwatersheds also take into account a previous subwatershed delineation by IDNR, the *Strategic Sub-Watershed Identification Process: Maximizing Benefits of Ecosystem Management DuPage River Coalition* (SSIP) completed in 2005. This report divides the Lower DuPage watershed into over 40 subwatersheds, which was deemed too many for the purposes of this plan. However, IDNR's subwatersheds were only combined to create the 12 subwatersheds in this plan; they were not divided. The 12 subwatersheds are numbered from north to south.

The United States Geological Survey (USGS) divides the country into local drainage basins called Watershed Hydrologic Unit Code or HUCs. The HUC for the Lower DuPage is 0712000408. The IEPA uses Assessment Unit Identification (AUID) codes to identify waterbody segments and lakes. The following AUIDs are found in the watershed:

Table 1-1: Stream segments and lakes by AUID.

Waterbody Name	*AUID*	*AUID Size*	*Units*
DuPage River	IL_GB-01	8	Miles
DuPage River	IL_GB-11	9.81	Miles
DuPage River	IL_GB-16	10.39	Miles
Illinois and Michigan Canal	IL_GBA	5.17	Miles
Lily Cache Creek	IL_GBE-01	7.56	Miles
Lily Cache Creek	IL_GBE-02	9.56	Miles
Mink Creek	IL_GBEA	5.64	Miles
Rock Run	IL_GBAA-01	9.63	Miles
Spring Brook	IL_GBKA	1.87	Miles
Spring Brook	IL_GBKA-01	3.55	Miles
Arbor	IL_RGZI	14.7	Acres
Big Heritage	IL_SGJ	5	Acres
Joliet Junior College	IL_WGZX	11	Acres
Renwick Lake East	IL_WGI	330	Acres

The primary land uses in the watershed are agriculture and residential, covering approximately 30% of the watershed area each. Public land in the watershed is owned and managed by a variety of different entities, mostly the Forest Preserve District of Will County and various park districts. Public lands in the watershed include the DuPage River Park (Naperville Park District); Springbrook Prairie (Forest Preserve District of DuPage County); Riverview Farmstead, Lake Renwick, Hammel Woods, O'Hara Woods and McKinley Woods (Forest Preserve District of Will County); Community Park and Remington Lakes (Bolingbrook Park District); Settlers' Park and Electric Park (west) (Village of Plainfield); Electric Park (east), Eaton Preserve, Riverview Park, Mather Woods, Renwick Community Park, Vintage Harvest Park, Streams Recreation Center, Riverwalk Park, Van Horn Woods, Riverside Parkway and Sunset Parkway (Plainfield Park District); West Shore Park, Little Coyote Park, Gabrielson/Oakwood Park, Shorewood Park and Seil Road Park (Village of Shorewood); Community Park and Chanooka Canoe Launch (Channahon Park District, the canoe launch is a partnership with the Villages of Minooka and Channahon); and Channahon State Park (Illinois Department of Natural Resources).

There are four segments that are listed as impaired, or not meeting their designated uses, including the entire main stem and the upper segment of the Lily Cache (IL_GBE-01). Total Maximum Daily Loads (TMDLs) are currently being developed by IEPA for all three mainstem segments: silver for the lower mainstem segment (IL_GB-01), chloride and fecal coliform for the middle main stem segment (IL_GB-11), and dissolved oxygen and fecal coliform for upper mainstem segment (IL_GB-16).

1.3 Importance to the Reader

This watershed plan will serve as a large first step towards improving water quality. The plan will identify current and future problems in the watershed and propose possible solutions. Means of implementing the solutions will be examined as well in order to leave the reader with as complete a resource as possible.

Through the voluntary participation of members of the community that are concerned about water quality and desire a concrete plan to improve the situation, the stakeholders determined that the overall goal of the Lower DuPage River Watershed Coalition (Coalition), the stakeholder group, is to protect and manage watershed health as measured by chemical, physical and biological integrity and through education and communication.

1.4 Project Background

A watershed plan for the Lower DuPage had not been created in the past. The entire DuPage River watershed has been examined by IEPA and IDNR, as detailed in Integrated Reports and the SSIP. However, there is a need for a more detailed and in depth study of a manageable subwatershed. The Conservation Foundation (TCF) applied for Clean Water Act Section 319 funds to complete a watershed plan for the Lower DuPage in 2008. Funding was not received under this grant. However, CMAP subsequently approached TCF with funds for the project provided by IEPA through Section 604b of the Clean Water Act and the American Recovery and Reinvestment Act of 2009.

The Conservation Foundation has a strong background in watershed planning, having completed watershed plans for the Upper DuPage, Aux Sable Creek, Tyler Creek and Big Rock Creek previously. We have also participated in numerous watershed groups and ecosystem partnerships including Blackberry Creek, Mazon Creek, the DuPage River Coalition Ecosystem Partnership, the Fox River Ecosystem Partnership, the Lower Des Plaines Ecosystem Partnership and the Prairie Parkland Ecosystem Partnership. Local buy in and support for watershed protection and enhancement is critical for success in any watershed as well as having professional staff to coordinate, organize and provide technical support throughout the planning and implementation process.

In order to accomplish things efficiently and effectively, the Coalition has organized a Steering Committee to make decisions and provide overall direction for the plan. The Steering Committee consists of representatives from all stakeholder groups willing to participate, including governmental representatives, wastewater treatment plants, and the environmental community. A Technical Committee has also been selected to support the Coalition through technical information. The Technical Committee is composed of the consultant, V3 Companies, who has completed the pollutant load analysis.

The plan is subject to criteria required by the U.S. EPA and CMAP as detailed below.

Nine minimum elements of watershed plan and section of this plan where addressed:

Element	Section
a) An identification of the causes and sources that need to be controlled to achieve pollutant load reductions estimated in this plan;	2.1.2
b) An estimate of the load reductions expected for the management measures described under (c) below;	4.1.5
c) A description of the nonpoint source management measures that will need to be implemented to achieve the load reductions estimated under (b) above;	4.1-4.2
d) An estimate of the amounts of technical and financial assistance needed, Associated costs, and/or the sources and authorities that will be relied upon, to implement this plan;	4.3, 6.2.3
e) An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented;	4.1.4
f) A schedule for implementing the nonpoint source management measures identified in this plan;	6.2.4
g) A description of interim, measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented;	6.4
h) A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards; and	6.3, 6.5
i) A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) above.	6.3

Regional Watershed Planning Criteria

As an outgrowth of the three watershed plans that CMAP and local partners developed in the Kishwaukee River Basin[1] in 2008, regional planning criteria are now addressed in watershed plans developed in northeastern Illinois. Regional watershed planning criteria that go beyond the plan components required of Section 319 funded watershed plans will enable future plans to be eligible for amendment to the state and areawide water quality management plans. Similarly, the new criteria allow communities to be potentially better prepared and thus, "get out in front of" future permit and revolving loan applications. More comprehensive watershed plans will also support intentions within the regulatory community to improve program integration and achieve better results while using increasingly constrained financial resources.

[1]These three planning processes went beyond the nine minimum components required of Section 319 funded watershed plans to draw upon the recommendations of the Basinwide Management Advisory Group. See: http://www.epa.state.il.us/water/watershed/facility-planning/basinwide-framework.pdf

The four new criteria are as follows:

1) **Develop a vision for watershed land use.** One method for conceptualizing such a vision involves "stitching together" the collection of municipal and county comprehensive plans for the watershed-planning area. While such plans are typically developed independent of one another, they represent a cumulative or de facto vision of future land use and thus, could enable modeling of future water quality (i.e., pollutant loads) as an outcome of collective comprehensive plan realization. While other methods of deriving future land use within the watershed might exist, none are likely to be as readily available or as inherently sanctioned as an existing collection of comprehensive plans. Making a composite picture of future land use from the comprehensive plans must be more than a forecasting exercise, however. Watershed plans can feature an evaluation of the vision of comprehensive plans for opportunities to reduce estimated future water quality impacts and support other resource planning objectives. Here, municipal staff participation and elected official support are both critical to the process.

2) **Set target pollutant-load reductions for impaired waters taking into account both point and nonpoint source pollution.** Land use, surface runoff management controls, and point-source discharges are the main determining factors for water quality within the watershed. An estimate of current pollutant loads, as well as potential future loads if quantified from criterion #1, allows for target setting. U.S, EPA ecoregional nutrient criteria guidelines, for example, can be used to develop target load reductions since state standards have not yet been established. State numeric or narrative standards can be applied towards setting load reductions for pollutants other than nutrients as long as doing so will ultimately solve the water quality problem. Note that if the watershed planning and TMDL programs are integrated, TMDLs will serve to set pollutant-load reductions where they exist.

3) **Give explicit consideration of groundwater protection from both water quality and water quantity (i.e., aquifer recharge) perspectives.** Discussion topics could include wellhead protection programs for groundwater-dependent communities, and appropriate land use within community water supply Phase II Wellhead Protection Areas (as delineated by IEPA) or sensitive aquifer recharge areas where delineated (e.g., McHenry County). Land-use strategies to protect Class III: Special Resource Groundwater Areas can also be evaluated where relevant. Water-demand-management strategies can also be discussed in order to avoid supply/demand imbalances that threaten parts of the region and to protect aquatic ecosystems that are hydrologically connected to shallow groundwater and impacted by overpumping.

4) **Compare municipal ordinances/codes to the Water Quality Scorecard developed by US EPA[2] or a similar scorecard developed specifically for northeastern Illinois.** Growth and development can proceed without compromising the region's natural capital, but not by following traditional development methods that have led to today's impaired water resources. Not unlike design guidance provided by the Center for Watershed Protection[3], the Water Quality Scorecard was developed to assist local governments in identifying opportunities to remove barriers and revise or create codes and ordinances that protect water quality. Designed to address development at multiple scales across the urban – rural land-use continuum, the Scorecard provides policy options, resources, and case studies to help communities develop a comprehensive water quality program. Watershed plans developed in northeastern Illinois should include an ordinance review that uses the Scorecard or a regional version of it as a yardstick for measuring how close or far communities are to having their ordinances work for them in protecting water quality.

[2]U.S. EPA Office of Policy. Economics, and Innovation. 2010. See: http://www.epa.gov/smartgrowth/water_scorecard.htm
[3]Center for Watershed Protection. 1998. *Better Site Design: A Handbook for Changing Development Rules In Your Community.* See: http://www.cwp.org/Store/bsd.htm

1.5 Goals Vision Statement

As stated previously, the overall goal of the Coalition is to protect and manage watershed health as measured by chemical, physical and biological integrity and through education and communication. The Coalition also created goals under each subtopic: biological, chemical, physical and education and outreach.

A. *Biological*

1. Protect natural resources
2. Restore stream health
    a. Identify pollutants and sources and how the pollutants affect stream biology
    b. Use the Index of Biotic Integrity (IBI) as a baseline indicator of watershed health
3. Establish and protect buffers and greenway corridors through the creation of a prioritized map based on quality, restoration potential and other factors
4. Protect and restore streambanks and floodplain
5. Identify areas for modification/improvements: riffle/pool sequences, shoreline stabilization, reconnection with floodplain (list of potential restoration projects)
6. Identify existing open space, potential open space areas for protection, acquisition, easements, parks/recreation
7. Reduce nutrient enrichment

B. *Chemical*

1. Attain data necessary to assess and monitor stream quality
    a. Develop and implement a monitoring and analysis program
    b. Identify monitoring parameters
    c. Establish baseline levels and ongoing program
    d. Continue data collection and analysis to measure achievement (monitoring program)

C. *Physical*

1. Improve recreational opportunities, access and awareness
    a. Develop a watershed map identifying stream access points
    b. Promote signs identifying natural resources in the watershed
2. Reduce flooding and flood damage
    a. Identify land for potential public acquisition for preservation or private conservation easements
    b. Identify stream stabilization and restoration projects
    c. Ensure that wetland and floodplain maps are accessible
3. Reduce erosion
    a. Promote native vegetation for streambank stabilization and restoration
    b. Promote BMPs to reduce runoff velocity
    c. Conduct landowner outreach
    d. Look for partner agencies to maximize efforts

D. *Education, Outreach and Communication*

1. Enhance stewardship in the watershed through education, outreach and communication
    a. Extend outreach to the watershed by identifying stakeholders and their interests in the watershed, contacting them and encouraging and measuring participation for the duration of the project
    b. Education will be accomplished during the project through the creation of a watershed map, brochure, webpage, and meetings regarding key issues

2. Watershed Resource Inventory

The Watershed Resource Inventory is a summary of existing data that has been collected in the past within the Lower DuPage River watershed. The data will be used to characterize the watershed and detail the existing conditions. It is not meant to enumerate all data that has been collected within the watershed, but to highlight important watershed characteristics. It is our understanding that other than IEPA and coordinating agencies examining the watershed to gather data for Water Quality Reports, the area has not been looked at on a watershed basis.

2.1 Integrated Water Quality Report

Each state must report to the U.S. EPA the quality of the surface water (lakes, streams, wetlands) and groundwater resources in their jurisdiction. States must report the quality of their waters in terms of the degree in which the beneficial or designated uses are attained. States are also required to report the reasons or causes and sources of non attainment. IEPA issues the Integrated Water Quality Report every two years. The agency is responsible for monitoring the quality of rivers and streams which is accomplished by a program of monitoring stations and intensive or facility-related stream surveys. IEPA partners with IDNR and USGS to assist in their data collection efforts. The following explains the contents of the report as it relates to the Lower DuPage River Watershed.

2.1.1 Designated Uses

There are seven designated uses in Illinois. Five of the seven designated uses apply to the Lower DuPage River watershed: aquatic life, fish consumption, primary contact, secondary contact and aesthetic quality. For the *2008 Integrated Report*[1], the IEPA assessed streams in the state to determine if they meet the designated uses. However, not all stream segments were assessed nor were all designated uses assessed. Within the Lower DuPage River watershed at most two designated uses were assessed: aquatic life and fish consumption.

The degree of support or attainment of a designated use is determined by various information including biological (fish and macroinvertebrate data), water chemistry, in stream habitat and toxicity data. Assessed designated uses in a segment are rated as follows:

Fully Supporting (good)

Not Supporting (fair)

Not Supporting (poor)

Waters in which one or more designated use is not fully supported are considered impaired.

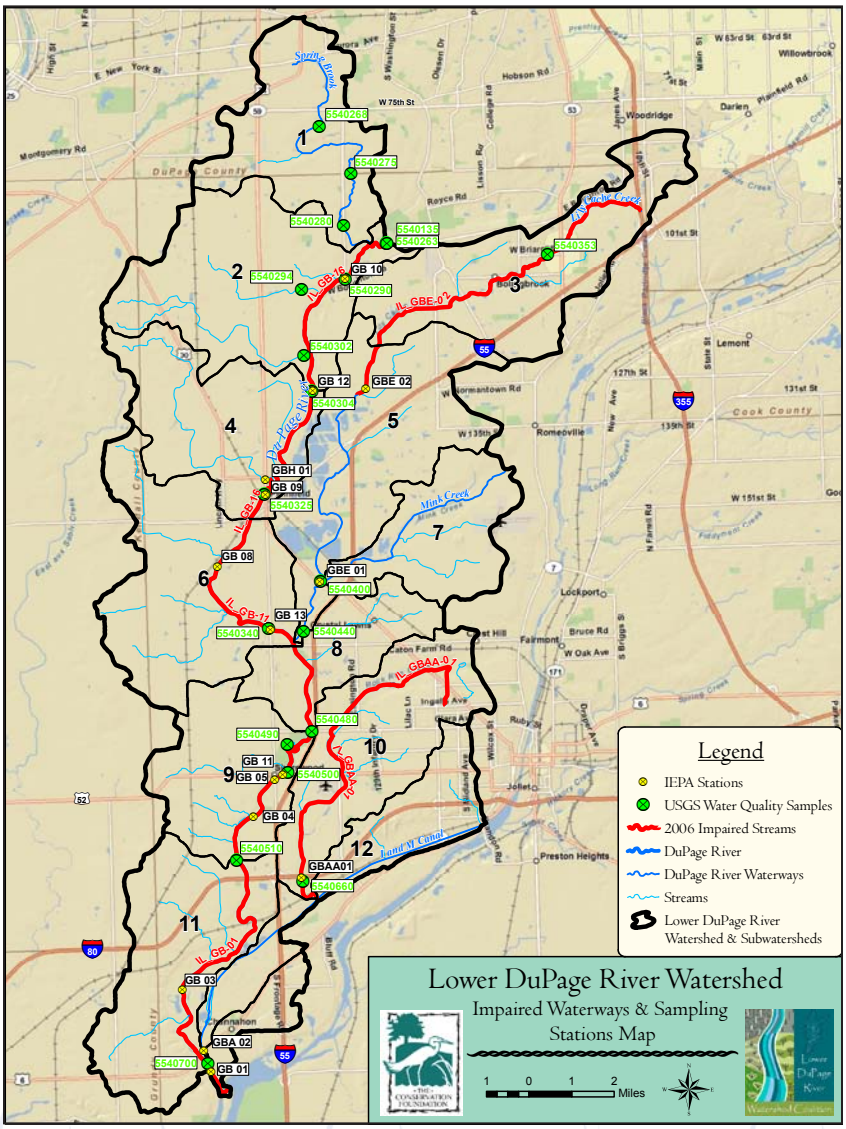


Figure 2-1: Impaired segments within the watershed and sampling sites, as designated by IEPA.

[1]http://www.epa.state.il.us/water/tmdl/303d-list.html

The IEPA assessed six segments in the Lower DuPage River watershed, three on the DuPage River mainstem (GB-01, GB-11, and GB-16), two on Lily Cache Creek (GBE-01 and GBE-02) and one on Mink Creek (GBEA). Spring Brook Creek was not assessed. Of the six segments assessed, four do not meet the assessed designated uses and are listed as impaired, including all main stem segments and one Lily Cache segment, as shown in Figure 2-1. TMDLs will be developed for the following parameters in three of the four impaired segments: chloride, dissolved oxygen, fecal coliform, and silver. It should be noted that although segments are listed instead of individual monitoring stations, stations are usually identified by the same code as the segment which its data is used for. Most often, the monitoring station is located within the segment.

Table 2-1: Subwatershed location and period of data collection of IEPA monitoring stations.

Subwatershed	Number of IEPA Stations	Station ID	Period of Record	
1	0	----	----	
2	1	GB 10	9/28/2005	11/3/2005
3	0	----	----	----
4	3	GB 09	----	----
		GBH 01	----	----
		GB 12	----	----
5	2	GBE 01	----	----
		GBE 02	----	----
6	2	GB 13	----	----
		GB 08	----	----
7	0	----	----	----
8	0	----	----	----
9	3	GB 04	----	----
		GB 05	----	----
		GB 11	9/28/2005	11/3/2005
10	1	GBAA01	----	----
11	2	GB 01	----	----
		GB 03	----	----
12	1	GBA 02	----	----

However, a monitoring station can be located outside the segment and there can be multiple monitoring stations for one segment. Data is collected at the monitoring stations by IEPA, IDNR, USGS and other partner agencies on a five year schedule. Figure 2-2 shows the locations of the USGS Streamflow Stations throughout the watershed as well as dams located by IDNR. Data for these impairments were collected in 2003 unless otherwise noted.

Table 2-2: Geographic location of IEPA monitoring stations.

Station Code	Basin	Waterbody	Intersection	County	Township	Range	Section	Quarter Section	Latitude	Longitude
GB-01	GB	DuPage River	Old Route 6 south of Channahon	Will	34N	9E	17	NW	41.42039	-88.2275
GB-02	GB	DuPage River	Route 6 Channahon	Will	34N	9E	17	NW	41.42639	-88.2325
GB-03	GB	DuPage River	Minooka Bonita-Vista WWTP, 103 Jardine	Will	34N	9E	7	SE	41.44834	-88.2405
GB-04	GB	DuPage River	1 mile south of Shorewood	Will	35N	9E	16	SE	41.50726	-88.2081
GB-05	GB	DuPage River	Route 59 bridge Shorewood old Route 66	Will	35N	9E	15		41.51983	-88.1986
GB-08	GB	DuPage River	Renwick Road southwest of Plainfield	Will	36N	9E	20	NE	41.5923	-88.2244
GB-10	GB	DuPage River	Plainfield-Naperville Road	Will	37N	9E	14	NE	41.69024	-88.1662
GB-11	GB	DuPage River	Route 52 Bridge in Shorewood	Will	35N	9E	10	SW	41.52157	-88.1948
GB-12	GB	DuPage River	127th Street 2 miles north of Plainfield	Will	37N	9E	26	SW	41.65185	-88.1811

Table 2-2: Geographic location of IEPA monitoring stations. (continued)

Station Code	Basin	Waterbody	Intersection	County	Township	Range	Section	Quarter Section	Latitude	Longitude
GB-14	GB	DuPage River	3 miles north of Plainfield	Will	37N	9E	23	SW	41.67222	-88.185
GB-15	GB	DuPage River	North of Shorewood	Will	35N	9E	10	SW	41.52222	-88.1939
GB-18	GB	DuPage River	2 miles north of Shorewood at Black Road Bridge	Will	35N	9E	3		41.53611	-88.1814
GB-19	GB	DuPage River	2 miles east of Minooka on Shepley Road	Will	35N	9E	33	SW	41.46807	-88.209
GBA-01	GBA	I & M Canal	Spillway on DuPage River	Will	34N	9E	17	SW	41.42063	-88.2287
GBA-02	GBA	I & M Canal	Route 6 in Channahon	Will	34N	9E	17	SW	41.42764	-88.2309
GBAA-01	GBAA	Rock Run	0.5 miles east of I-55/80 Intersection	Will	35N	9E	27	NE	41.48652	-88.1865
GBE-01	GBE	Lily Cache Creek	Route 30 Bridge 1 southeast of Plainfield	Will	36N	9E	23	SW	41.58721	-88.178
GBE-02	GBE	Lily Cache Creek	127th Street north northeast of Plainfield	Will	37N	9E	36	SW	41.65256	-88.1569
GBH-01	GBH	Norman Drain	Route 59 143rd Street in Plainfield	Will	36N	9E	10	NW	41.62198	-88.2026
GBJ-01	GBJ	Spring Brook Creek	0.25 miles south of Brook Crossings Park on Plainfield-Naperville Road	Will	37N	9E	12	NW	41.70781	-88.1669
GBJ-02	GBJ	Spring Brook Creek	0.25 miles southwest of Naperville on Plainfield-Naperville Road	DuPage	38N	9E	36	NW	41.73586	-88.1673

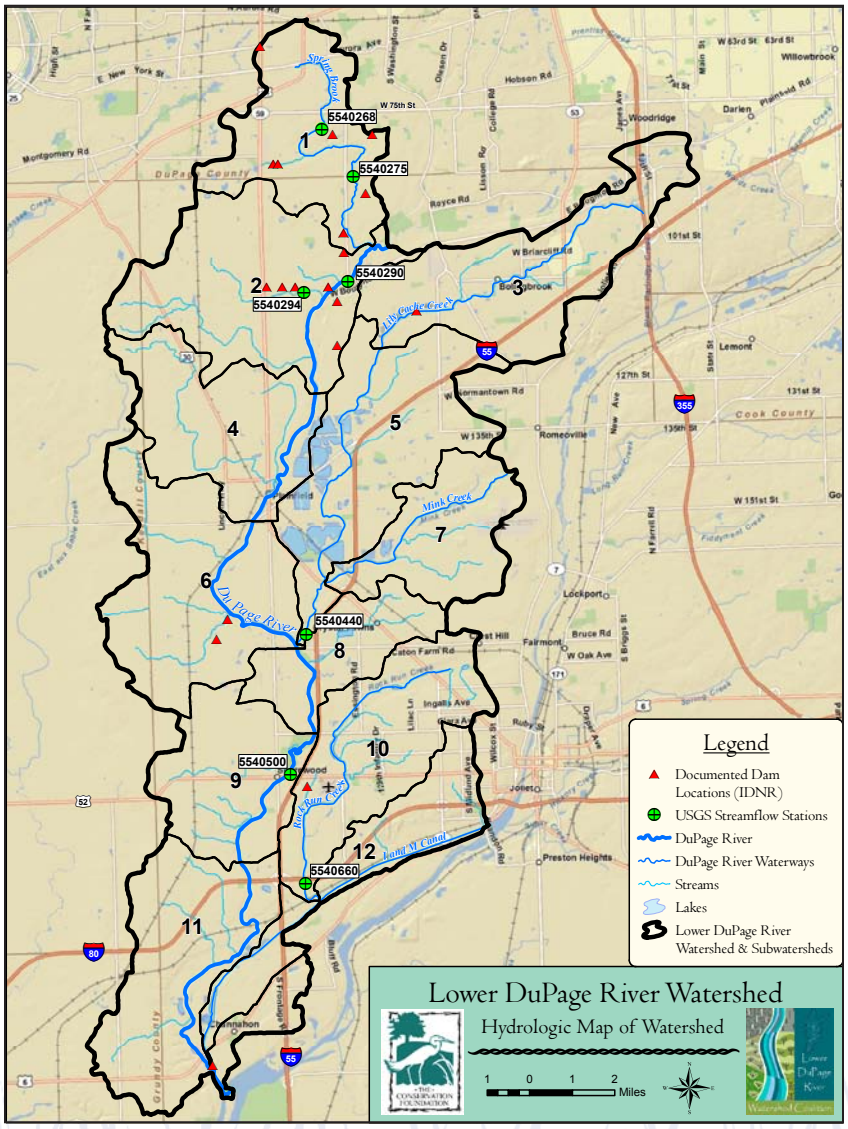


Figure 2-2: USGS Streamflow Stations and IDNR dam locations.

Table 2-3: Location of USGS Streamflow Stations within the watershed.

Subwatershed	Number of USGS Stations	Station ID	Site Name	Period of Record	
1	2	5540268	Spring Brook at 75th Street, Naperville, IL	9/1/2009	4/15/2010
		5540275	Spring Brook at 87th Street, Naperville, IL	9/30/1987	4/15/2010
2	2	5540290	DuPage River near Naperville, IL	10/30/1984	9/20/1990
		5540294	Clow Creek at Book Road near Plainfield, IL	8/9/1983	8/9/1983
3	0	----	----	----	----
4	0	----	----	----	----
5	1	5540440	Lily Cache Creek above Caton Farm Road near Joliet, IL	7/21/2000	7/21/2000
6	0	----	----	----	----
7	0	----	----	----	----
8	0	----	----	----	----
9	1	5540500	DuPage River at Shorewood, IL	3/19/1948	4/22/2010
10	1	5540660	Rock Run near Shorewood, IL	7/21/2000	7/21/2000
11	0	----	----	----	----
12	0	----	----	----	----

Table 2-4: Location of USGS Water Quality Stations within the watershed.

Subwatershed	Number of USGS Stations	Station ID	Site Name	Period of Record	
1	3	5540268	Spring Brook below 75th Street near Naperville, IL	9/1/2009	4/15/2010
		5540275	Spring Brook at 87th Street near Naperville, IL	10/28/1987	5/12/2010
		5540280	Spring Brook near Naperville, IL	7/18/1983	8/8/1983
2	4	5540290	DuPage River near Naperville, IL	11/14/1977	5/5/1997
		5540294	Clow Creek at Book Road near Plainfield, IL	7/18/1983	8/9/1983
		5540302	Wolf Creek at Book Road near Plainfield, IL	7/18/1983	8/8/1983
		5540304	DuPage River at 127th Street near Plainfield, IL	7/18/1983	8/9/1983
3	1	5540353	Lily Cache Creek at Briar Circle Road near Barbers Corners	7/17/1983	7/19/1983
4	1	5540325	DuPage River at State Route 59 at Plainfield, IL	7/18/1983	8/9/1983
5	2	5540400	Lily Cache Creek near Plainfield, IL	7/18/1983	8/9/1983
		5540440	Lily Cache Creek above Caton Farm Road near Joliet, IL	7/21/2000	7/21/2000
6	1	5540340	DuPage River at State Route 59 near Plainfield, IL	7/18/1983	8/9/1983
7	0	----	----	----	----
8	0	----	----	----	----
9	4	5540480	DuPage River at Black Road at Shorewood, IL	7/18/1983	8/9/1983
		5540490	DuPage River at Hammel Woods at Shorewood, IL	8/2/1989	7/30/1990
		5540500	DuPage River at Shorewood, IL	10/7/1970	9/25/2002
		5540510	DuPage River near Minooka, IL	7/8/1981	7/17/1981
10	1	5540660	Rock Run near Shorewood, IL	7/21/2000	7/27/2000
11	0	----	----	----	----
12	1	5540700	DuPage River at Channahon, IL	11/3/1981	12/2/1981

2.1.1.1 Aquatic Life

The aquatic life designated use is assessed primarily using biological data. The attainment or non attainment of the aquatic life designated use is decided based on biological, chemical and in stream habitat data. IEPA uses a decision matrix weighing the different factors to determine if a segment is impaired for aquatic life. Specific metrics used to assess aquatic life for the Lower DuPage watershed include the fish Index of Biotic Integrity (fIBI) and the Macroinvertebrate Biotic Index (MBI). Water chemistry and in stream habitat are also taken into account.

The fish Index of Biotic Integrity combines several parameters to measure the health of the area's fish population and ranges from 10 to 60 with higher scores indicating higher quality areas. A value of 41 or below indicates impairment. Fish surveying is a joint effort by IEPA and IDNR. Sampling was conducted in 1997, 2001, 2003 and 2008. The 2001 effort is summarized in the *Assessments of the Impacts of Dams on the DuPage River*, by Jennifer Hammer and Robert Linke, October 2003.

Table 2-5: Fish IBI scores used to assess aquatic life.

Station	Segment	1997	2001	2003	2008	Average
GB-11	GB-11	48	--	45 (2002)	43	45
GB-10	GB-16	--	33	--	--	33
GB-05	GB-11	--	28	--	--	28
GB-04	GB-11	--	42	--	--	42
GB-02	GB-01	--	14	--	--	14
GB-01	GB-01	38	48	57	58	50
Average		43		51	51	

IDNR summarizes the findings of the fish survey in the report entitled Status of Fish Communities and Stream Quality in the Des Plaines and DuPage Rivers: 2003 Basin Survey[2]. The report states that stream quality based on fIBI on the DuPage mainstem ranged from Moderate to Limited and dams appear to be limiting factors. For example, site GB-01 is below the Channahon Dam and is directly connected with the lower Des Plaines River, near the confluence with the Illinois and Kankakee Rivers. This accounts for the site being the most species diverse location in the entire DuPage River Basin (including the East and West Branches in the upper DuPage River watershed). Nine additional species were collected in 2003 in this location alone including two river redhorses (*Moxostoma carinatum*), a state endangered fish. However, the dam prevents further migration of fish upstream, regardless of whether the habitat would support the fish or not.

The 2003 survey also found a reduction in the relative abundance of pollutant tolerant species including carp and green sunfish and an increase in smallmouth bass, a species classified as intolerant. The reason for the observed improvement from 1997 to 2003 is unclear.

The fIBI is the basis for determining Biological Stream Characterization[3] as follows:

51-60	A	Unique Aquatic Resource
41-50	B	Highly Valued Aquatic Resource
31-40	C	Moderate Aquatic Resource
21-30	D	Limited aquatic Resource
0-20	E	Restricted Aquatic Resource

Portions of the Lower DuPage River received a rating of a C and D according to the above criteria.[4]

[2]Stephen Pescitelli and Robert Rung. December 2005.

[3]Bertrand *et al.* 1996.

[4]IDNR's *Integrating Multiple Taxa in a Biological Stream Rating System*

MBI measures the abundance and pollutant tolerance of macroinvertebrate species. The index ranges from 0 to 11, with lower scores indicating higher quality. A value of 5.9 or above indicates impairment.

Table 2-6: MBI scores used to assess aquatic life.

Station	Segment	2001	2003	Average
GB-16	GB-16		6.2	6.2
GB-11	GB-11		5.6	5.6
GB-10	GB-16	5.6		5.6
GB-05	GB-11	5.0		5.0
GB-04	GB-11	5.1		5.1
GB-02	GB-01	5.5	--	5.5
GB-01	GB-01	5.6	5.4	5.5
Average		5.4	5.7	

IDNR (in conjunction with IEPA) also evaluates habitat using the qualitative habitat evaluation index (QHEI). Six variables are taken in account in calculating QHEI: substrate, instream cover, channel morphology, riparian zone, pool quality and riffle quality. Scores range from 0 to 100A QHEI value was calculated at stations GB-01 and GB-11 based on 2003 data. The QHEI scores were 87 and 68, respectively. A score above 60 is representative of habitat without impairment. Although a segment in Lily Cache Creek, GBE-02, is listed as impaired for Aquatic Life, no data was collected for this segment during the years we examined.[5]

2.1.1.2 Fish Consumption

The assessment of fish consumption is based on fish tissue data and fish consumption advisories issued by the Illinois Fish Contaminant Monitoring Program (FCMP), which determines levels of contaminants in sport fish and issues consumption advisories for species accumulated contaminants above specified levels. Fish consumption is impaired within the watershed because of polychlorinated biphenyl (PCB) contamination. For segment GB-16 the FCMP recommends consuming carp as only one meal a week. For segment GB-01, carp, channel catfish, and smallmouth bass are recommended to be consumed no more than once a month.[6]

2.1.1.3 Primary Contact

Primary contact means any recreational or other use in which there is a risk of ingesting water in quantities that would pose a health hazard. Assessment of primary contact is based on fecal coliform data. Fecal coliform is sampled using the geometric mean of five samples in a maximum 30 day period. From May to October the geometric mean cannot exceed 200/100ml nor can more than 10 percent of the samples during any 30 day period exceed 400/100ml, year round. However, sampling is not usually conducted at the required frequency.

2.1.2 Causes of Impairment

After an impairment is determined by IEPA, the next step is to determine what is causing the impairment, often an exceedance of a numeric water quality standard.

The causes of the impairments to segment GB-01 that have numeric standards are mercury, PCBs and silver. The PCBs were found to be at an elevated level of 10ug/kg, which is the limit for an elevated level, during the 2003 sediment sampling. The silver standard of 5µg/L was violated once out of 18 observations in 2000[7]. The phosphorous standard of 0.61 mg/L was exceeding three out of four sampling points in 2003.[8]

[5]Personal communication, Howard Essig, IEPA.

[6]2008 Illinois Fishing Information Guide http://www.idph.state.il.us/envhealth/fishadv/2008_fish_advisories.pdf

[7]DuPage TMDL Stage 1 Final, p. 5-12.

[8]Des Plaines 2003 Water Quality Data provided by IEPA

The causes of impairment for segment GB-11 that have numeric standards are chloride, DDT, hexachlorobenzene, mercury, PCBs, phosphorus and fecal coliform. Exceedances of the numeric standard were identified in sediment data for DDT, hexachlorobenzene, PCBs. An exceedance to the chloride numeric standard of 500mg/L was identified in 2002 and 2003. The phosphorus standard of 0.61 mg/L was exceeded many times from 1999-2002, but no exceedances were found in the 2003 data. Exceedances of the numeric standard for fecal coliform were also identified in data collected from 2002-2006. Data for total suspended solids from 1999-2005 was not found.

The causes of impairment for segment GB-16 that have numeric standards include dissolved oxygen, phosphorous, mercury, PCBs and fecal coliform. Sediment data for this segment was not provided by IEPA, which likely means that it has not been collected for this segment since prior to 1999. Exceedances of the numeric standard for fecal coliform were also identified in data collected in 2003 and 2004. Phosphorus data was above the standard from 2000-2003. Data was provided for dissolved oxygen exceedances.

After examining water quality data for segments GB-01, GB-11 and GB-16 from 1999-2003 and 2005, an exceedance in the mercury standard was not found which likely means that it occurred prior to 1999. The cause of impairment for segments GB-01, GB-11 and GB-16 is also listed as other flow regime altered, siltation/sedimentation (not GB-16) and aquatic plants which are all based on field observations and notes.[9]

Segment GBE-02 is listed as impaired for aquatic life. The cause of impairment is listed as unknown. As previously stated, this impairment is not based on data that has been collected in the last ten years. It is likely that part of the cause of impairment was due to an altered flow regime, the creek had been straightened and channelized. A restoration project was undertaken 2005 to stabilize the banks and restore more of a naturalized channel to the stream in this location.

Sources of PCBs include old electrical transformers, landfills and hazardous waste sites, circuit breakers, fluorescent light ballasts and other types of electrical equipment that contain electric insulting fluid. The manufacturing of PCB was banned in 1977, however PCB containing equipment still in use can fail.[10]

Table 2-7: Impaired segments, causes and sources. From Appendix B-2 2008 Integrated Report.

Name	*Assessment Unit ID*	*Cat.*	*Size (miles)*	*Use Attainment*	*Causes*	*Sources*
DuPage River	IL_GB-01	5	8	N582, N583, X585, X586, X590	319, 371, 375, 462, 478, 274, 348	58, 122, 132, 144, 177, 85, 10, 140
DuPage River	IL_GB-11	5	9.81	N582, N583, N585, X586, X590	138, 177, 246, 319, 348, 371, 403, 462, 478, 274, 400	85, 177, 28, 58, 122, 132, 10, 140
DuPage River	IL_GB-16	5	10.39	N582, N583, N585, X586, X590	319, 322, 462, 478, 274, 348, 400	58, 85, 122, 177, 10, 140
Lily Cache Creek	IL_GBE-01	2	7.56	F582, X583, X585, X586, X590	N/A	N/A
Lily Cache Creek	IL_GBE-02	5	9.56	N582, X583, X585, X586, X590	463	N/A
Mink Creek	IL_GBEA	3	5.64	X582, X583, X585, X586, X590	N/A	N/A

Source ID Description

N/A	No Source Identified
10	Atmospheric Deposition - Toxics
28	Contaminated Sediments
58	Impacts from Hydrostructure Flow Regulation/modification
85	Municipal Point Source Discharges
122	Site Clearance (Land Development or Redevelopment)
132	Upstream Impoundments
140	Source Unknown
144	Crop Production (Crop Land or Dry Land)
177	Urban Runoff

Support Code	Use Support Level
F	Fully Supporting
N	Not Supporting
X	Not Assessed

Use ID	Use Description
582	Aquatic Life
583	Fish Consumption
585	Primary Contact
586	Secondary Contact
590	Aesthetic Quality

Cause ID	Description
N/A	No Cause Identified
138	Chloride
177	DDT
246	Hexachlorobenzene
274	Mercury
319	Other flow regime alterations
322	Oxygen, Dissolved
348	Polychlorinated biphenyls

Cause ID	Description
371	Sedimentation/Siltation
375	Silver
400	Fecal Coliform
403	Total Suspended Solids
462	Phosphorus (Total)
463	Cause Unknown
478	Aquatic Plants

[9]Personal communication, Howard Essig, IEPA.

[10]http://www.chesapeakebay.net/pcbs.aspx?menuitem=19494

2.1.3 Total Maximum Daily Loads

The Clean Water Act requires that a designated agency, in this case IEPA, develop a Total Maximum Daily Load (TMDL) for each pollutant of an impaired water body. IEPA develops TMDLs for waters that are impaired by a pollutant, which include metals or pesticides. TMDLs are not developed for nonpollutant impairments. TMDLs set numerical pollutant reduction goals to improve impaired waters.

TMDLs are estimations of the maximum amount of a pollutant that a waterbody can receive and continue to meet water quality standards. TMDLs take into account point and nonpoint sources of the particular pollutant, as well as a margin of safety, in order to accurately depict the amount of pollutant that a waterbody can receive. States and local communities then will establish controls to limit the amount of the pollutant entering the waterbody. The TMDL report will also identify potential contributing sources to the impairment.

There are three segments within the Lower DuPage River watershed in which TMDLs are being developed: GB-01, GB-11, and GB-16. TMDLs are being developed for chloride, dissolved oxygen, fecal coliform, and silver in the watershed. The table below shows acceptable levels of the parameters exceeded in the Lower DuPage that are surveyed by IEPA.

Table 2-8: Water quality standards for TMDL Parameters.

Parameter	Units	General Use Water Quality Standard
Chloride	Mg/L	500
Dissolved oxygen	Mg/L	5.0, March-July; 3.5, August-February*
Fecal coliform bacteria	Count/100 ml	200[11], 400[12] (May-October)
Silver	µg/L	5.0

*Segment GB-16 is subject to enhanced protection meaning that the standard is 5.0 Mg/L instantaneous minimum for March through July and 4.0 Mg/L for August through February.

A TMDL is being developed for silver in segment GB-01. IEPA has listed urban runoff/storm sewers as a potential source of silver contamination. Additional potential sources of silver include industrial and landfill waste.

A TMDL is being developed for chloride for segment GB-11. Potential sources for chloride include municipal point source discharges and urban runoff and storm sewers. Chloride TMDLs have been previously developed for the Upper DuPage watershed. Through their data collection, it is evident that chloride impairment in the area is due to snow removal activities. It is likely the cause of the impairment in the Lower DuPage as well.

TMDLs are being developed for fecal coliform in segments GB-11 and GB-16. Fecal coliform is a widespread cause of impairment for primary contact throughout the watershed. At this point, it is unknown what the source of fecal coliform is, whether it be from wastewater treatment plants, failing septic fields, pet and wildlife waste, or a combination of factors. Stakeholder input has indicated that wildlife, in particular water fowl, is likely to blame. No fecal coliform issues of note have been associated with wastewater treatment plants in the watershed.

A TMDL is being developed for dissolved oxygen in segment GB-16. Segments GB-11 and GB-16 are held to a higher standard for dissolved oxygen because they have been designated enhanced protection zones. IEPA has listed impacts from hydrostatic flow regulation/modification as a potential source of low dissolved oxygen levels. Altered flow regimes, widening of rivers and streams into wide flat channels, slows down water movement, causing stagnation and algae growth, resulting in low dissolved oxygen.

2.2 Physical Watershed Characteristics

The physical conditions of the watershed, including historical conditions, land use, topography, geology, soils, wetlands and floodplain have a great influence over potential problems and solutions.

[11]Geometric mean based on a minimum of 5 samples taken over not more than a 30-day period.

[12]Not to be exceeded by more than 10% of samples in a 30-day period.

2.2.1 Historical Conditions

Pre-settlement data, as depicted in Figure 2-3, shows that the vegetation within the watershed was forested in pockets along the main stem of the river, but otherwise was comprised mostly of prairie.

2.2.2 Land Use

Land use data was taken from the CMAP 2005 data set to create Figure 2-4. Agriculture and residential land uses are nearly equally dominant in the watershed. Agricultural land use is dominated by row cropping of mostly corn and soybeans. There are other types of agriculture being conducted in the watershed including nurseries, tree farms, sod farms, animal production operations and dairy facilities. Residential use is dominated by single family homes, duplexes and townhouse units. There are very few commercial uses.

Table 2-10: Current land use in the watershed.

Land Use	*Acres*	*Percent in Watershed*
Agricultural Land	28,786	26.72%
Commercial and Services	4,338	4.03%
Industrial, Warehouse, and Wholesale Trade	5,596	5.19%
Institutional	2,916	2.71%
Open Space	8,771	8.14%
Residential	34,951	32.44%
Transportation, Communication, and Utilities	2,848	2.64%
Vacant, Wetlands, or Under Construction	15,871	14.73%
Water	3,652	3.39%

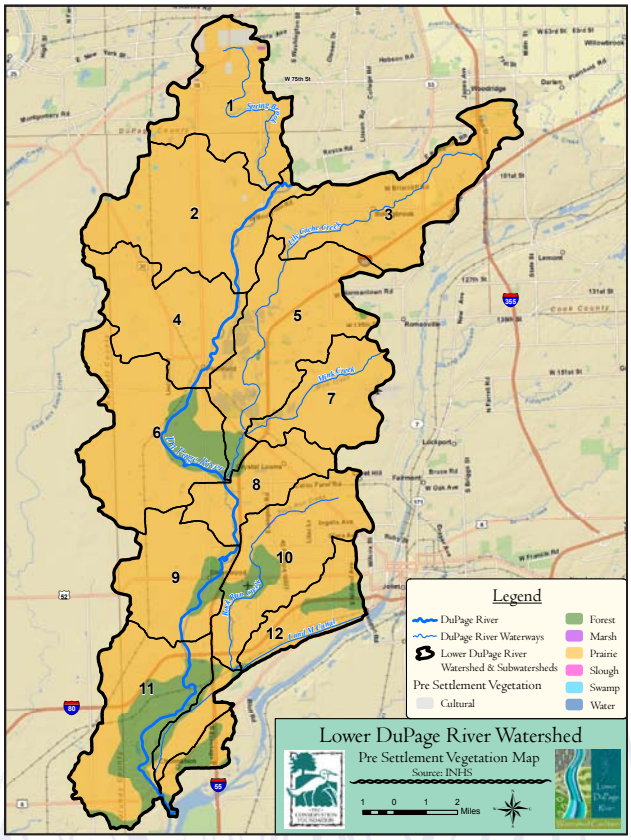


Figure 2-3: Pre-settlement vegetation.

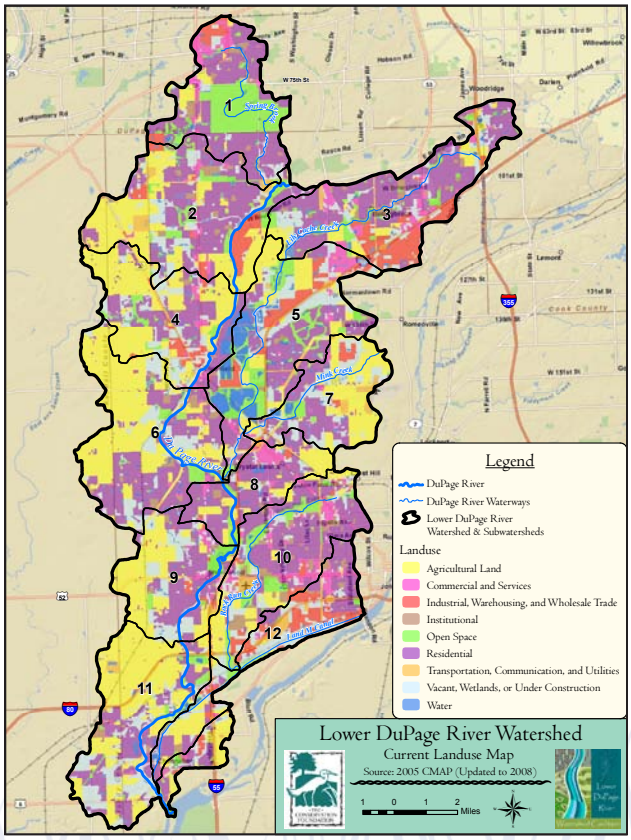


Figure 2-4: Land use.

Open space is comprised of forest preserve district, park district, municipal, state and other land that is designated as open space, unimproved or for recreational uses. This land use is further subdivided and specific parcels shown on the Conservation and Recreation Lands (CARL) map, Figure 2-5. Table 2-11 shows the area of these lands by subwatershed. It should be noted that the open space land use classification in Table 2-10 is calculated from data from CMAP and can include unprotected lands while the CARL open space number is calculated from data supplied by Ducks Unlimited for conservation and recreation areas.

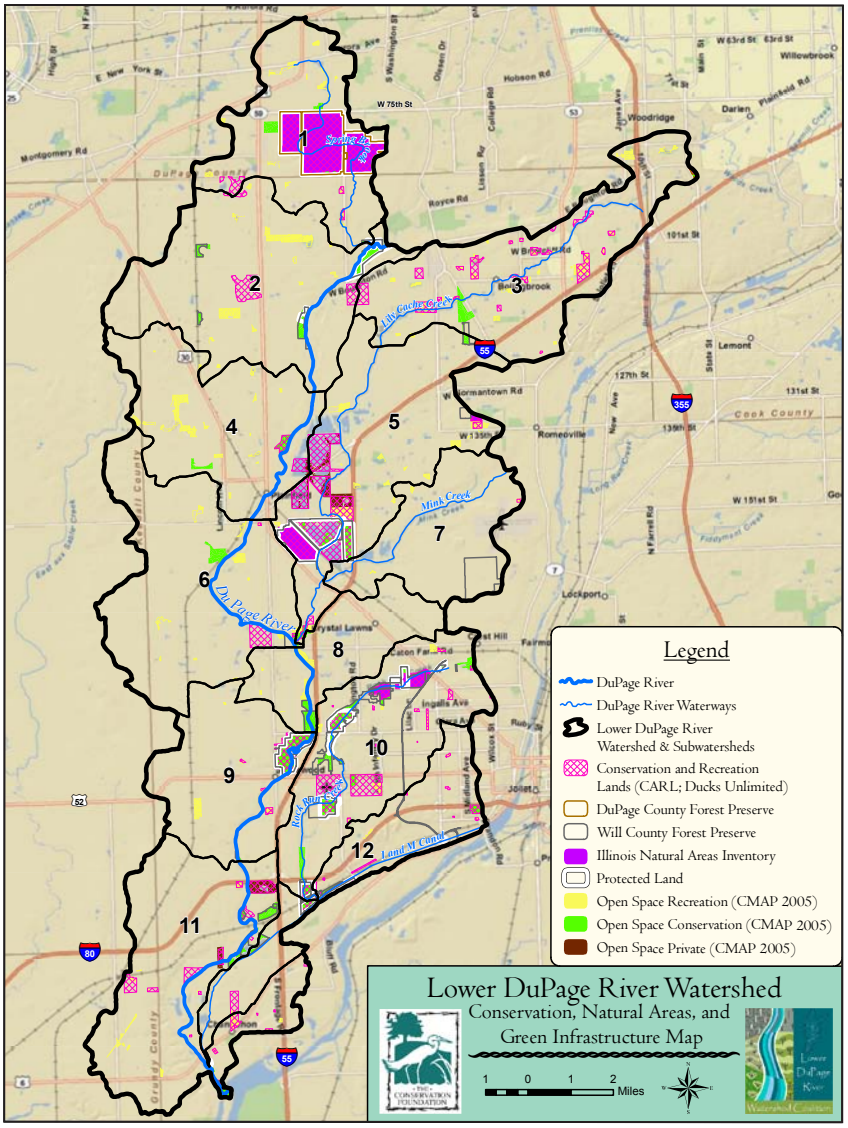


Figure 2-5: Conservation and Recreation Lands.

Table 2-11: Conservation and Recreation Lands by subwatershed.

Subwatershed	Total Acres in Subwatershed	Acres of CARL in Subwatershed	Percent CARL in Subwatershed	Percent CARL in Watershed
1	8,183	1,824.59	22.30%	1.69%
2	12,217	254.31	2.08%	0.24%
3	10,593	478.06	4.51%	0.44%
4	8,689	123.13	1.42%	0.11%
5	11,358	1,779.51	15.67%	1.65%
6	11,754	178.00	1.51%	0.17%
7	6,062	13.41	0.22%	0.01%
8	4,826	0.14	0.00%	0.00%
9	7,076	350.66	4.96%	0.33%
10	9,143	1,064.38	11.64%	0.99%
11	11,734	438.75	3.74%	0.41%
12	6,147	266.43	4.33%	0.25%
Entire Watershed	107,782	6,771.36		6.28%

There are a number of Illinois Natural Area Inventory sites within the watershed, high quality natural areas that often serve as habitat for threatened and endangered species. These sites are assessed and designated by the IDNR and can be located on private or public land. These sites are worth taking note of their location for future planning purposes.

Table 2-12: Illinois Natural Areas Inventory sites by subwatershed.

Subwatershed	*Total Acres in Subwatershed*	*Acres of INAI in Subwatershed*	*Percent INAI in Subwatershed*	*Percent INAI in Watershed*	*Site Name*
1	8,183	1,708.68	20.88%	1.59%	Springbrook Prairie
2	12,217	1.01	0.01%	0.00%	Vermont Cemetery Prairie
3	10,593	-----	-----	-----	-----
4	8,689	-----	-----	-----	-----
5	11,358	351.28	3.09%	0.33%	O'Hara Woods and Lake Renwick Heron Rookery
6	11,754	0.16	0.00%	0.00%	Lake Renwick Heron Rookery
7	6,062	-----	-----	-----	-----
8	4,826	-----	-----	-----	
9	7,076	-----	-----	-----	-----
10	9,143	252.03	2.76%	0.23%	Theodore Street Marsh
11	11,734	-----	-----	-----	-----
12	6,147	7.57	0.12%	0.01%	Rockdale Railroad Prairie/ Mount Road Botanical Area
Entire Watershed	107,782	2,320.73		2.15%	

There are also many forest preserve district properties within the watershed, with both the Will County and DuPage County Forest Preserve Districts having significant land holdings.

Table 2-13: Forest Preserve Districts of Will and DuPage Counties properties and associated land area.

Will County Forest Preserves			
Preserve Name	*Total Acres*	*Preserve Name*	*Total Acres*
Alessio Prairie	12	Lower Rock Run Preserve	183
Birds Junction Marsh	56	Lake of the Woods	3
Briscoe Mounds	27	McKinley Woods	16
Caton Farm Preserve	35	O'Hara Woods Preserve	38
Colvin Grove Preserve	172	Prairie Bluff Preserve	428
DuPage River Confluence	160	Riverview Farmstead	71
Hastert-Bechstein Preserve	18	Rock Run Preserve	316
Hammel Woods	404	Theodore Marsh	278
Joliet Junction Trail	52	Vermont Cemetery	24
Kraske Preserve	3	Wolf Creek Preserve	15
Lake Chaminwood Preserve	115	***DuPage County Forest Preserves***	
Lily Cache Wetlands	50	Springbrook Prairie	1701
Lake Renwick Heron Rookery Nature Preserve	316	Leverenz Estate	6
Lake Renwick Preserve	492	Oldfield Oaks	10

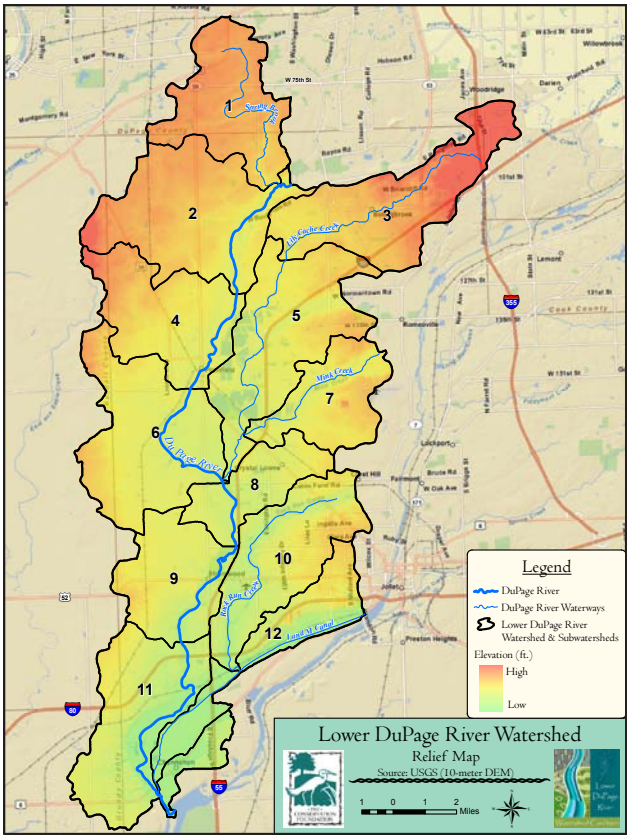


Figure 2-6: Topography.

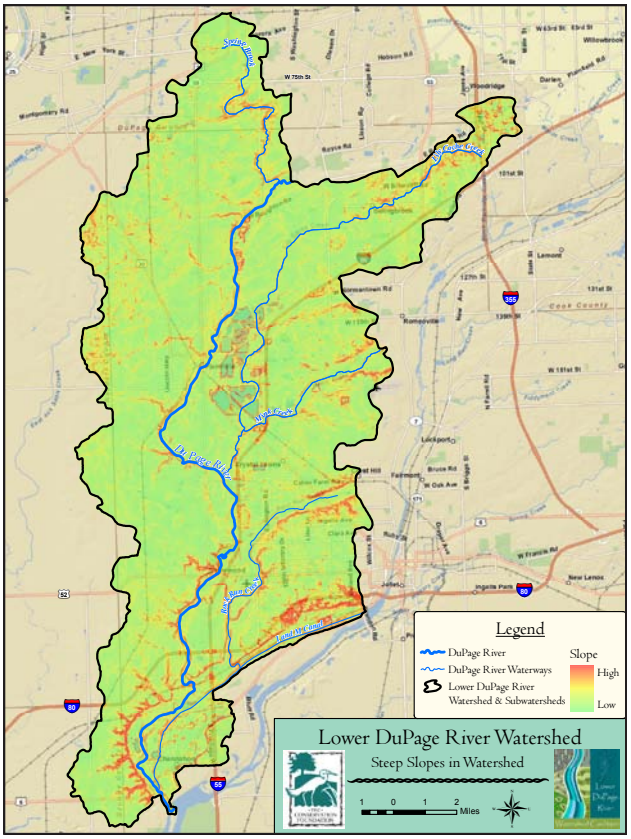


Figure 2-7: Steep Slopes.

2.2.3 Topography

Elevations are higher in the north and west portions of the watershed and lower at the south and east end of the watershed, near the confluence with the Des Plaines River, as shown in Shaded Relief Map, Figure 2-6. This results in an overall flow from north to south. Elevations range from a high of 238 feet above sea level within the Lily Cache Creek basin to a low of 153 feet above sea level at the confluence of the Lower DuPage with the Des Plaines River. The topography of each subwatershed has been mapped in greater detail and is included in Appendix B.

The Steep Slopes Map, Figure 2-7, shows locations within the watershed that have steep slopes, where erosion is more of a risk factor than at other locations. Areas of steep slopes tend to increase moving from north to south in the watershed. These areas should be given consideration when examining potential areas for streambank stabilization projects.

2.2.4 Geology

The unconsolidated geologic materials left behind by glacial deposits can help indicate infiltration, soil quality, depth to bedrock, and other factors. Surficial Geology is depicted in Figure 2-8. The majority of the watershed is underlain with "diamicton deposited as till and ice-marginal sediment", although there is a large percentage of sediment and sand mixture, as shown in Table 2-14, mostly surrounding the main stem and larger tributaries.

Table 2-14: Surficial geology in the watershed.

Code	*Description*	*Acres*	*Percent in Watershed*
C1	Waterlain river sediment and wind blown beach sand	25,081	23.27%
E1	Fine-grained sediment deposited in lakes	698	0.65%
M1	Diamicton deposited as till and ice-marginal sediment	82,002	76.08%

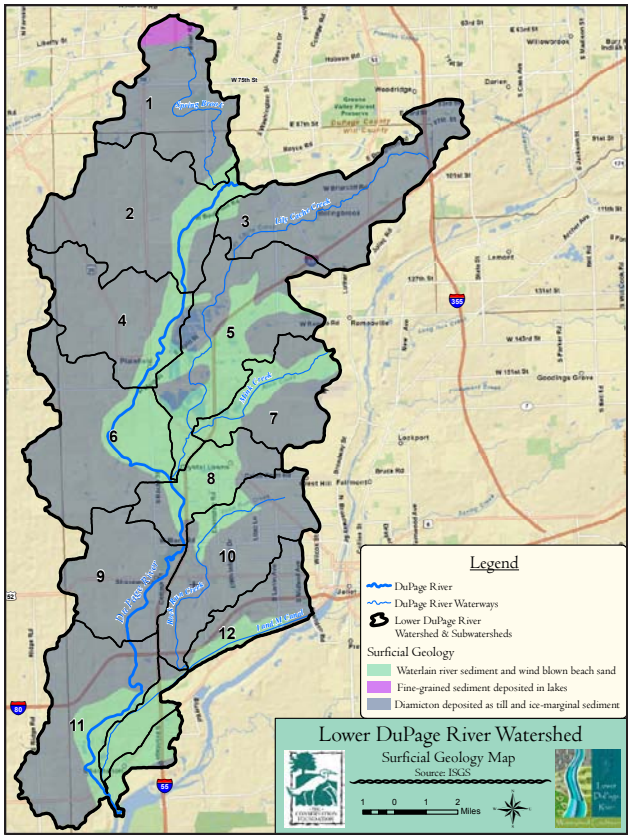


Figure 2-8: Surficial Geology.

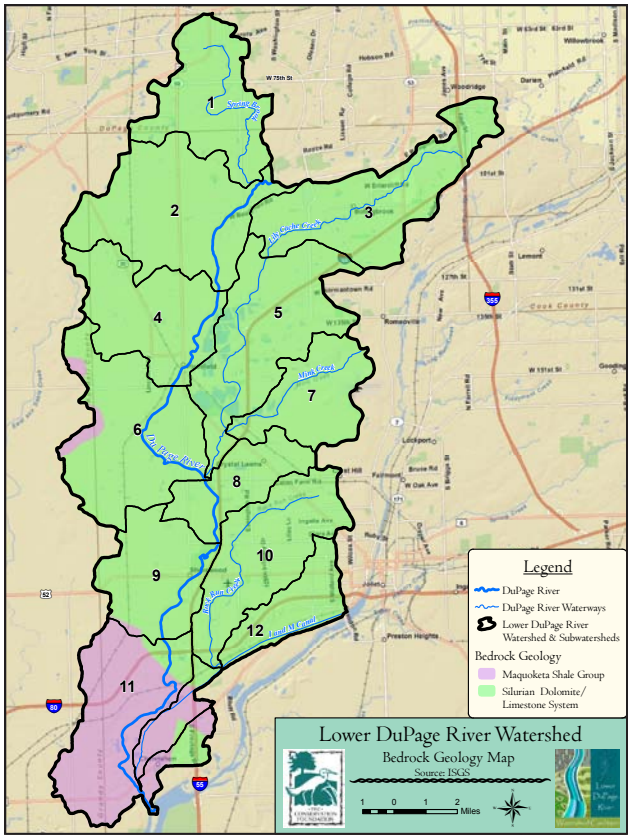


Figure 2-9: Bedrock Geology.

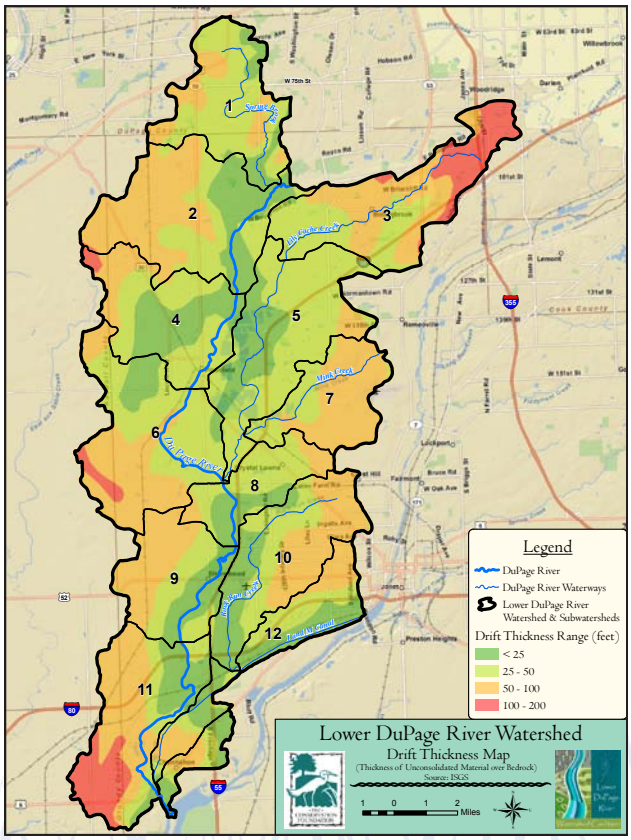


Figure 2-10: Drift Thickness.

Bedrock composition is almost uniform throughout the watershed, with small areas of Maquoketa Shale and the majority of Silurian Dolomite/Limestone System. Figure 2-9 shows the bedrock composition and Table 2-15 shows the breakdown of the percentage.

Table 2-15: Bedrock geology in the watershed.

Abbreviation	*Lithology Name*	*Acres*	*Percent in Watershed*
Om	Maquoketa Shale Group	12,351	11.46%
Su	Silurian Dolomite / Limestone System	95,431	88.54%

Figure 2-10 shows the post glacial drift thickness, or depth to bedrock, which ranges from 200 feet to less than 25 feet. Both pre-settlement vegetation and drift thickness are important factors to consider in restoration and infiltration projects. There are areas of the watershed in which gravel mining takes place and the bedrock is almost located at the surface.

Table 2-16: Drift thickness in the watershed.

Thickness	*Thickness Range*	*Acres*	*Percent in Watershed*
1	< 25	22,257	20.65%
2	25 - 50	42,587	39.51%
3	50 - 100	37,467	34.76%
4	100 - 200	5,471	5.08%

2.2.5 Soils

Soil affects land use planning, for example whether construction is more likely to cause erosion can often be foretold by looking at what particular types of soil are located on site. Soil properties can change drastically in short distances. Some soils are seasonally wet while others are subject to flooding. In some areas there is shallow bedrock. Clay and wet soils are unsuitable for septic fields. An area with a high water table is unsuitable for basements.

Soil forms through the deposition of geological material. Factors that affect soil formation include climate, plant and animal life, elevation and time.

Hydric soils are essential for wetland formation and identification. The three characteristics of wetlands are hydrophytic vegetation, hydric soils and wetland hydrology. Undrained hydric soils that have natural vegetation should support a wetland system. The extensive amount of mapped hydric soils, as shown in Figure 2-11, shows that historically, a large amount of wetlands have been drained and converted to other uses, otherwise there would be a greater area of wetlands. Table 2-17 shows the area of hydric soil in the various subwatersheds and Table 2-18 and Figure 2-12 describes the amount of soil in the different hydrologic groups within the watershed.

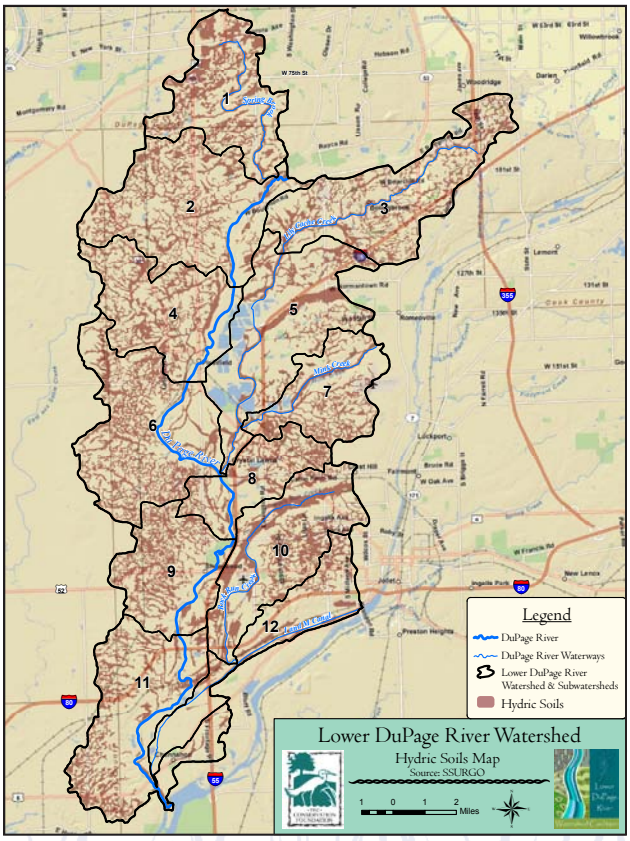


Figure 2-11: Hydric Soils.

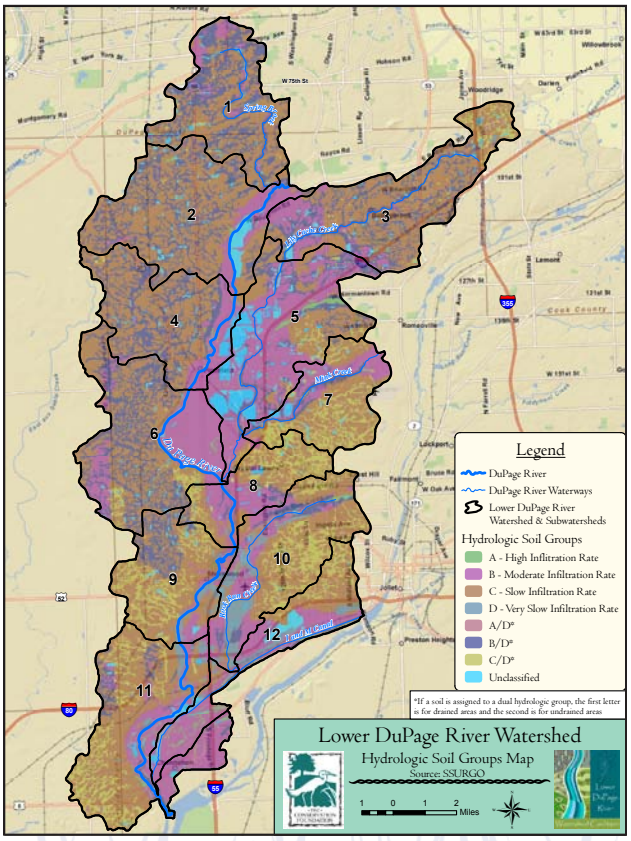


Figure 2-12: Hydrologic Groups.

Table 2-17: Hydric soil area and percent composition by subwatershed.

Subwatershed	Total Acres in Subwatershed	Acres of Hydric Soils in Subwatershed	Percent Hydric in Subwatershed	Percent Hydric in Watershed
1	8,183	3,174	38.79%	2.95%
2	12,217	3,580	29.30%	3.32%
3	10,593	3,102	29.28%	2.88%
4	8,689	2,600	29.92%	2.41%
5	11,358	2,614	23.01%	2.42%
6	11,754	3,882	33.02%	3.60%
7	6,062	1,883	31.07%	1.75%
8	4,826	1,659	34.38%	1.54%
9	7,076	2,455	34.69%	2.28%
10	9,143	3,385	37.03%	3.14%
11	11,734	2,830	24.12%	2.63%
12	6,147	1,163	18.93%	1.08%
Entire Watershed	107,782	32,327		29.99%

Table 2-18: Hydrologic soil groups in the watershed.

Hydrologic Soil Groups	Description	Acres	Percent in Watershed
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet.	919	0.85%
B	Soils having a moderate infiltration rate when thoroughly wet.	23,121	21.46%
C	Soils having a slow infiltration rate when thoroughly wet.	49,064	45.55%
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet.	2,305	2.14%
A/D*	-----	298	0.28%
B/D*	-----	18,562	17.23%
C/D*	-----	8,506	7.90%
1	Unclassified	4,942	4.59%

The soil erodibility factor, or K-factor, is a quantitative description of the erodibility of a particular soil. The erodibility factor reflects that different soils erode at different rates when other factors including infiltration rates, permeability, total water capacity, dispersion, rain splash and abrasion, are held constant. Areas of high erodibility, as shown in red on Figure 2-13, as well as areas of stream instability as shown in purple on Figure 2-14, may be targeted for bank stabilization practices or taken into special consideration when planning for development.

2.2.6 Wetlands

The U.S. Fish and Wildlife Survey National Wetlands Inventory (NWI) used aerial photography from the 1980's to map the nation's wetlands. Wetlands provide habitat, ground water recharge, flood protection and naturally cleanse water of pollutants. Wetlands have the potential to remove nutrients from the water that flows through them. They can also assist in the prevention and reduction of flooding.

The NWI, Figure 2-15, shows that there is less than 6,000 acres of wetland located within the watershed. A majority of the wetlands in the area are lakes, likely due to gravel pit excavation. The NWI is not updated and often does not take into account small scale isolated wetlands. Wetlands that have been impacted by development since the NWI was created are also not reflected. The NWI only maps the location and general type of wetland; there is no indication of wetland quality in this database. There is no other wetland database in the watershed, except for the portion that is within DuPage County.

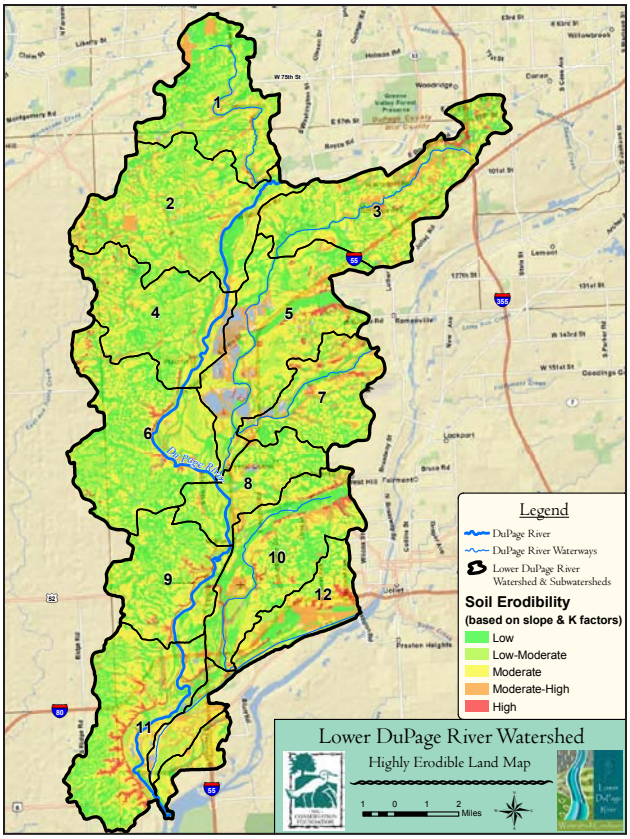


Figure 2-13: Highly erodible land.

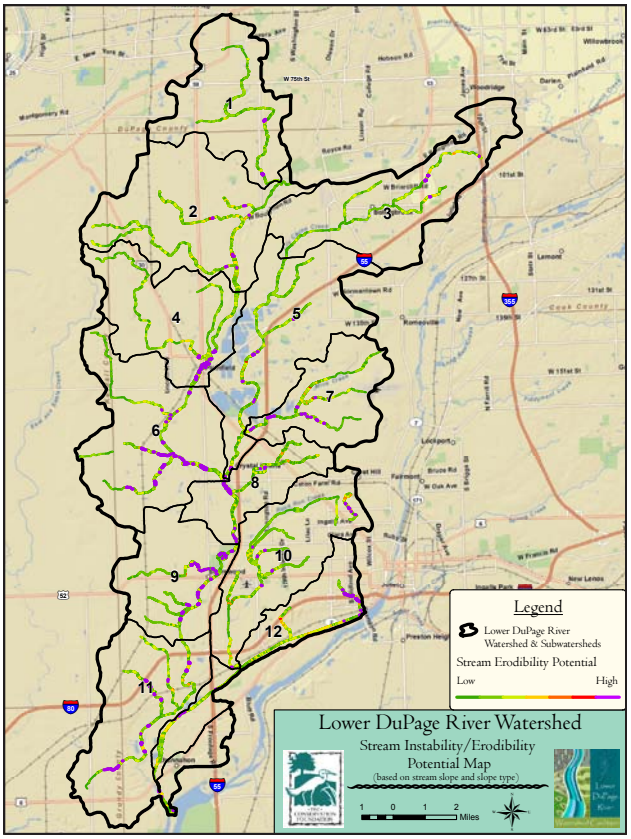


Figure 2-14: Stream Instability.

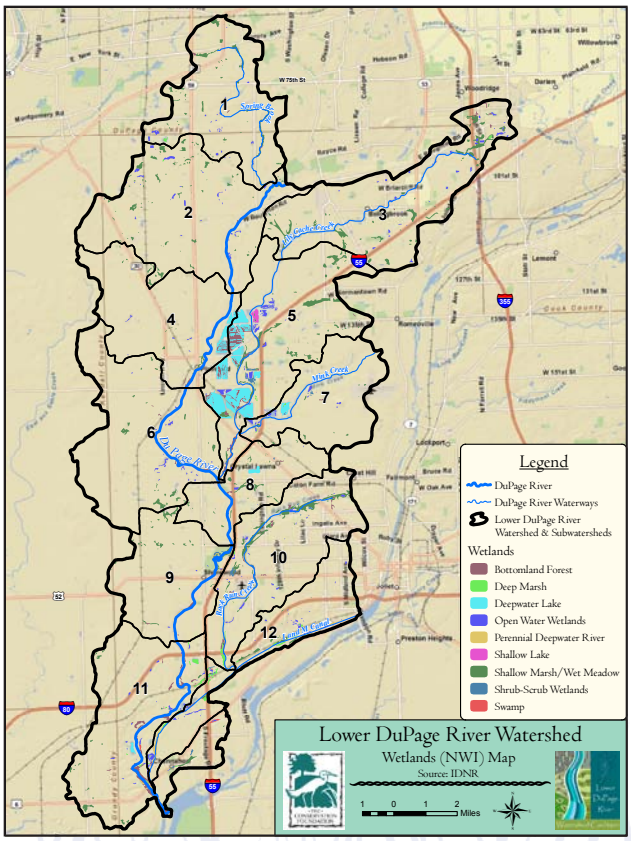


Figure 2-15: Wetlands.

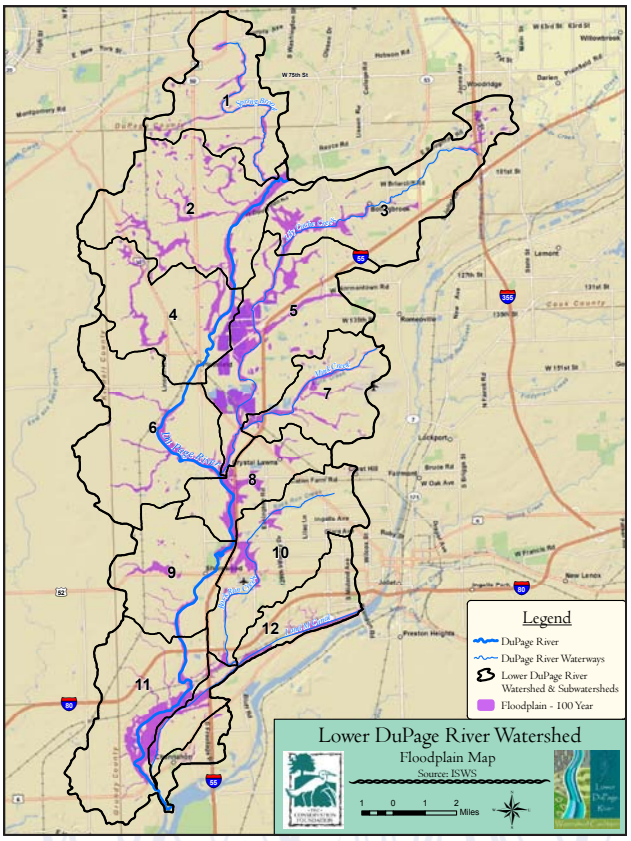


Figure 2-16: Floodplain.

2.2.7 Floodplain

Floodplain maps identify areas that flood in the 100 year storm event for regulatory purposes, insurance reasons and to identify riparian corridors. Floodplains are flat areas, usually adjacent to a stream that experiences period flooding. Floodplains are important from planning and restoration practices. Figure 2-16 and Table 2-20 describe the amount of floodplain within the watershed further. Subwatershed 2 has the greatest area of floodplain and Subwatershed 5 has the largest percentage area of floodplain. Subwatershed 8 has the smallest area of floodplain and Subwatershed 9 has the smallest percentage of floodplain.

Table 2-19: Wetlands within the watershed as shown by the NWI.

Type of Wetland	*Acres*	*Percent in Watershed*
Bottomland Forest	797	0.74%
Deep Marsh	193	0.18%
Deepwater Lake	1,071	0.99%
Open Water Wetlands	612	0.57%
Perennial Deepwater River	585	0.54%
Shallow Lake	42	0.04%
Shallow Marsh/Wet Meadow	2,011	1.87%
Shrub-Scrub Wetlands	143	0.13%
Swamp	20	0.02%
Other	0	0.00%
Total Acres of Wetland in Watershed	5,453	
Total Acres in Watershed	107,782	
Total Percentage of Wetland in Watershed		5.08%

Table 2-20: Floodplain area and percent by subwatershed.

Subwatershed	*Total Acres in Subwatershed*	*Acres of Floodplain in Subwatershed*	*Percent Floodplain in Subwatershed*	*Percent Floodplain in Watershed*
1	8,183	621	7.59%	0.58%
2	12,217	1,692	13.85%	1.57%
3	10,593	948	8.95%	0.88%
4	8,689	925	10.65%	0.86%
5	11,358	2,502	22.02%	2.32%
6	11,754	800	6.80%	0.74%
7	6,062	595	9.82%	0.55%
8	4,826	703	14.56%	0.65%
9	7,076	464	6.56%	0.43%
10	9,143	615	6.73%	0.57%
11	11,734	1,458	12.42%	1.35%
12	6,147	849	13.82%	0.79%
Entire Watershed	107,782	12,172		11.29%

2.2.8 Center for Watershed Protection Watershed Survey Summary

An important component of the WRI is field reconnaissance, through which a visual inventory of the watershed characteristics is conducted. The catalogue of observed conditions provides a source of information for the stakeholders to become more familiar and aware of the watershed resources. These inventories also provide an opportunity to assess the current conditions of the watershed, provide reference information for future comparison, and identify project opportunities.

Lower DuPage River in Shorewood

Traditionally, watershed reconnaissance and assessments have focused primarily on the stream corridor. Visually evaluating the streams, waterways, and riparian areas provide a wealth of information; however, excluding an assessment of upland watershed areas results in an incomplete picture. Runoff from the surrounding tributary areas transports pollutants from the various land uses to stream corridors and water bodies. There is a complex, yet inseparable link between stormwater management in the upland tributary areas of the watershed and the quality of the receiving waters.

Strategic watershed reconnaissance was performed to complement the initial WRI and the BMP implementation strategy for the Lower DuPage River Watershed Plan. The reconnaissance effort included the evaluation of areas that were potential sources of nonpoint pollution and the identification of potential retrofit opportunities. The field reconnaissance and the assessments were guided by a process to target priority locations, both in the stream and throughout the upland watershed areas. The work conducted is intended to be only the first step in an ongoing evaluation program. The reconnaissance and assessment methodology selected needed to have clear guidance documents to establish a standardized approach for future efforts. For this reason, the field observations were recorded following the Center for Watershed Protection's (CWP) Unified Subwatershed and Site Reconnaissance (USSR) methodology for the upland watershed areas and the Unified Stream Assessment (USA) methodology for stream corridors. The data from these two assessments provided a comprehensive picture of the watershed's possible sources of pollution along with potential curative opportunities. Together, the assessments provide the information to build an understanding of the long-term relationship between the practices within the upper watershed to the conditions observed along the stream corridors. As this relationship is studied along with future assessments, the Coalition can use this information to prioritize BMP implementation projects.

Canoe Reconnaissance

2.2.8.1 Stream Assessment

The approach used for the stream corridor assessment was a modified version of the CWP's USA methodology. The majority of the assessment was conducted by field staff entering the stream corridors at strategic access points (e.g., road crossings); however, a portion of the Lower DuPage River from the confluence of the East and West Branches down to Route 126 in Plainfield was observed during a canoe-based reconnaissance. The focus of the stream corridor assessment was to evaluate problem areas within the Lower DuPage River and its tributaries. Assessments were categorized into one of eight categories: Channel Modification, Erosion, Impacted Buffer, Outfall, Stream Crossing, Trash and Debris, Utility Impacts, and Miscellaneous. At a few locations, more than one form was used to classify the conditions at that location. No utility impacts were observed. For the majority of the assessments, the form that coincided with the primary condition was used to document the conditions. Annotations were made within the comment field to document other visible conditions.

All observed conditions were cataloged within a detailed Microsoft Access database created by the CWP. The database includes field forms for each of the eight aforementioned categories. Summary tables have been extracted from this data for inclusion into this report; however, the intent is for the database to be a living document that is routinely updated by the Coalition. As part of the management of the field reconnaissance data for the watershed plan, a GIS database was created to link the geographic locations of the assessments with the data contained within the database. This allows the data to be searched both by data entries and spatial information. A total of sixty-seven assessments were completed at sixty locations in the field. Summary tables for each category, except the "Utility Impacts" category, are included with the full report in Appendix C. A summary of all issues identified is in Table 2-21.

Bank erosion

Agricultural channel

Table 2-21: Summary of the number of different issues identified in the field reconnaissance.

Category	*Channel Modification*	*Erosion*	*Impacted Buffer*	*Outfall*	*Stream Crossing*	*Trash and Debris*	*Utility Impacts*	*Miscellaneous*
Occurrences	1	10	9	10	9	9	0	19

2.2.8.2 Stream Habitat Assessment

The Stream Assessment outlined in the previous section, focused on problem area identification to support the implementation and planning of water quality improvement initiatives. The quality of the physical habitat of a stream has a close relationship to the biological community that can be sustained. The structure of the CWP Unified Stream Assessment (USA) methodology does not incorporate this relationship within the evaluation. To complement the information gathered as part of the stream assessments, a limited stream habitat assessment was performed at three locations along the Lower DuPage River. These habitat assessments provide a record of the current condition of ten habitat parameters of the DuPage River at each location. This information can be compared to future data when a thorough, geographically dispersed assessment is conducted of the stream's habitat. These initial assessments offer a snapshot of the stream's condition, drawing attention to the need to incorporated both problem area assessments and habitat evaluations.

The approach used for the stream corridor assessment was the Stream Habitat Assessment Project Procedure developed by the Missouri Department of Natural Resources. The protocol is applicable for community-level surveys of aquatic macroinvertebrates in wadeable streams. This protocol includes the assessment of a very inclusive set of habitat parameters that can be easily transferred to other assessment approaches. This protocol was also used in the extensive habitat assessment for the Hickory Creek watershed plan, which was being developed concurrently. Table 2-22 presents a summary of the assessment converted into the Qualitative Habitat Evaluation Index (QHEI). QHEI can range from 0-100, with scores over 60 typically representing streams with good habitat that can support a diverse fish community.

Lower DuPage River

Table 2-22: Stream Habitat Assessment in terms of QHEI.

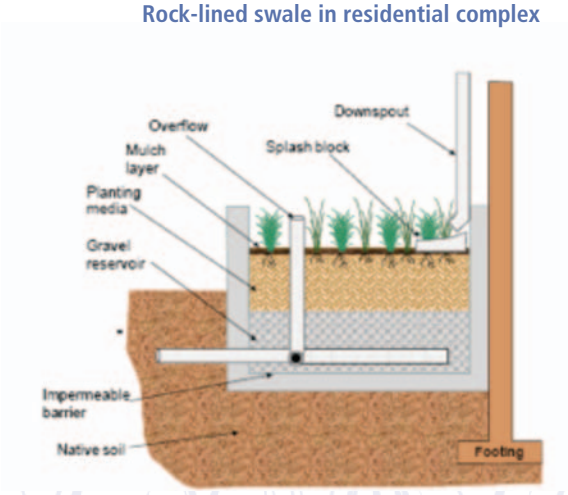
Assessment Location	*QHEI 2001*	*QHEI 2010*
GB-01	80.5	--
GB-02	38	--
GB-03	--	55
GB-04	92	--
GB-05	79.5	--
GB-10	64.5	--
GB-13	--	54.5
Site 30 (135th Street)		59

2.2.8.3 Upland Watershed Assessment

The approach used for the upland watershed assessment was a modified version of the CWP's USSR methodology. The USSR manual is intended for conducting a "windshield" survey of the entire watershed by driving every street within the watershed. The resources for this watershed plan did not allow for this level field reconnaissance. However, with the advancement of GIS analysis software tools, availability of high resolution aerials, and the availability of detailed municipal GIS data sets, the need to perform windshield reconnaissance to collect data was minimized. Much of the data, such as percent impervious, location of combined sewers, floodplain encroachment, or location of detention can be easily obtained from available GIS data sets. The methodology was employed to efficiently, yet thoroughly assess the watershed. The focus of the upland watershed assessment was to identify and then evaluate possible locations of nonpoint sources of pollution and potential restoration opportunities.

Rock-lined swale in residential complex

Roof runoff retrofit opportunity



Planter Box for downspouts

Swale through urban neighborhood

A total of forty-seven locations were assessed throughout the watershed. In addition, eleven locations were identified as areas of interest, primarily as locations that offer unique opportunities for corridor protection or low impact development. Observed conditions were cataloged in a Microsoft Excel table that was customized to meet the needs of the Lower DuPage watershed effort. As with the stream assessment data, a GIS database was created to link the geographic location of the assessment with the collected data. Summary tables are included at the end of this subsection. As with the stream assessment data, the Microsoft Excel table and the GIS database are intended to be living documents. The information should be updated as needed by the watershed coalition. The documents provide a tool to assess the condition of the watershed and prioritize potential restoration opportunities. A "priority" column is included in the summary table for use by the coalition to indicate the relative priority of projects with an "H" for high, "M" for medium, "L" for low, and "NA" for non-applicable for non-project related observations. Based on the initial reconnaissance and assessment, twenty four locations are recommended as a high priority. The database will also be used to evaluate the effectiveness of ordinances on the improvement of water quality from potential nonpoint sources of pollution. Future assessments should evaluate the prominence or the effectiveness of stormwater BMPs in the watershed after target projects or ordinance revisions are implemented. A summary table of structural BMP opportunities is shown below. Full summary tables are included in Appendix C with the complete report.

Table 2-23: Upland watershed assessment summary table of structural BMP opportunities.

Land Use	*Basin Retrofit*	*Filtration*	*Conveyance*	*Infiltration-Bioretention*	*Rooftop Retrofits*	*Buffer Establishment*
Single Family Residential	12	8	6	7	2	8
Multi Family Residential	6	5	3	2	3	2
Commercial/Institutional	4	7	2	1	3	5
Recreational	0	1	2	0	0	3

2.3 Existing Protections

There are many existing programs that offer water quality protections, in both agricultural and urban settings. This section reviews the more prominent programs in both categories.

2.3.1 Agricultural

There are many existing government programs designed to protect agricultural lands and water quality. Below is a summary of existing programs designed to protect both uplands and wetlands including streams, wetlands and other water bodies within agricultural watersheds. These programs typically target open space and wetland or stream side protections. It should be noted that program availability and funding changes frequently.

2.3.1.1 Conservation Reserve Enhancement Program

The Conservation Reserve Enhancement Program (CREP) is a voluntary land retirement program that helps agricultural land owner protect environmentally sensitive sites, reduce erosion, restore wildlife habitat and protect ground and surface waters. A partnership between farmers, State and Federal governments and some cases private groups, CREP is a subprogram of the Conservation Reserve Program described below. It is administered by the United States Department of Agriculture's (USDA) Farm Service Agency (FSA). A CREP project begins when a project partner identifies an agriculturally influenced environmental issue of state or national significance. CREP provides farmers with financial incentives to take environmental sensitive land out of production that will positively affect the state or national goal for

a 10 to 15 year minimum. Examples of environmental issues that qualify include threatened and endangered species or species of concern, erosion, and local water supplies.

2.3.1.2 Conservation Reserve Program

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners. The program provides annual rent payments and cost-share assistance to convert highly erodible or other environmentally sensitive land to vegetative cover such as native grasses, wildlife plantings, trees, or buffer and filter strips. The program is administered by the FSA with the National Resource Conservation Service (NRCS) providing technical assistance.

2.3.1.3 Wetlands Reserve Program

The Wetlands Reserve Program (WRP) is a voluntary program which assists landowners in protecting, restoring, and enhancing wetlands on their property. The NRCS provides technical and financial assistance. The goal is to achieve the highest level of function and habitat on all lands enrolled in the program. Landowners receive financial incentives to restore wetland functionality for retiring marginal agricultural lands.

2. 3.1.4 Illinois Department of Agriculture Programs – T by 2000

The Illinois Erosion and Sediment Control law, often referred to as the T by 2000 program, became effective in 1980. The law is designed to preserve the long-term productivity of Illinois soil and to protect water quality. The "T" represents tolerable soil loss, signifying the point at which new soil is naturally produced in greater or equal amounts to that which is lost to erosion. The law authorizes the Illinois Department of Agriculture to set erosion control guidelines for reducing soil erosion to T by the year 2000. The program continues today by primarily promoting crop residue management strategies. The program is administered jointly by the Illinois Department of Agriculture and the local Soil and Water Conservation District (SWCD). Each local SWCD receives funds from the Illinois Department of Agriculture, as well as other sources, to help develop and implement conservation plans designed to meet the Illinois Erosion and Sediment Control laws.

2.3.1.5 Illinois Department of Agricultural Livestock Management Facilities Program

The Livestock Management Facilities Program is a public input process for the siting of new livestock facilities and changes to the operations of existing livestock management facilities. It is important to manage and treat livestock waste, preventing its release into local streams and waterways without treatment. The Illinois Department of Agriculture has an extensive process for siting animal facilities in residential areas and setbacks from aquatic resources.

2.3.1.6 Nutrient Management Planning

The University of Illinois Extension in partnership with the Illinois Department of Agriculture and the IEPA oversees Nutrient Management Planning for nitrogen and phosphorus best management practices.

2.3.2 Urban

2.3.2.1 NPDES Phase II

NPDES Phase II extends regulatory requirements to small municipal separate storm sewer (MS4) owners and operators in urbanized areas to protect water quality, requiring all municipalities to reduce pollutants in stormwater to the maximum extent practicable through compliance with the six minimum control measures and implementing a variety of BMPs. Impervious surfaces in urban areas collect oils, grease, pesticides, fertilizers, road salt, litter and other pollutants that are washed off by precipitation and are then transported to a storm sewer system which leads directly to a waterway, or to the waterway itself. This nonpoint source pollution is harmful to aquatic life and can causes local waterways to be unsafe for swimming and drinking water supplies.

The permit program also extends these regulations to smaller construction sites. Construction site runoff can be a large contributor of sediment to waterways. These Phase II permit holders are considered nonpoint source permit holders and the locations of these facilities are shown in Figure 2-17. The Phase II permit also encourages watershed planning and the implementation of the stormwater program on a watershed basis.

2.3.2.2 Code and Ordinance Protection

2.3.2.2.1 Center for Watershed Protection's Code and Ordinance Protection Worksheet

The Coalition used the Center for Watershed Protection's Code and Ordinance Protection worksheet as an initial guide to self assess local regulations as they affect nonpoint source pollution. The worksheet consists of 77 questions which were answered by representative from each municipality and can be found online at www.cwp.org. The survey is divided into three categories: residential streets and parking lots, lot development, and the conservation of natural areas. Eight out of nine municipalities completed the survey: Naperville, Bolingbrook, Romeoville, Plainfield, Shorewood, Joliet, Channahon, and Will County. Scores ranged from 33 to 68 out of 100 with an average of 52.

Within the parking lot, road and driveway subcategory, the scores ranged from 6 to 21 out of 40, averaging 14. Municipalities could improve in this area by reducing roadway widths and the number of parking spots required for a development.

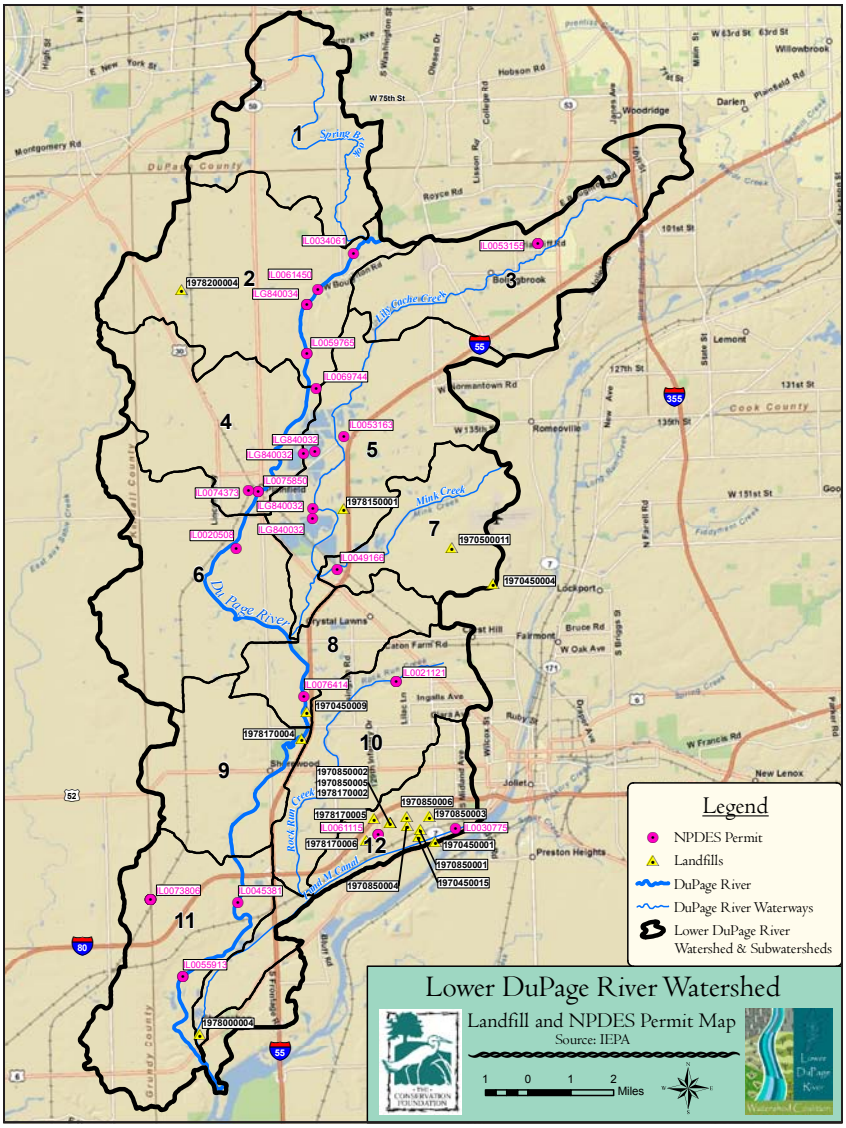


Figure 2-17: NPDES.

The second category covered lot size and shape as well as density of development. Scores ranged from 13 to 25 out of a possible 36, averaging 21.25. Participants could show improvement within this area by allowing for the flexibility of lot sizing to promote clustered development and preservation of larger tracts of open space.

The last category evaluated the protection of natural resources and open space; participants scores ranged from 3 to 23 out of 24, averaging 16.625. Municipalities could improve in this area by enforcing buffers, requiring buffer maintenance, requiring native vegetation and tree preservation, and regulating stormwater quality.

2.3.2.2.2 Comprehensive Code and Ordinance Review: Stormwater, Natural Areas, Landscaping Standards, Impervious Area and Conservation Design

Cowhey Gudmundson and Leder evaluated the ordinances of the communities in the Lower DuPage River watershed. The particular focus is how well the ordinances control the effects of development on water quality, hydrology, and aquatic habitat. In addition, the review considers ordinance provisions for sustainable development that can promote overall watershed health.

The ordinance review began with the development checklist to provide an objective template for the review of stormwater, subdivision, zoning, and related development ordinances. The checklist emphasizes key stormwater provisions, including detention, floodplain, erosion control, and stream/wetland protection. It also looks at relevant subdivision, zoning, landscaping, and conservation design provisions, if present.

This checklist is very similar to a checklist that was applied to the Hickory Creek watershed. It is based on a combination of local, regional, and national ordinances and resources, including:

- NIPC *Facility Planning Area Nonpoint Source Management* checklist
- Conservation-based provisions of local municipal ordinances, countywide stormwater ordinances, and other municipal or county conservation design ordinances
- NIPC/CMAP *Ecological Planning and Design Directory* (http://www.chicagowilderness.org/sustainable/directory_documents.php)
- *Blackberry Creek Watershed: Zoning Code Analysis and Ordinance Language Recommendation* report (Kane County, 2004, http://www.co.kane.il.us/kcstorm/blackberry/zoning/FinalReport.pdf)
- U.S. EPA *Water Quality Scorecard* (http://www.epa.gov/smartgrowth/pdf/2009_1208_wq_scorecard.pdf)
- Center for Watershed Protection, *Better Site Design (Code and Ordinance Worksheet and related publications*) (http://www.northinlet.sc.edu/training/media/resources/Better%20Site%20Design%20SW%20Code%20Ordinance%20Worksheet.pdf)

The ordinance review considers five major topical areas. These include:

1) Comprehensive Stormwater Standards

   a. Stormwater drainage and detention

   b. Soil erosion and sediment control

   c. Floodplain management

   d. Stream and wetland protection

2) Natural Area Standards

3) Landscaping Standards

4) Impervious Area Reduction: Street and Parking Requirement

5) Conservation Design: Zoning/Subdivision Standards

The review was performed for the following communities, as well as for the countywide *Will County Stormwater Management Ordinance*.

- Bolingbrook	- Naperville
- Channahon	- Plainfield
- Crest Hill	- Romeoville
- Joliet	- Shorewood
- Minooka	- Will County (unincorporated)

The complete report is located in Appendix D and a discussion of the report's recommendations is presented in Chapter 5.

3. Pollutant Load Analysis and Estimation of Future Needs and Concerns

3.1 Overview of Watershed Pollutant Loading

Pollutant loading within the watershed is the sum of point sources and nonpoint sources. These pollutant sources and their associated loading quantities were investigated and characterized using customized Geographic Information System (GIS) modeling applications and a review and analysis of existing state water quality permits. The Coalition identified total nitrogen, total phosphorus, total suspended sediment, chloride and fecal coliform bacteria as the priority pollutants to address in the watershed plan to accomplish their goals of improving the water quality of the watershed. These specific pollutants were identified based on first-hand experiences in the watershed, land-use activities in the watershed, and water quality impairments identified by the IEPA. TMDLs are currently under development in the watershed to address chloride, fecal coliform, dissolved oxygen, and silver. Silver and dissolved oxygen are not directly addressed in the pollutant load analysis in part because they are being addressed in the TMDL process. Dissolved oxygen is also not a parameter that can be quantified in terms of annual loading. The impairment of silver was not regarded as a watershed-wide priority because the impairment was based on one water quality sample that only slightly exceeded the regulatory standard. Further, addressing nutrients and sediment will contribute to improvements in dissolved oxygen and silver conditions in the waterways.

Environmental contaminants such as PCBs, mercury, hexachlorobenzene and DDT have also contributed to water quality impairments in the watershed based on historical sampling performed by the IEPA, however, most of these parameters are now banned from use in the United States and their occurrences will subside over time. These pollutants are attributed to be from the industrial and agricultural legacies and are thought to be present predominantly in isolated locations with contaminated soils and fluvial sediment sinks throughout the watershed that store sediment for long periods of time.

As defined by the U.S. EPA, the pollution from nonpoint sources originates from urban runoff, construction activities, manmade modification of hydrologic regime of a watercourse (e.g. retention, detention, channelization, etc.), silviculture, mining, agriculture, irrigation return flows, solid waste disposal, atmospheric deposition, stream bank erosion, and individual or zonal sewage disposal. Nonpoint source pollution originates in a wide spectrum of public and private activities and, when not known or properly controlled, affects, in a large percentage, the water quality in a certain area.

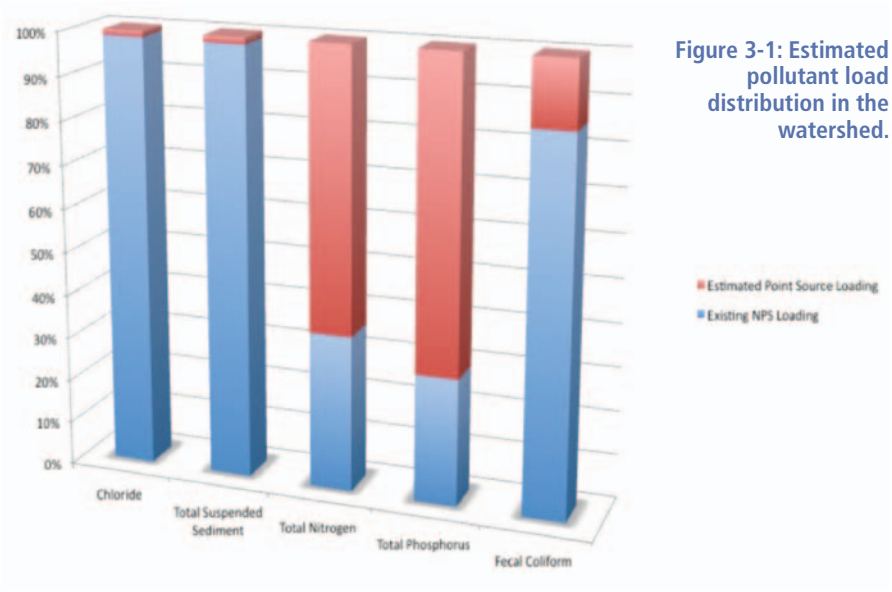


Figure 3-1: Estimated pollutant load distribution in the watershed.

Since runoff from the rainfall flows over or through the land and collects pollutants and nutrients prior to entering waterways, the overall characteristics of the land use within a watershed greatly influences water quality. Land use types have diverse effects on water quality, by contributing different pollutants with varying amounts and concentrations. The cumulative effect of this pollution throughout the watershed represents the contribution of nonpoint source pollution.

Point sources, which are permitted facilities, are also significant contributors to the overall watershed pollutant loading. The permitted facilities within the Lower DuPage River watershed include municipal wastewater treatment plants, mining operations and private utility operations. All permitted facilities are subject to regulation through IEPA and annual discharge volume estimates and permitted pollutant concentration of the applicable constituents are publically available.

Figure 3-1 illustrates the estimated breakdown of pollutant loading from the point sources and nonpoint sources of the watershed. It is important to note that these are estimates based on modeling and analysis of available permit data

collected from the IEPA. Fecal coliform and chloride estimates for the point sources are based only on the permitted facilities that reported data for those constituents.

Based on Figure 3-1, it is apparent that point sources are the dominant contributors to total nitrogen and total phosphorus loading in the watershed. Total suspended sediment, chloride and fecal coliform are primarily contributed by nonpoint sources. Total suspended sediment is primarily contributed from agricultural land use practices in the watershed; chloride loading is mostly the result of road salt applications and fecal coliform loading is largely attributed to common sanitary infrastructure challenges in residential areas.

3.2 Nonpoint Source Pollution Load Model

3.2.1 Summary Overview

Nonpoint source pollution management is highly dependent on hydrologic simulation models and the use of computer modeling is often the only viable means of providing useful input information for adopting the best management decisions. As previously mentioned, the nonpoint source pollution sources are generated by activities that are spatially distributed on the analyzed watershed or study area. Due to this spatial distribution of nonpoint source pollution sources, the computation models used to study pollutant transport and stream bank erosion requires large amounts of data for analysis, even in a small watershed.

For the Lower DuPage River watershed, a customized GIS based model was used to calculate nonpoint source pollutant loads to assess the nonpoint source pollution of the five identified pollutant parameters (Total Nitrogen, Total Phosphorus, Sediment, Fecal Coliform Bacteria and Chloride) that have been identified as elements of concern by the stakeholders and are implicated from the land uses present in the watershed.

The GIS based model was executed for each subwatershed within the watershed. It should be noted that all computation models have assumptions and limitations. Therefore, the provided analytical results may not represent the exact pollution loads due to calibration and model limitations. In these conditions, even if the results are relative, they still can provide very useful information for targeting and prioritizing subwatersheds for BMPs.

3.2.2 Methodology and Calibration

The GIS based model was developed for the watershed, which compiled 2005 CMAP land-use (updated using 2008 aerials) and SSURGO soils data for the entire watershed. Using these layers and regional climate data, average annual runoff volumes were estimated for the entire watershed. Following the runoff calculations, event mean pollutant concentrations (EMCs) were applied to the runoff based on each type of land use practice in the watershed. The EMCs were established based on literature sources, water quality studies and professional experience, the EMCs used in the model can be found in Appendix E.

For open and agricultural areas the model incorporates a Universal Soil Loss Equation (USLE) with a delivery ratio based on the soil types and land practices. The USLE portion of the model allows for more accurate sediment, nitrogen and phosphorus loading for individual land parcels based on soil types and topography, Appendix E outlines the details of the USLE equation.

Formulas and selected variables were derived from Spreadsheet Tool for Estimation of Pollutant Load (STEPL)

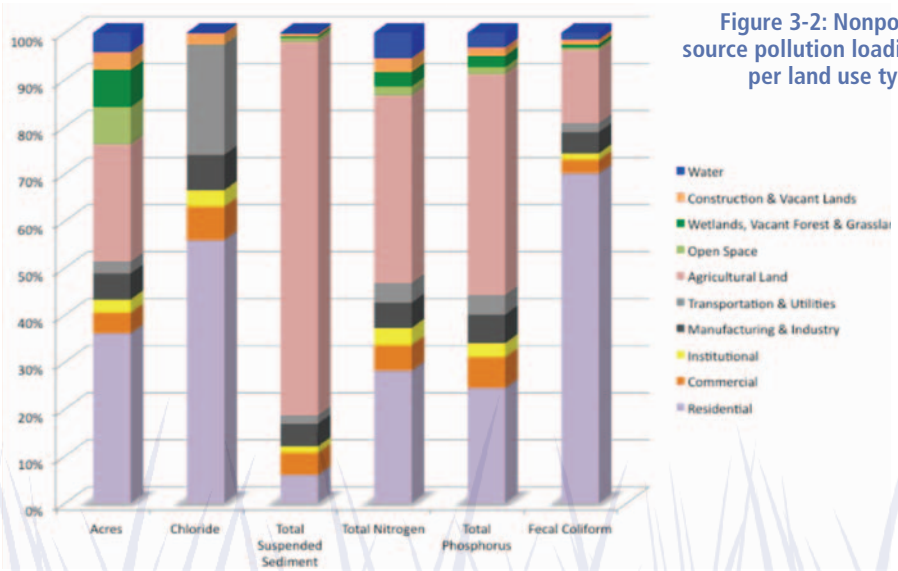


Figure 3-2: Nonpoint source pollution loading per land use type.

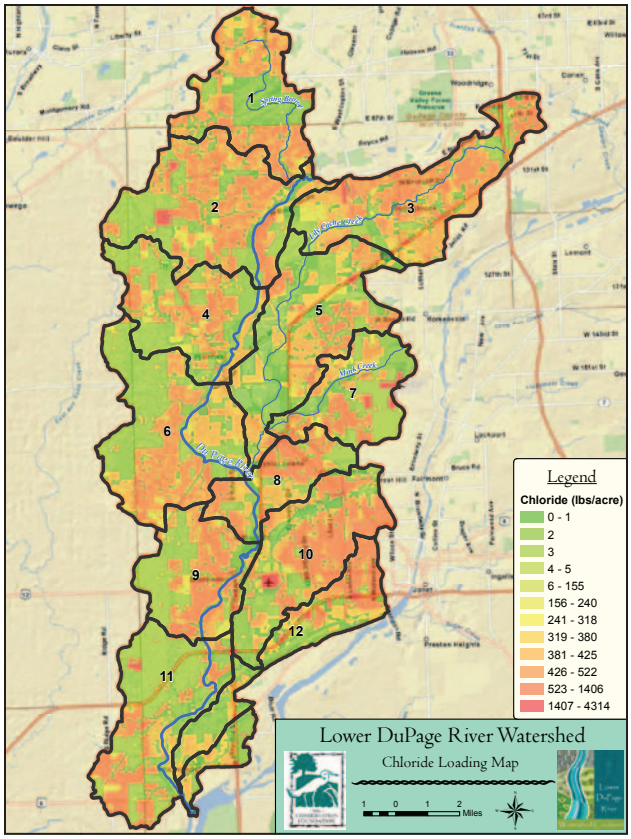


Figure 3-3: Chloride existing conditions.

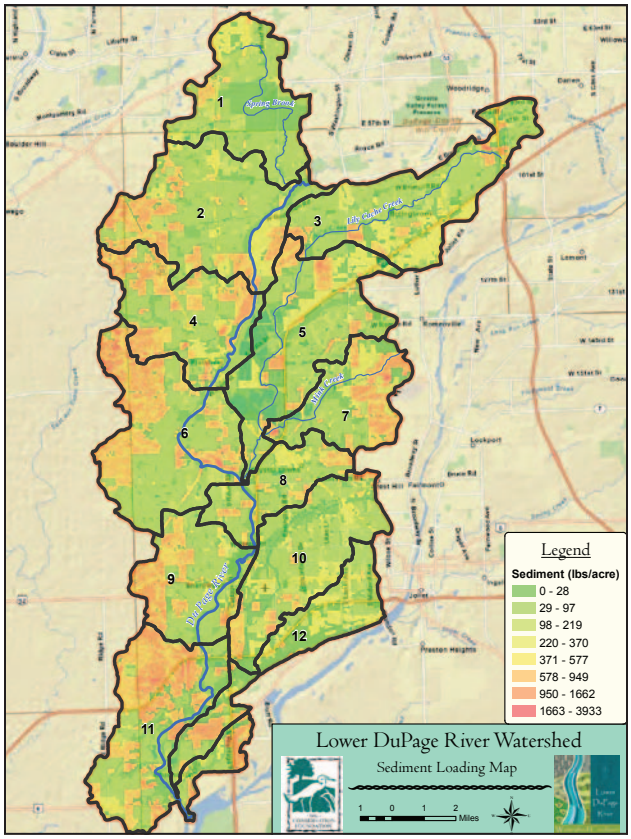


Figure 3-4: Total suspended sediment existing conditions.

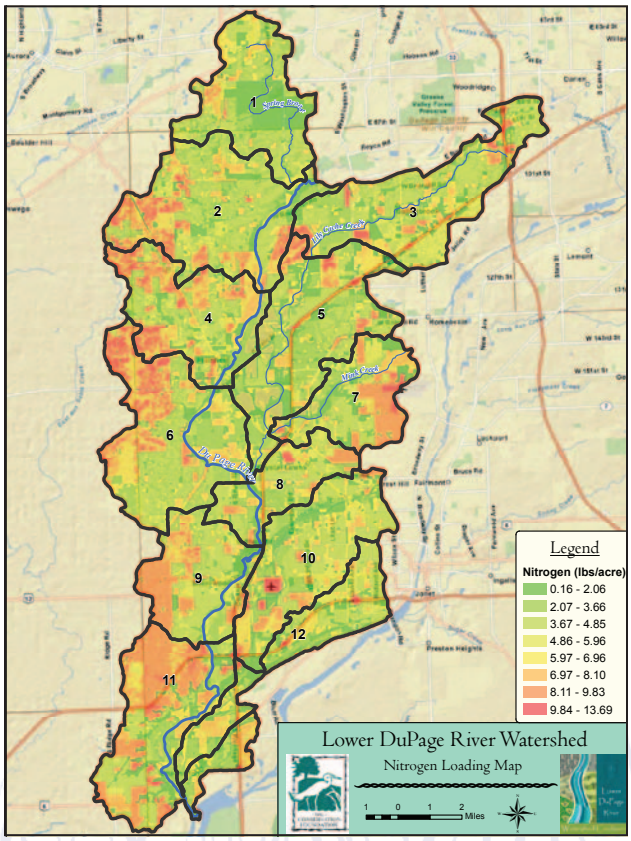


Figure 3-5: Total nitrogen existing conditions.

Version 3, Tetra Tech, 2004. For Fecal Coliform, Schueler's Simple Method (1987) was modified for calculating bacterial loads (refer to Appendix E for further citations and details).

Model calibration was performed for the runoff by comparing values to published literature and established USGS stream gages in the watershed. Water quality and associated flow data within the watershed are extremely limited for the modeled water quality parameters, this is primarily due to the fact the Lower DuPage River watershed is fed by the Upper DuPage watershed. The result is that water quality data collected in the Lower DuPage reflects a much larger contributing watershed that is not part of the study area for this plan. Further, there is a lack of water quality data from within the watershed that address the range of stream flows and the specific parameters of concern.

Final calibration was performed based on professional judgment and also incorporated limited IEPA water quality data from several tributaries in the watershed. Chloride loading values estimated for other watersheds in the region were provided by Stephen McCracken of The Conservation Foundation and the DuPage River Salt Creek Workgroup. These values were used to help calibrate the chloride loading results.

3.2.3 Existing Conditions

Figure 3-2 and Tables 3-1, 3-2, and 3-3 illustrate the modeling results for the existing land use conditions. Figures 3-3, 3-4, 3-5, 3-6 and 3-7 show the existing condition pollution loads for chloride, total suspended sediment, total nitrogen, total phosphorus, and fecal coliform bacteria, respectively.

Chloride nonpoint source loading is elevated due to the developed and urban nature of the watershed. The watershed nonpoint source loading is estimated at 35,652,092 pounds per year, averaging 331 lbs/acre per year for the entire watershed, as shown in Figure 3-3. Subwatershed 3 has the highest rate of loading per unit area and Subwatershed 6 has the lowest, the subwatersheds are of similar overall size. Transportation/Utilities, Commercial and Residential land-uses contribute the highest chloride loading which is almost entirely due to road salt application. Table 3-2 shows the current pollutant loads by land use and Table 3-3 shows the current pollutant loads by subwatershed.

Total suspended sediment loading is 16,177 tons per year, average 0.15 tons/acre per year for the entire watershed, as shown in Figure 3-4. This loading is low in comparison to other watersheds in the Midwest and Great Lakes areas primarily due to the replacement of agricultural land with developed lands which contribute significantly less sediment (Demissie et al. 2004). The agriculture land use category is by far the dominant contributor of sediment in the watershed as shown in Table 3-2 and Figure 3-2. This sediment loading can be attributed predominantly to sheet/rill, gully and streambank erosion, as these are the three primary sources of sediment loading in a watershed.

Total nitrogen nonpoint source loading in the watershed is 552,834 lbs/year, averaging 5.13 lbs/acre per year for the entire watershed, as shown in Figure 3-5. This total loading is predominantly attributed to residential and agricultural land uses in the watershed; see Figure 3-2 and Table 3-2. On a per acre basis, the land use categories of agricultural land and transportation/utilities show the highest loading. Subwatershed 11 is a significant contributor of nitrogen, primarily due to the agricultural land practices that dominate that subwatershed. The primary nonpoint sources of nitrogen loading in the watershed are related to agricultural production, fertilizer application and common sanitary infrastructure issues in developed areas. Common sanitary infrastructure issues refer to the typical known and unknown sanitary sewer leakage, overflows and other related issues that are common in developed areas with sanitary infrastructure.

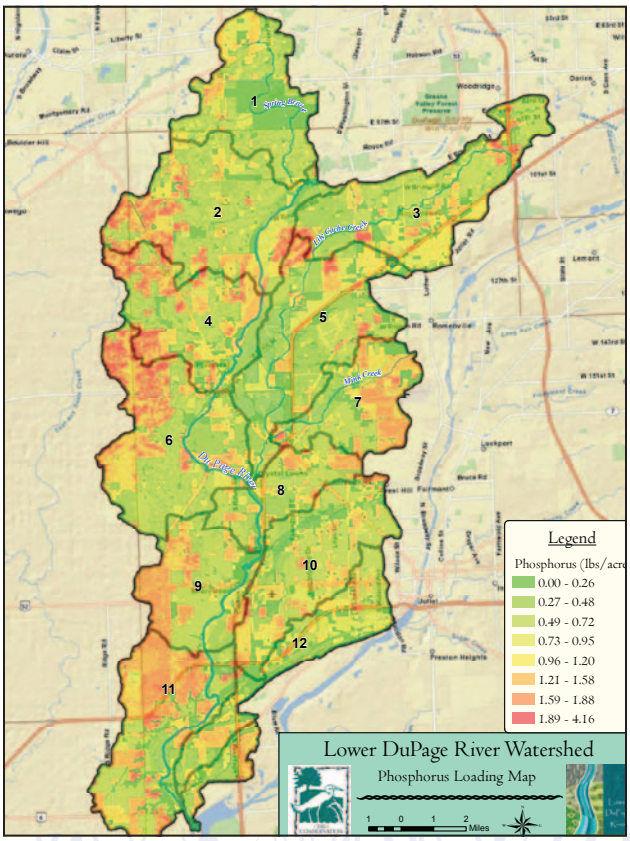


Figure 3-6: Total phosphorus existing conditions.

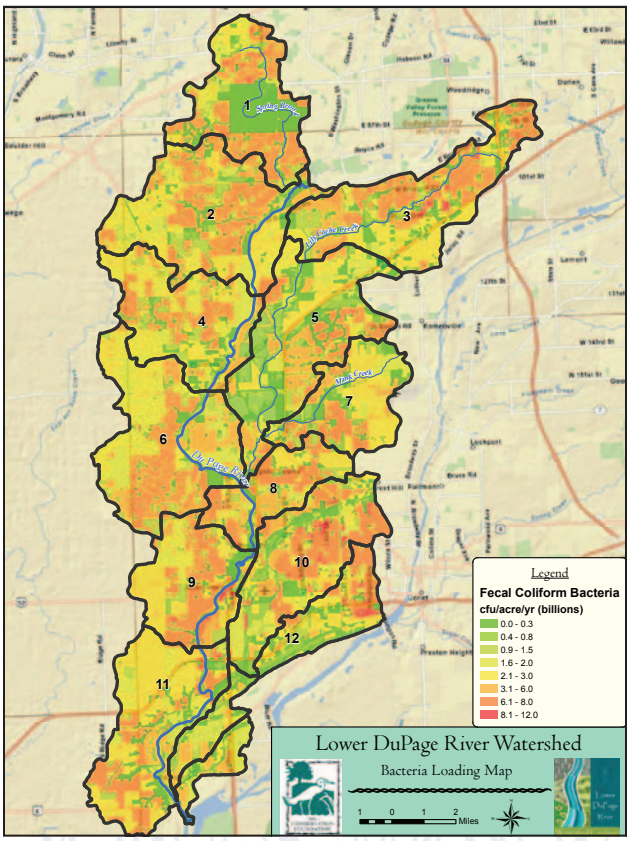


Figure 3-7: Total fecal coliform existing conditions.

Total phosphorus nonpoint source loading in the watershed is 84,946 lbs/year, averaging 0.79 lbs/acre per year over the entire watershed, as shown in Figure 3-6. The total phosphorus loading is also dominated by the agricultural and residential land use practices; however, on a per area basis, agricultural land, transportation/utilities and commercial land uses are the three categories that stand out from the rest; see Figure 3-2 and Table 3-2. Subwatersheds 11 and 4 are the two watersheds that contribute the highest loading per unit area within the watershed Table 3-3. The dominant typical nonpoint sources of phosphorus loading in the watershed are related to agricultural production, fertilizer application and common sanitary infrastructure issues.

Fecal coliform bacteria nonpoint source loading in the watershed is 3.3 x 109 coliform units per year, as shown in Figure 3-7. This averages 6.18 x 109 coliform units per acre/year. This loading is fairly average for an urban watershed such as the Lower DuPage. Residential land use dominates the loading in the watershed due to standard and common factors such as animal wastes, septic issues, waste management and misconnected sanitary sewers; see Figure 3-2, Tables 3-2. Subwatershed 8 contributes the highest loading of fecal coliform in the watershed on a per acre basis.

Table 3-1: Existing condition nonpoint source pollutant loadings per selected parameter.

Parameter	*NPS Loading*
Chloride (lb/yr)	35,652,092
Total Suspended Sediment (ton/yr)	16,177
Total Nitrogen (lb/yr)	552,834
Total Phosphorus (lb/yr)	84,946
Fecal Coliform (CFU in billions/yr)	335,242

Table 3-2: Existing conditions nonpoint source pollutant loadings per land use category.

Land-Use Type	*Acres*	*Chloride (lbs/acre)*	*Total Suspended Sediment (tons/acre)*	*Total Nitrogen (lbs/acre)*	*Total Phosphorus (lbs/acre)*	*Fecal Coliform (billions-cfu/acre)*
Residential	38,888	512.9	0.02	4.01	0.54	6.04
Commercial	4,759	534.0	0.16	6.30	1.17	2.01
Institutional	2,965	415.3	0.07	6.73	0.84	1.56
Manufacturing and Industry	6,026	446.1	0.13	4.96	0.86	2.53
Transportation and Utilities	2,701	3,072.5	0.11	8.53	1.30	2.35
Agricultural Land	26,808	1.9	0.48	8.21	1.49	1.95
Open Space	8,588	1.0	0.02	1.27	0.15	0.20
Wetlands, Vacant Forest, Grasslands	8,530	1.2	0.01	1.97	0.23	0.24
Construction and Vacant Lands	4,082	209.6	0.02	4.11	0.39	0.90
Water	4,382	5.4	0.01	6.74	0.59	1.07

Table 3-3: Nonpoint source loadings for the existing condition, by subwatershed.

Subwatershed	Chloride (lbs)		Total Suspended Sediment (tons)		Total Nitrogen (lbs)		Total Phosphorus (lbs)		Fecal Coliform (cfu in billions)	
	Total	lbs/acre	Total	tons/acre	Total	lbs/acre	Total	lbs/acre	Total	per acre
1	2,607,723	319.05	404	0.05	29,403	3.60	4,137	0.51	25,511	3.12
2	4,286,011	350.86	1,946	0.16	63,603	5.21	9,864	0.81	40,673	3.33
3	4,725,927	446.88	1,006	0.10	50,626	4.79	7,463	0.71	37,288	3.53
4	2,065,761	237.74	1,935	0.22	49,823	5.73	7,977	0.92	25,102	2.89
5	3,445,064	303.46	1,144	0.10	51,575	4.54	7,352	0.65	26,774	2.36
6	2,764,880	235.26	2,610	0.22	66,198	5.63	10,707	0.91	38,310	3.26
7	1,997,408	330.03	1,165	0.19	34,304	5.67	5,409	0.89	16,364	2.70
8	1,962,751	406.81	519	0.11	24,284	5.03	3,641	0.75	18,373	3.81
9	2,281,129	322.41	1,258	0.18	40,870	5.78	6,302	0.89	25,853	3.65
10	3,820,313	418.04	836	0.09	43,556	4.77	6,491	0.71	31,927	3.49
11	3,043,847	259.09	2,740	0.23	71,081	6.05	11,435	0.97	32,991	2.81
12	2,651,271	432.48	614	0.10	27,503	4.49	4,162	0.68	16,068	2.62

3.2.4 Future Land Use Conditions

The GIS based model was also performed for a future land use scenario. The future land use information was compiled based on comprehensive plans and zoning maps provided by most of the major municipalities in the watershed which included: Joliet, Naperville, Plainfield, Romeoville, Channahon, and Shorewood. Planning maps from the Forest

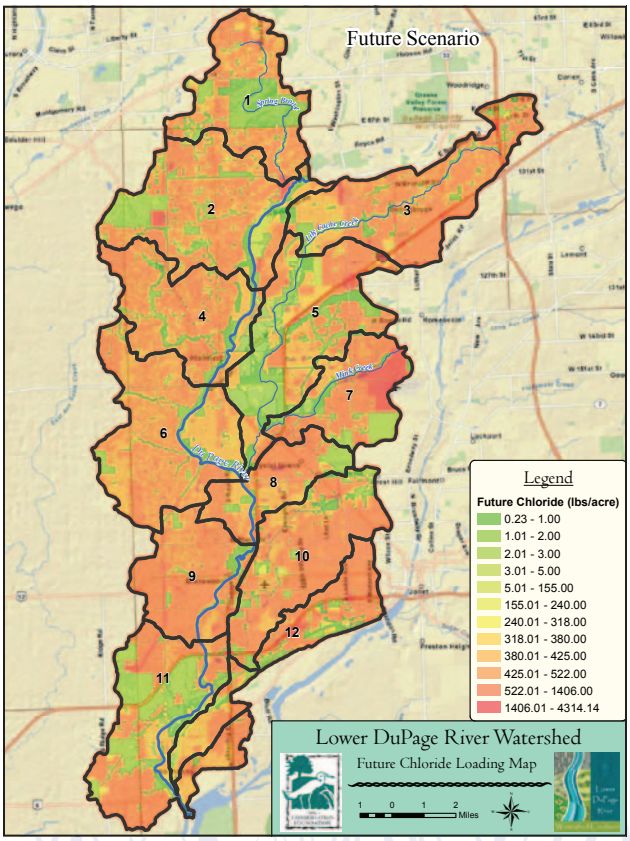


Figure 3-8: Chloride future conditions.

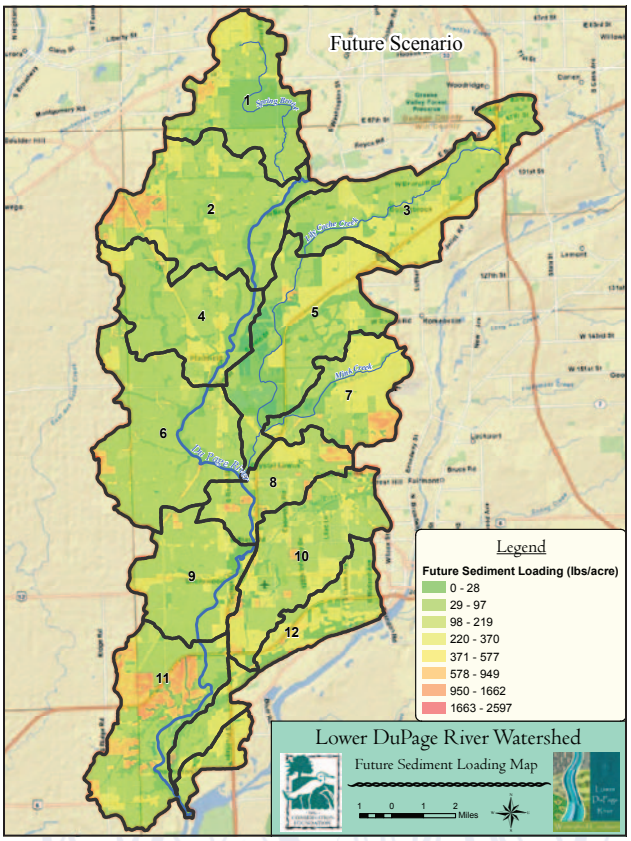


Figure 3-9: Total suspended sediment future conditions.

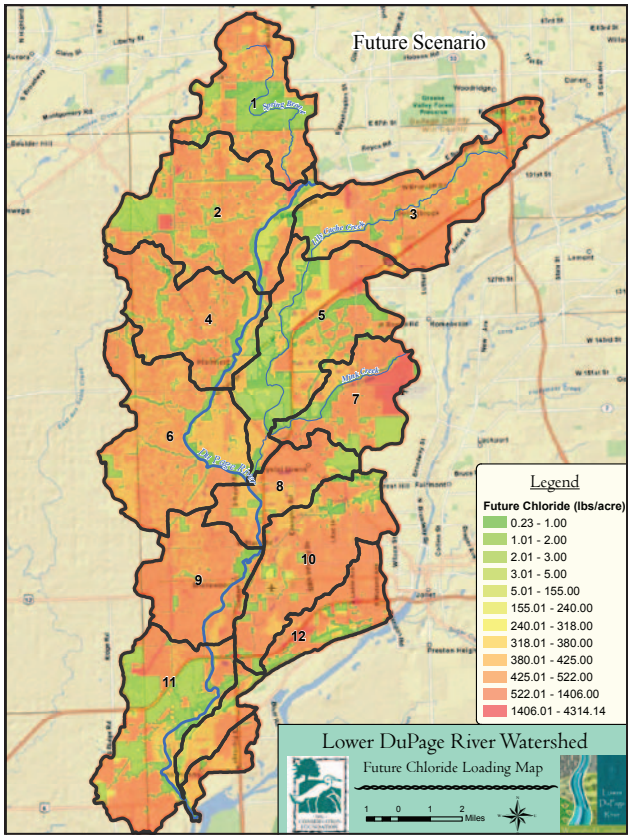


Figure 3-10: Total nitrogen future conditions.

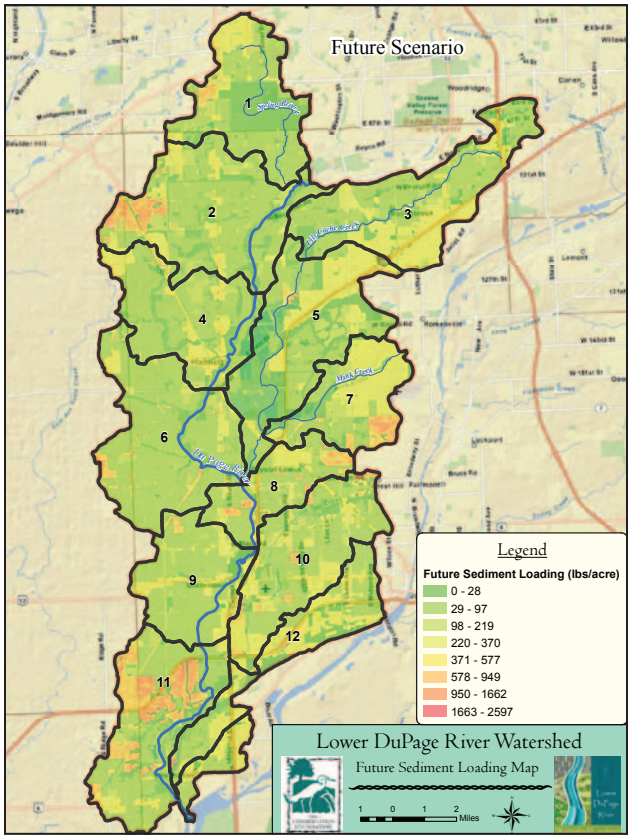


Figure 3-11: Total phosphorus future conditions.

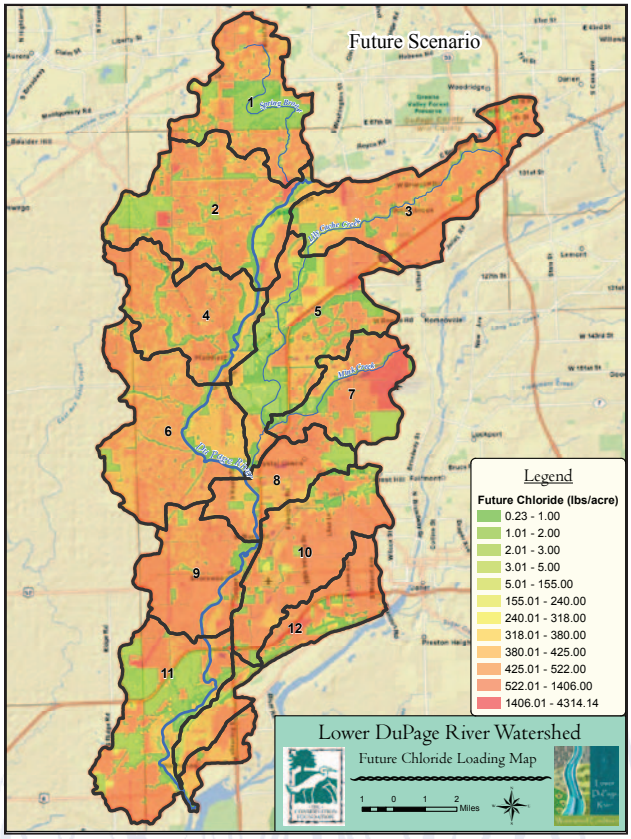


Figure 3-12: Total fecal coliform future conditions.

Preserve District of Will County were also included into the future model scenario. The land use scenario used for the model represents the ultimate build out condition of the watershed. Table 3-4 below summarizes the results of the future land use model and maps that illustrate the distribution of nonpoint source pollutant loading throughout the watershed are shown in Figures 3-8, 3-9, 3-10, 3-11, and 3-12.

Table 3-4: Future land use in terms of nonpoint source pollutant modeling.

Parameter	*Existing NPS Loading*	*Future NPS Loading*	*Percent Change*
Chloride (lb/yr)	35,652,092	61,331,247	72%
Sediment (ton/yr)	16,177	8,158	-50%
Nitrogen (lb/yr)	552,834	505,395	-9%
Phosphorus (lb/yr)	84,946	71,746	-16%
Fecal Coliform (CFU in billions/yr)	335,334	426,875	27%

The future land use scenario includes a significant increase of urban development and a decrease in agricultural lands. This change in land use will actually decrease the sediment, nitrogen, and phosphorus loading from the watershed because there will be less fertilizer application and loose tillage and exposed soils associated with agricultural production. Chloride loading will increase because the urban development introduces more road salt application and the increased population density will contribute to higher fecal coliform loading. Stormwater runoff also increases by about 7% in the future scenario due to less infiltration and soil retention, as shown in Table 3-5.

Table 3-5: Changes in average annual runoff (ac-ft) for stormwater under the future condition.

	Existing Conditions	*Future Conditions*	*Percent Change*
Runoff Volume	82,771	88,393	7%

3.3 Point Sources

3.3.1 Point Source Pollutant Loading Estimates

As stated previously and shown in Figure 3-1, point sources are a significant source of watershed pollutant loading. The permitted facilities within the Lower DuPage River watershed include municipal wastewater treatment plants, mining operations and private utility operations. Table 3-6 outlines the permits within the boundary of the watershed.

Point source loading estimates were derived using average pollutant concentrations of effluent from the IEPA permit compliance data within the watershed. The estimates also incorporate input provided by some of the permitted facilities that provided additional information to help refine the estimates. All of these estimates have limitations due to the limited data available in the permit compliance database for each of the permitted facilities, it is also recognized that the compliance data does not always represent average or typical conditions for the permitted facilities. It is therefore only the intent to provide watershed-scale estimates of point source loading for planning purposes. The highlighted facilities in Table 3-7 provided input to support and confirm the planning estimates.

3.3.2 Permitted Point Sources in Watershed

A total of 18 permitted point sources were identified within the Lower DuPage River watershed. Table 3-6 identifies each of the permitted facilities and the status of the permit and Figure 2-17 shows their locations. Table 3-7 summarizes the total estimated pollutant loading from the permitted sources.

Table 3-6: List of permitted point sources within the watershed, including wastewater treatment facilities and quarries.

Permit Number	Name	Status
IL0034061	Naperville – Springbrook WRC	Effective
IL0059765	Heil Trust – Prairie Quarry 1	Effective
IL0061450	Boughton Trucking & Materials	No record found
ILG840034	Vulcan – Bolingbrook 361	Effective
IL0053155	Elmhurst Chicago Stone – Barbers	Effective
IL0069744	Village of Bolingbrook STP #3	Admin Continued*
IL0074373	Village of Plainfield N STP	Effective
IL0075850	Diageo North America Inc	Effective
IL0053163	Elmhurst Chicago Stone – Plainfield	Effective
ILG840032	Vulcan Construction Materials	Effective
IL0049166	IL American Water – Essington	Effective
IL0076414	Joliet Aux Sable Creek WWTP	Effective
IL0021121	City of Crest Hill West STP	Effective
IL0045381	Camelot Utilities Inc STP	Effective
IL0055913	Village of Minooka STP	Admin Continued*
IL0073806	Kendall Energy Facility	Effective
IL0030775	Village of Rockdale STP	Effective
IL0061115	LaFarge Joliet Inc – Joliet Quarry	Effective

**Admin Continued Backlog: The Clean Water Act specifies that NPDES permits may not be issued for a term longer than five years. Permittees that wish to continue discharging beyond the five year term must submit a complete application for permit renewal at least 180 days prior to the expiration date of their permit. If the permitting authority receives a complete application, but does not reissue the permit prior to the expiration date, the permit may be "administratively continued. "Permits that have been administratively continued beyond their expiration date are considered to be "backlogged." Where information is available, facilities awaiting their first NPDES permits are also considered part of the NPDES permit backlog.*

Table 3-7: Permitted point sources and associated estimated pollutant loads for selected parameters.

Permit #	Name	Average Daily Discharge (mgd)	Total Chloride Load (lbs/yr)	Total Sediment Load (tons/yr)	Total Nitrogen Load (lbs/yr)	Total Phosphorus Load (lbs/yr)	Total Fecal Coliform Load (cfu/ yr-billions)
IL0034061	Naperville - Springbrook WRC	21	ND	68.2	671,659	144,970	48,746
IL0059765	Heil Trust - Prairie Quarry 1	0.3	ND	7.0	ND	ND	ND
IL0053155	Elmhurst Chicago Stone - Barbers	4.3	ND	50	ND	ND	ND
IL0069744	Village of Bolingbrook STP #3	2.8	ND	11.94	109,364	24,119	3,598
IL0074373	Village of Plainfield N STP	3.6	ND	32.79	101,983	8,773	995
IL0075850	Diageo North America Inc	0.02	2,068	0.04	ND	ND	ND
IL0049166	IL American Water - Essington	0.01	ND	0.03	308	68.4	1
IL0076414	Joliet Aux Sable Creek WWTP	1.1	ND	7.04	37,528	8,161	1,748
IL0021121	City of Crest Hill West STP	1.3	ND	7.13	43,559	9,453	2,604
IL0045381	Camelot Utilities Inc STP	0.1	ND	0.62	3,960	10,032	133
IL0055913	Village of Minooka STP	1.03	ND	6.70	29,272	2,510	1,499
IL0073806	Kendall Energy Facility	0.13	59,313	1.1	ND	ND	ND
IL0061115	LaFarge Joliet Inc - Joliet Quarry	2.5	418,236	60	ND	ND	ND
Total Estimated Point Source Loading		**38.19**	**479,617**	**252.6**	**997,633**	**208,086**	**59,324**

ND indicates that "No Data is Available" and the blue highlight indicates that the Facility provided input to develop estimates.

3.4 Summary of Watershed Pollutant Loading

The overall watershed pollutant loading takes into account both the nonpoint source modeling results and the permitted point sources within the watershed. Table 3-8 summarizes the total watershed pollutant loading within the Lower DuPage River watershed.

Table 3-8: Overall pollutant loading as estimated by the model.

Parameter	*Existing Estimated NPS Loading*	*Estimated Point Source Loading*	*Total Estimated Current Loading*
Chloride (lb/yr)	35,652,092	479,617	36,131,709
Total Sediment (ton/yr)	16,177	252.6	16,430
Total Nitrogen (lb/yr)	552,834	997,633	1,550,467
Total Phosphorus (lb/yr)	84,946	208,086	293,032
Fecal Coliform (CFU in billions/yr)	335,334	59,324	394,658

3.5 Load Reduction Goals and Targets

3.5.1 Overview of Load Reduction Goals and Targets

Load reduction goals are utilized in the watershed planning process to provide a numeric reference goal for a watershed plan so that the plan works towards achieving water quality regulatory standards or other water quality standards through the diverse range of flows over the course of a year. Target loads can be set in several ways, including reduction of current loads by a defined percentage or basing the reduction on known water quality guidelines. For the Lower DuPage River watershed, target loads were identified based on known water quality guidelines or standards for each pollutant. Table 3-9 indicates the water quality targets identified and the source of the target concentration.

Table 3-9: Water quality targets for pollutant load reductions based on parameters.

Parameter	*Target*	*Source*
Chloride	75 mg/L	15% of the Illinois Water Quality Standards, Title 35: Environmental Protection (500 mg/L)
Sediment	75 mg/L	US EPA recommendation for good to moderate fisheries for suspended sediment concentration (Range 25-80 mg/L)
Nitrogen	3.2 mg/L	US EPA Ambient Water Quality Recommendations for Nutrient Ecoregion VI (Range 1.16 – 3.26 mg/L)
Phosphorus	0.763 mg/L	US EPA Ambient Water Quality Recommendations for Nutrient Ecoregion VI (Range 0.062 – 1.18 mg/L)
Fecal Coliform	200 CFU/100mL	50% of the Illinois Water Quality Standards, Title 35: Environmental Protection (400 CFU/100mL)

Sediment, nitrogen and phosphorus have recommended water quality target ranges based on U.S. EPA guidance documents and statistical analyses that have been performed for the region to meet water quality standards. Due to the wastewater treatment contributions in the watershed, middle to high values of the recommended range were selected as targets. Due to the seasonal nature of chloride loading, a value of 15% of the applicable water quality standard was used to set the target. The fecal coliform target concentration was set at 50% of the water quality standard based on the results of the existing annual loading as it established an achievable load reduction goal of 19%.

3.5.2 Pollutant Load Reductions

3.5.2.1 Target Load Reductions

The water quality targets chosen for the Lower DuPage River watershed reference a concentration; therefore a flow rate was needed in order to convert the targets into either lb/year or ton/year for comparison to the calculated current pollutant loadings.

The target concentrations shown in Table 3-9 were applied to an average annual flow from the watershed of 180 cubic feet per second (cfs). This average annual flow was developed using a GIS based hydrologic model and applying the average annual flows from the point sources. The estimate of annual flow was then verified with flow statistics from the USGS gaging station number 05540500, located near Shorewood. Table 3-10 shows the target loads that were calculated and the required reductions to meet these goals.

Table 3-10: Target load reductions for pollutants.

Parameter	Total Current Loading	Target Loading		
		Concentration	Load	Reduction
Chloride (lb/yr)	36,131,709	75 mg/L	26,588,790	9,542,919 (26%)
Sediment (ton/yr)	16,430	75 mg/L	13,294	3,136 (19%)
Nitrogen (lb/yr)	1,550,467	3.2 mg/L	1,063,552	486,915 (31%)
Phosphorus (lb/yr)	293,032	0.763 mg/L	270,319	22,713 (8%)
Fecal Coliform (CFU in billions/yr)	394,658	200 (CFU/100mL)	321,614	73,044 (19%)

3.5.2.2 Interim Load Reduction Goals

Since the overall reduction goals are significant, interim goals were also developed to aid in the progress measurement of plan implementation. The overall reduction goals represent a 20-year timeline; therefore interim goals were identified for the 5-year and 10-year timeframes. Table 3-11 identifies the interim load reduction goals.

Table 3-11: Interim target load reductions for pollutants of interest.

Parameter	Total Current Loading	5-Year Target Load (10% of Total Reduction)	10-Year Target Load (40% of Total Reduction)	20-Year Target Load
Chloride (lb/yr)	36,131,709	35,177,417	32,314,541	26,588,790
Sediment (ton/yr)	16,430	16,116	15,176	13,294
Nitrogen (lb/yr)	1,550,467	1,501,776	1,355,701	1,063,552
Phosphorus (lb/yr)	293,032	290,761	283,947	270,319
Fecal Coliform (CFU in billions/yr)	394,658	387,354	365,440	321,614

4. Best Management Practices

There are a variety of tools, or Best Management Practices (BMPs), that have been selected through the watershed planning process to improve water quality within the Lower DuPage River watershed. In this chapter, BMPs for nonpoint source, point source, and policy and education BMPs are described, as a way to give stakeholders a selection of tools that can be used based on specific site and project constraints.

4.1 Strategy to Reduce Nonpoint Source Pollutant Loads

Nonpoint source pollution is one of the most difficult threats to water quality to control. The BMPs described in this section represent some of the best available practices for reducing nutrients, sediment, chlorides, and bacteria from entering the waterways. The Coalition was provided a draft list of BMPs based on the impairments within the watershed and the measures that would improve the water quality within the watershed. Comments were received and the list was revised. The selected measures and BMPs for improvement are categorized as Agricultural/Rural, Urban, and Policy/Regulation Best Management Practices. The following BMP summaries are typical BMPs and are provided as a reference and generally describe each measure and its design components; it is not meant to be an all inclusive list, but only a guide.

4.1.1 Agricultural/Rural Best Management Practices

Agricultural/Rural BMPs are implemented on agricultural lands for the purpose of protecting water resources, protecting aquatic wildlife habitat, and protecting the land resource from degradation. These practices control the delivery of nonpoint source pollutants to receiving water resources by first minimizing the pollutants available.

Agricultural/Rural BMPs that would benefit this watershed include:

- Buffer/Filter Strips
- Cover Crops
- Conservation Tillage
- Grassed Waterways
- Nutrient/Waste Management
- Stream Restoration
- Water and Sediment Control Basins
- Wetland Restoration

Buffer/Filter Strips

A buffer/filter strip is a strip of grass, native vegetation, trees or shrubs with vegetation underneath that filters runoff and removes contaminants before they reach water bodies or water sources. Creating and maintaining buffers along stream and river channels increases open space and can reduce some of the water quality and habitat degradation effects associated with increased imperviousness and runoff in the watershed. Buffers provide hydrologic, recreational, and aesthetic benefits as well as water quality functions and wildlife habitat. Sediment, phosphorus, and nitrogen are partly removed from water passing through a vegetated buffer. E. coli concentrations are also reduced with buffers. The percentage of pollutants removed depends on the pollutant load, the type of vegetation, the amount of runoff, and the character of the buffer area. The most effective buffer width can vary based on stream channel geometry and geomorphic stability. Adjacent land uses, topography, runoff velocity, and soil and vegetation types are all factors used to determine the optimum buffer width.

Cover Crops

Cover crops can be legumes or grasses, planted or volunteered vegetation established prior to or following a harvested crop primarily for seasonal soil protection and nutrient recovery. Cover crops protect soil from erosion, decreasing sediment concentrations in waterways and recover/recycle phosphorus in the root zone.

Cover crops are established during the non-crop period, usually after the crop is harvested, but can be inter-seeded into a crop before harvest by aerial application or cultivation. Cover crops reduce nitrogen and phosphorus transport by reducing soil erosion and runoff. Both wind and water erosion move soil particles that have phosphorus attached. Sediment that reaches water bodies may release phosphorus into the water. The cover crop vegetation recovers plant-available phosphorus in the soil and recycles it through the plant biomass for succeeding crops. The soil tilth also benefits from the increase of organic material added to the surface. Growing vegetation promotes infiltration and roots enhance percolation of water supplied to the soil. This reduces surface runoff. Runoff water can wash soluble phosphorus from the surface soil and crop residue and carry it off the field.

Conservation Tillage

This practice manages the amount, orientation, and distribution of crop and other plant residues on the soil surface year-round, while growing crops planted in narrow slots or tilled, residue free strips previously untilled by full-width inversion implements. The purpose of this conservation practice is to reduce sheet and rill erosion, which in turn facilitates water quality improvements by reducing sediment and nutrient loading in the waterways. Additional benefits of this practice are to reduce wind erosion of soils, to maintain or improve soil organic matter content and tilth, to conserve soil moisture, to manage drift accumulations, to increase plant available moisture or reduce plant damage from freezing or desiccation, and to provide food and escape cover for wildlife. This technique includes tillage and planting methods commonly referred to as no-till, zero till, slot plant, row till, direct seeding, or strip till.

No-till or strip till may be practiced continuously throughout the crop sequence, or may be managed as part of a system which includes other tillage and planting methods such as mulch till. Production of adequate amounts of crop residues is necessary for the proper functioning of this conservation practice and can be enhanced by selection of high residue producing crops and crop varieties in the rotation, use of cover crops, and adjustment of plant populations and row spacings.

Maintaining a continuous no-till system will maximize the improvement of soil organic matter content. Also, when no-till is practiced continuously, soil reconsolidation provides additional resistance to sheet and rill erosion. The effectiveness of stubble to trap snow or reduce plant damage from freezing or desiccation increases with stubble height. Variable height stubble patterns may be created to further increase snow storage.

Grassed Waterways

Grassed waterways are natural or constructed channels established for transport of concentrated flow at safe velocities using adequate channel dimensions and proper vegetation. They are generally broad and shallow by design to move surface water across farmland without causing soil erosion. Grassed waterways are used as storm runoff conveyance channels to prevent rill and gully formation. The vegetative cover slows the water flow, minimizing channel surface erosion. When properly constructed, grassed waterways can safely transport large water flows downslope. These waterways can also be used as outlets for water released from contoured and terraced systems and from diverted channels. This BMP can reduce sediment concentrations of nearby waterbodies and pollutants in runoff. The vegetation improves the soil aeration and water quality due to its nutrient removal through plant uptake and absorption by soil. The waterways can also provide wildlife corridors.

Nutrient/Waste Management

Nutrient management is the management of the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments to minimize the transport of applied nutrients into surface water or groundwater. Nutrient management seeks to supply adequate nutrients for optimum crop yield and quantity, while also helping to sustain the physical, biological, and chemical properties of the soil.

Nutrient management plans are generally developed with assistance from NRCS. A nutrient budget for nitrogen, phosphorus, and potassium is developed considering all potential sources of nutrients including, but not limited to, animal manure, commercial fertilizer, crop residue, and legume credits. Realistic yields are based on soil productivity information, potential yield, or historical yield data based on a 5 year average. Nutrient management plans specify the form, source, amount, timing, and method of application of nutrients on each field in order to achieve realistic production levels while minimizing transport of nutrients to surface and/or groundwater.

Animal waste is a major source of pollution to waterbodies. To protect the health of aquatic ecosystems and meet water quality targets, manure must be safely managed. Good management of manure keeps livestock healthy, returns nutrients to the soil, improves pastures and gardens, and protects the environment, specifically water quality. Poor manure management may lead to sick livestock, unsanitary and unhealthy conditions for humans and other organisms, and increased insect and parasite populations. Proper management of animal waste can be done by implementing BMPs, through safe storage, by application as a fertilizer, and through composting. Proper manure management can effectively reduce E. coli concentrations, nutrient levels and sedimentation. Manure management can also be addressed in education and outreach to encourage farmers to participate in this BMP.

Stream Restoration

Stream restoration techniques are used to improve stream conditions so they more closely mimic natural conditions. For urban stream reaches, restoration to natural conditions may not be possible or feasible. For instance, physical constraints due to adjacent development may limit the ability to re-meander a stream. In addition, the natural stream conditions may not be able to accommodate the increased volume of flow from the developed watershed.

Even in cases where restoring the stream to its natural condition is not possible, the stream can still be naturalized and improved by reestablishing riparian buffers, performing stream channel maintenance, stabilizing streambanks using bioengineering techniques, and, where appropriate, by removing manmade dams and installing pool/riffle complexes. Stream restoration projects may be one component of floodplain restoration projects and can be supplemented with trails and interpretive signs, providing recreational and educational benefits to the community.

Water and Sediment Control Basin

A water and sediment control basin (WASCB) is a small earthen embankment built across a small watercourse or area of concentrated flow within a field. They are commonly built in a parallel series with the first ridge crossing the top of the watercourse and the last ridge crossing the bottom, or nearly so. They are designed to trap agricultural runoff water and sediment as it flows down the watercourse; this keeps the watercourse from becoming a field gully and reduces the amount of runoff and sediment leaving the field.

Wetland Restoration

Wetland restoration is the process of reestablishing a wetland on a site that has been converted to other uses. Wetlands have the ability to reduce E. coli concentrations, nutrient loading, sediment concentrations, and flood damage.

Wetland functional values vary substantially from wetland to wetland; they receive special consideration because of the many roles they play. Because of the wetland protection laws currently in place, the greatest impact on wetlands from future development will likely be a shift in the types of wetlands. Often in mitigation projects, various types of marshes, wet prairies, and other wetlands are filled and replaced elsewhere, usually with existing open water wetlands. This replacement may lead to a shift in the values served by the wetland communities due to a lack of diversity of wetland types. The wetland restorations that are proposed should include a variety of different wetland types to increase the diversity of wetlands in the watershed. The restoration of wetlands can decrease flood damage by providing new stormwater storage areas, will improve water quality by treating stormwater runoff, and will create new plant and wildlife habitat. In addition to these values, wetlands can be part of regional greenways or trail networks. They can be constructed with trails to allow the public to explore them more easily, and they can be used to educate the public through signs, organized tours, and other techniques. They do require long term maintenance activities which may include prescribed burning, herbiciding, mowing, and other activities.

4.1.2 Urban Best Management Practices

For the past two decades the rate of land development across the country has been more than two times greater than the rate of population growth. The increased impervious surface associated with this development has increased stormwater volume and degrade water quality, which is harmful to the overall watershed.

The best way to mitigate stormwater impacts from new developments and urban areas is to use urban BMPs to treat, store, and infiltrate runoff onsite before it can affect water bodies downstream. Innovative site designs that reduce imperviousness and smaller-scale low impact development practices dispersed throughout a site are excellent ways to achieve the goals of reducing flows and improving water quality.

Some Urban BMPs that would benefit the watershed include:

- Bioretention (Rain Garden)
- Filtration Basin
- Infiltration Trench
- Naturalized Stream Buffer
- Rain Barrels/Cisterns
- Stream Restoration
- Constructed Wetland/Naturalized Detention Basin
- Green Roofs
- Manufactured Products for Stormwater Inlets
- Pervious Pavement/Permeable Pavers
- Road Salt Application Calibration and Storage
- Vegetated Swale/Bioswale

Bioretention (Rain Garden)

Bioretention practices (including bioinfiltration or biofiltration) or rain gardens are primarily used to filter runoff by first storing the runoff in shallow depressions and then by utilizing plants that are tolerant of wet conditions to help infiltrate the runoff into permeable soil. Rain gardens most often consist of soil amendments such as gravel or sand to promote infiltration, a shallow ponding area, soil for the plants to grow in, and plants that tolerate wet conditions. They can also include an overflow structure or underdrain system for high volume rain events.

Rain gardens are an excellent BMP in residential areas or in community open space. They are effective at treating parking lot runoff, roadway runoff where there is sufficient space, and pervious areas such as golf courses. Rain gardens not only provide a landscape feature and reduce the need for irrigation, but can also be used to provide stormwater storage and treatment. They can be integrated into the stormwater management to maximize depressional storage, pretreatment of the stormwater runoff, promote evapotranspiration, and facilitate groundwater recharge. The combination of these benefits can result in decreased flooding due to a decrease in the peak flow and total volume of runoff generated by a storm event. In addition, these features can be designed to provide a significant improvement in the quality of the stormwater runoff. Rain gardens require long term maintenance similar to any garden.

Constructed Wetland/Naturalized Detention Basins

Constructed wetlands and naturalized wet-bottom detention basins are used to temporarily store runoff and release it at a reduced rate. Naturalized wet-bottom detention basins are better than traditional detention basins because they encourage water infiltration, and thereby recharge groundwater tables. Native wetland and prairie vegetation also help to improve water quality by trapping sediment and other pollutants found in runoff, and can be aesthetically pleasing. Naturalized wet-bottom detention basins can be designed as either shallow marsh systems with little or no open water or as open water ponds with a wetland fringe and prairie side slopes. Wetlands/naturalized basins have the ability to reduce bacteria concentrations, nutrient loading, sediment concentrations, and flood damage. Constructed wetlands are often designed with sediment forebays for pretreatment and lengthened flow paths to increase the efficiency of the wetland. These basins also require long term management activities which may consist of prescribed burning, herbiciding, mowing, and other activities.

Filtration Basin

Filtration basins provide pollutant removal (including sediment, nutrients, and E. coli) and reduce volume of stormwater released from the basin. These basins utilize sand filters or engineered soils to filter stormwater runoff through a sand or engineered soil layer within an underdrain system that conveys the treated runoff to a detention facility or to the ultimate point of discharge. The filtration system consists of an inlet structure, sedimentation chamber, sand/engineered soil layer, underdrain piping, and liner to protect against infiltration.

Green Roof

A green roof is a roof of a building that is partially or completely covered with vegetation and a growing medium planted over a waterproofing membrane. Green roofs can be used as an alternative to conventional roofing on commercial, industrial and residential buildings. Green roofs absorb and store precipitation, thereby acting as a stormwater management system and reducing overall peak flow discharge to a storm sewer system. Green roofs also have the potential to reduce discharge of pollutants such as nitrogen and phosphorous. Green roofs offer additional benefits including reduction of urban heat island effects, increased thermal insulation and energy efficiency, and increased durability and lifespan compared to conventional roofs.

Infiltration Trench

Infiltration trenches are excavated trenches backfilled with a coarse stone aggregate and biologically active organic matter. Infiltration trenches allow temporary storage of runoff in the void space between the aggregate and help surface runoff infiltrate into the surrounding soil. Infiltration trenches remove fine sediment and the pollutants associated with them. Soil infiltration trenches can be effective at reducing sediment concentrations and nutrient loading. Soluble pollutants can be effectively removed if detention time is maximized. The degree to which soluble pollutants are removed is dependent primarily on holding time, the degree of bacterial activity, and chemical bonding with the soil. The efficiency of the trench to remove pollutants can be increased by increasing the surface area of the trench bottom. Infiltration trenches can provide full control of peak discharges for small sites. They provide groundwater recharge and may augment base stream flow.

Manufactured Products for Stormwater Inlets

Manufactured products for stormwater inlets are systems designed to remove debris, pollutants (such as sediment, oil and grease) from stormwater runoff. The best application for these products is as a pretreatment to another stormwater management practice and they are best installed in highly urbanized or impervious areas.

Naturalized Stream Buffer

Creating and maintaining buffers along stream and river channels and lakeshores increases open space and can reduce some of the water quality and habitat degradation effects associated with increased imperviousness and runoff in the watershed. Buffers provide hydrologic, recreational, and aesthetic benefits as well as water quality functions, and wildlife habitat. Sediment, phosphorus, and nitrogen are at least partly removed from water passing through a naturally vegetated buffer. The percentage of pollutants removed depends on the pollutant load, the type of vegetation, the amount of runoff, and the character of the buffer area. The most effective buffer width can vary based on stream channel geometry and geomorphic stability. Adjacent land uses, topography, runoff velocity, and soil and vegetation types are all factors used to determine the optimum buffer width.

Pervious Pavement/Permeable Pavers

Pervious pavement has the approximate strength characteristics of traditional pavement but allows rainfall and runoff to percolate through it. This decreases sediment concentrations and flood damage in the watershed by slowing the water from entering the streams and waterways, it also provides an opportunity for water to infiltrate into the ground, recharging shallow groundwater systems. The key to the design of these pavements is the elimination of most of the fine aggregate found in conventional paving materials. Pervious pavement options include porous asphalt and pervious concrete. Porous asphalt has coarse aggregate held together in the asphalt with sufficient interconnected voids to yield high permeability. Pervious concrete, in contrast, is a discontinuous mixture of Portland cement, coarse aggregate, admixtures, and water that also yields interconnected voids for the passage of air and water. Underlying the pervious pavement is a filter layer, a stone reservoir, and filter fabric. Stored runoff gradually drains out of the stone reservoir into the subsoil.

Modular pavement consists of individual blocks made of pervious material such as sand, gravel, or sod interspersed with strong structural material such as concrete. The blocks are typically placed on a sand or gravel base and designed to provide a load-bearing surface that is adequate to support vehicles, while allowing infiltration of surface water into the underlying soils. An alternative to pervious and modular pavement for parking areas is a geotextile material installed as a framework to provide structural strength. Filled with sand and sodded, it provides a completely grassed parking area.

Rain Barrels/Cisterns

A rain barrel is a container that collects and stores rainwater from rooftops (via disconnected downspouts) for later use. Rainwater stored in rain barrels can be useful for watering landscapes, gardens, lawns, and trees. Rain is a naturally soft water and devoid of minerals, chlorine, fluoride, and other chemicals. In addition, rain barrels help to reduce peak volume and velocity of stormwater runoff to streams and storm sewer systems.

Road Salt Application, Calibration, and Storage

The controlled application, storage of deicing materials, and use of alternative deicing substances can minimize the water quality impairments to surrounding areas. Properly storing road salts prevents the salt from lumping together and reduces salt loss from stormwater runoff. The amount of road salt applied should be regulated to reflect site-specific characteristics, such as road width, traffic concentration, and proximity to surface waters. Calibration devices also help apply the proper amount of road salt. A wide variety of alternative deicing products are available on the market which have different affects on the environment and water quality.

Stream Restoration

(see section under Agricultural/Rural BMPs)

Vegetated Swale/Bioswale

Bioinfilitration systems such as swales are used to treat stormwater runoff from small sites such as driveways, parking lots, and roadways. They provide a place for stormwater to settle and infiltrate into the ground. Biofiltration swales are a relatively low cost means of treating stormwater runoff for small sites typifying much of the urban environment, such as parking, roadways, driveways, and similar impervious features. They provide areas for stormwater to slow down and pollutants to be filtered out. Careful attention to location and alignment of swales can lend a pleasing aesthetic quality to sites containing them.

Native Landscaping

Native landscaping can be used to increase infiltration and decrease runoff. Plants that are native to the region have extensive root system, helping to keep soil in place and reduce sediment, nitrogen, and phosphorus runoff. Native landscaping is low cost and low maintenance.

4.1.3 Policy/Regulation Best Management Practices

Efficient site designs that reduce imperviousness and smaller-scale low impact development practices dispersed throughout a site are excellent ways to achieve the goals of reducing flows and improving water quality. Policy/Regulation BMPs encourage planning to reduce water quality impacts prior to the start of a project and ongoing maintenance/ practices to reduce water quality impacts from municipal operations.

Some of the Policy/Regulation BMPs that may be beneficial for this watershed include:

- Conservation Design Developments
- Conservation Easements
- Long Term Management of Installed BMPs
- Road Salt Application Education
- Water Quality Ordinance

Conservation Design Developments

The goal of conservation design development is to protect open space and natural resources for people and wildlife, while at the same time allowing development to continue. Conservation-based design developments focus on designating large portions of the buildable land area as undivided permanent open space. They are density neutral, allowing the same average density as in conventional developments, but that density is realized on smaller areas of land by clustering buildings and infrastructure. In addition to clustering, conservation design developments incorporate natural riparian buffers and setbacks for streams, wetlands, other waterbodies, and adjacent agricultural.

The first and most important step in designing a conservation development is to identify the most essential lands to preserve in conservation areas. This will require coordination with local officials and the community as this practice is commonly added into ordinances and future planning efforts. Natural features including streams, wetlands, lakes, steep slopes, mature woodlands, native prairie, and meadow (as well as significant historical and cultural features) are included in conservation areas. Clustering is a method for preserving these areas. Clustered developments allow for increased densities on less sensitive portions of a site, while preserving the remainder of the site in open space for conservation and recreational uses (such as trails, soccer or ball fields).

Conservation Easements

Conservation easements are agreements that allow individuals or groups to limit the type or amount of development on their property. A conservation easement can cover all or a portion of a property. They are typically used to preserve agricultural lands and natural areas threatened by development.

Conservation easements indirectly contribute to water quality protection through land use protection. Specific pollutant removal efficiency depends on how much land is conserved and the specific nature of the easement. Conservation easements may be monitored and enforced by either public agencies or private nonprofit conservation organizations. As conservation easements are not the best solution for every development scenario, government bodies may develop policies that require conservation easements for specific development situations.

Long Term Management of Installed Best Management Practices

The effectiveness of BMPs depends on regular inspections and maintenance of the measures. Routine inspection and maintenance helps protect property values, prevent potential nuisances (odors, mosquitoes, weeds, etc.), reduces the need for repair maintenance, and reduces the chance of polluting stormwater runoff by finding and fixing problems before the next rain. Long term management plans identifying the responsible party and maintenance tasks prior to construction of the selected BMP help ensure that the BMPs are routinely inspected and maintain their removal efficiencies.

Road Salt Application Education

The controlled application and storage of deicing materials can minimize the water quality impairments to surrounding areas. Properly storing road salts prevents the salt from lumping together and reduces salt loss from stormwater runoff. The amount of road salt applied should be regulated to reflect site-specific characteristics, such as road width, traffic concentration, and proximity to surface waters. Calibration devices also help apply the proper amount of road salt. Educating private snow removal servicers on the proper storage and application of salt would potentially help reduce the amount of salt applied and therefore reduce pollutant loads within the watershed.

Water Quality Ordinance

An ordinance promotes the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land. The goal of a water quality ordinance is to limit water runoff pollutant loadings.

4.1.4 Education and Outreach

We all have an impact on water quality. From the cars that we drive to the fertilizer we put on our lawns, pollutants from these activities and many others wash off the land and flow across the landscape, often through storm sewer systems, to our rivers and streams. These individual actions have relatively small impacts on water quality, but when looked at cumulatively they have a huge impact. This is nonpoint source pollution, so named because it does not originate from one pipe, but from many sources scattered across the landscape. Nonpoint source pollution is the nation's largest remaining water quality problem.

Education and outreach is essential to improving water quality within a watershed. If people don't understand what effects their actions have on water quality, improvements can be made through regulation and incentives, but only for a period of time. People want to do the right thing; they often just don't know what it is or how to do it. A watershed plan needs to include ways to make stakeholders aware of the issues, educating them on what needs to be done, and motivating them to take action. If stakeholders are involved in creating and implementing the plan, research shows that the watershed will have a higher level of long-term support and success.

Education of local residents must start with the basics; many studies have found that although the general public has heard the term "watershed," few are able to define it or explain how they have an impact on it. Not only will the education and outreach campaign need to define terms, but it will need to raise a general awareness of the problems in the watershed and the potential solutions. Then the campaign will need to find a way to motivate residents to act, contributing to improving water quality, through their own actions, their government, and those in which they support financially. The impact of not taking action must also be demonstrated.

This section of the watershed plan will lay the groundwork for creating a successful education and outreach campaign. First, it will summarize some existing literature on how to create a successful education and outreach campaign. Then it reviews some education and outreach activities that occurred during the watershed planning effort. Lastly, this section closes with a look ahead at education and outreach activities that were determined by the stakeholders to be necessary for improving water quality in the Lower DuPage River watershed.

4.1.4.1 Resources for Watershed Education and Outreach Campaigns

There are many resources available to assist in developing an effective watershed education and outreach campaign. Agencies like U.S. EPA and IEPA have many resources available including U.S. EPA's *Getting in Step: a Guide for Conducting Watershed Outreach Campaigns* (2003) and IEPA's *Guidance for Watershed Action Plans in Illinois* (2007). Not-for-profit

organizations like the Center for Watershed Protection and The Conservation Foundation are also great sources of information, often having brochures, fliers and other information applicable to watershed problems already on hand. The following information summarizes key findings from these resources.

Cause-Based Marketing

Research has shown that cause-based or social marketing is the most effective way to get people to change their behavior. Cause-based marketing is the practice of looking at people as consumers, but instead of selling products or services, as a watershed group, we are selling ideas, attitudes and behaviors. The goal of cause-based marketing is not to make a profit, but to improve society and the environment. Part of this campaign should include persuading the public that there is a problem that only they can solve.

Identifying the Audience

Before any of the following education and outreach strategies are employed, the target audience(s) must be identified. Different strategies will be used for different audiences. For example, if the goal is to reduce phosphorus in the watershed, then targeting residents and lawn care companies that apply fertilizers might be the most effective strategy. The target audience should be broken down into the smallest segment possible to achieve the best results, a message that resonates with the target audience and inspires them to act.

Understanding the Audience

Knowing some information about the target audience(s) is essential. Campaign audiences have varied values and beliefs, and they will not necessarily be the same as those implementing the watershed plan. The following is a list of a few questions that are important to know about the target audience(s), before education and outreach activities begin:

What does the audience know already? What are their existing beliefs and perceptions?

How does the audience receive messages and information?

What will make the audience change their behavior?

Other important factors include: Education, age, culture, and religion

In order to create a successful education and outreach campaign, it is necessary to understand the audience(s). What causes the audience to engage in the behaviors we want to change? How can we most effectively convey that message to them? How can we motivate the audience(s) to change? The understanding of the audience can be completed at the same time or subsequent to identifying the audience(s). Surveys, focus groups, and even simple observations can lead to a greater understanding of the audience and a successful campaign.

Barriers

Another component to establishing a successful education and outreach campaign is anticipating problems and road blocks. Barriers are just that, problems that might prevent residents from changing their behavior. Often barriers include time and/or resources. A barrier can also be that a person is simply not aware of the affect of their actions.

A common barrier is that the action desired is not socially acceptable. For example, rain gardens or other native vegetation is often perceived as looking weedy or unkempt. A resident might want to improve infiltration and have a low maintenance garden, but is resistant to installing a rain garden because he doesn't want to offend his neighbors. The message needs to be conveyed to that resident and his neighbors that natives can be planted in beds, can be low to the ground, and not look weedy. In this regard, barriers need to be minimized or removed.

Social Norms

Related to the example just cited are social norms. Social norms are the behavioral expectations and cues within a group of people. It is a social norm that we maintain our lawns with grass species that are mowed to a certain height frequently. Through education and outreach, new examples need to be created showing the different, desired action. Then one by one, new social norms need to be established. People are more likely to change their behavior if they see someone else benefitting from the new behavior.

Creating the Message

Messages must be clear and contain specific calls to action. They are designed to raise awareness, educate or motivate to action. Campaigns should inform and suggest acceptable behaviors. People are more likely to change their behaviors when they see other people modeling the behavior first

Messages need to capture the audience's attention. What is needed to get the audience's attention will vary by different segments of the audience. Insights to this information may have been gleaned when identifying the audience, through information such as demographics or may be indicated by the message itself.

Ask people to do something in response and let them know what effect this behavior will have. Be clear and concise. Consider what behavior you are trying to change and what behavior should replace it.

Formatting the Message

How the message is distributed to the audience can make or break an outreach campaign. The packaging of a message can help foster relationships and a sense of community, build understanding, and motivate people to action or it can be expensive and time consuming while producing little results. The target audience(s) should dictate which format should be used to convey the message. Formats can change over the course of the campaign. A campaign could start out raising general awareness with public service announcements (PSAs) and once the audience understands the problem, brochures could be distributed to further inform residents about what they can to do to contribute to the solution. According to the U.S. EPA's Getting in Step guide, if the budget is small, the frequency in which your audience hears or sees the message is important. The following describes formats and messages that were used during the planning effort and what the Coalition would like to do going forward.

4.1.4.2 Education and Outreach Activities during Watershed Planning

A variety of education and outreach activities took place during the creation of this plan. They have laid the groundwork for a successful education and outreach campaign and may also indicate what may not work in the future.

Website

Materials for the watershed planning effort are currently located at www.dupagerivers.org, which is the Coalition website by The Conservation Foundation. Agendas, maps, upcoming events, and the watershed plan are posted there. However, after the planning effort is complete, there is no funding available to maintain this website. The websites was created using existing software and is limited in functionality.

Brochures

Two brochures were developed as part of the watershed planning effort, one about the watershed planning effort itself and a second about the specific impairments facing the Lower DuPage and what can be done to improve water quality.

Webcasts

Watershed stakeholders attended one webcast put on by the Center for Watershed Protection entitled "The Watershed Treatment Model – A TMDL and MS4 Tracking Tool." The webcast was paid for by the grant used to create this watershed plan. There was not sufficient interest to support participation in additional webcasts. Other webcast topics made available to the Coalition included permeable pavement, rooftop disconnection, and site designing principles.

Watershed Site Tours

Throughout the watershed planning process, the Coalition combined short on-site tours with our regular meetings. Joliet Junior College's (JJC) Lake Rehabilitation and Management Project was the first of these visits. JJC is using an IEPA Section 319 grant to partially fund several projects on campus, including the removal of sediment from the on campus lake, incorporating BMPs on campus including a bioswale, oil and grit separators, and native plantings to improve water quality.

The Coalition took a walking tour of the Forest Preserve District of DuPage County's Spring Brook Prairie Forest Preserve in Naperville. The property is close to the headwaters of Spring Brook, a northern tributary to the main stem. Over the years, the Forest Preserve District has undertaken several remeandering projects to create a more natural channel for Spring Brook, reversing decades of impacts. Funds for portions of these projects were also provided in part through IEPA's 319 grant. The remainder of the property is planted with native prairie species. A variety of bank stabilization techniques were used and available for viewing. The most important lesson learned that day was that the Forest Preserve District was able to complete this project because they knew the exact size of the tributary area. Therefore, they could model the effects of different storm events and stabilize the banks to the degree necessary.

The Coalition also toured McDonald Farm, The Conservation Foundation headquarters, and heard a presentation regarding BMPs intended for homeowners incorporated on that site including rain barrels, butterfly and rain gardens, rainwater harvesting and permeable pavement.

The Forest Preserve District of Will County's Four Rivers Environmental Education Center in Channahon has many sustainable design elements incorporated into the building including the reuse of an existing building and materials, a green roof, geothermal heating and cooling and bioswales and native vegetation in the parking lot. The Coalition held a stakeholder meeting there to give participants a chance to see a sustainable designed building and its features.

Public Forum

The watershed plan was presented to stakeholders at a public forum, where people could ask questions of the committee, consultants, and other parties involved in writing the plan.

4.1.4.3 Education and Outreach Activities Going Forward

Throughout the watershed planning process, the stakeholders discussed education and outreach a number of times. The following activities were determined to be the most desired.

Website

Websites are an excellent way of quickly connecting to a large audience. A mix of scientific and general information about the watershed can be located all in one place. The material can be changed and updated frequently and people can provide feedback and information quickly. A website is a relatively inexpensive education and outreach tool.

Brochures

Printed material is a popular format for conducting education and outreach activities. It can be created easily and inexpensively. People can refer to printed materials again and again. The current brochures should continue to be distributed as long as they are useful. New brochures could be developed to cover additional topics including BMPs for homeowners, information on proper salt and fertilizer use, and information on fecal coliform.

Conservation @ Home

Conservation @ Home is a program created by The Conservation Foundation which is geared towards homeowners. The program encourages and recognizes property owners who protect and/or create yards that are environmentally friendly and conserve water. This includes planting native vegetation, creating butterfly and rain gardens, and removing invasive species.

The core of the program is the use of native plants. Native plants require little to no watering and fertilizer once established. The deep roots of native plants hold the soil in place and prevent erosion, allowing water to infiltrate instead of running off the landscape. Using native landscaping can help reduce localized flooding and improve water quality.

The Conservation @ Home program has many existing resources, however, funds are necessary to expand, promote and sustain the program throughout the watershed. Funding would support staff time needed to conduct outreach to municipalities, park districts, homeowners and homeowner associations through seminars, workshops, one-on-one conversations and the distribution of printed materials.

Mighty Acorns

Mighty Acorns is a stewardship-based curriculum for 4th-6th graders. Classes adopt a natural area in their community and visit it throughout the school year in order to participate in stewardship activities. Each field trip is preceded by a classroom lesson on related ecological concepts. Summer nature camps for Mighty Acorns have also been developed through partnerships between The Conservation Foundation and local park districts.

River Sweep

A river sweep is a coordinated, periodic clean-up of area waterways. The purpose is to use volunteers to remove trash and debris from the river, while at the same time creating a connection between people and the river. Funding for supplies is available through the IEPA SCALE grant program.

Storm Drain Stenciling

Storm drain stenciling involves volunteers painting a stenciled message on or near a storm drain as well as handing out literature explaining what they are doing. Stenciling is a way of explaining nonpoint source pollution to the general public and connecting volunteers and residents to the environment.

Events

The Coalition could prompt its message about improving water quality in the Lower DuPage by attending and distributing information at existing environmental fairs or by creating their own event. A number of environmental fairs occur throughout the watershed that would give the Coalition the opportunity to talk to residents and gauge their understanding of the water quality problem as well as hear their concerns about the watershed. The Coalition could also host its own events, such as a watershed tour, an environmental fair, or a listening session.

Public Service Announcements

A public service announcement (PSA) can be an inexpensive way to reach a variety of people. PSAs can be broadcast on radio, television or even on websites. Local college students and broadcasting classes can be used to assist in the creation of a PSA. PSAs are often aired for no charge on local cable access channels or radio stations, although time slots may not be ideal.

4.1.5 Best Management Practices: Load Reductions

Load reduction calculations were estimated for nitrogen, phosphorus, sediment, fecal coliform, and chloride based on the potential BMPs to be implemented within the watershed. The percent reductions for each BMP were based on the review of U.S. EPA's Stormwater Menu of BMPs, U.S. EPA's National Management Measures to Control Nonpoint Source Pollution from Agriculture, The Nature Conservancy of Illinois, and the Center for Watershed Protection and STEPL. The reductions only apply to the drainage area that is directly tributary to the BMP implemented. Therefore, when looking at overall reductions in a given subwatershed, an aggregate for all BMPs implemented with each associated tributary area will need to be evaluated.

Table 4-1 shows a range of load reduction efficiencies for each BMP type based on industry accepted literature and publications throughout the United States. For the purposes of planning and estimating load reductions we recommend using these values or using the middle value where ranges are provided. The load reduction efficiencies provided indicate an expected and reasonable range as actual efficiencies are variable based on many site and project specific factors. Adjustments in load reduction efficiencies can be made on a project by project basis when necessary.

Load reduction estimates are not provided for the Policy/Regulation BMPs since they are typically planning tools and direct impacts are not easily determined.

Table 4-1: Load reduction estimates for each BMP based on literature review.

Agricultural/Rural Best Management Practices

BMP/Measure	Estimated Load Reductions				
	Suspended Sediment	Phosphorus	Nitrogen	Fecal coliform	Chloride
Buffer/Filter Strips	55 - 85%	50 – 65%	40 - 50%	45 – 55%	20 – 30%
Cover Crops	40%	45%	40%	-	-
Conservation Tillage	75%	45%	55%	-	-
Grassed Waterways	80%	45%	55%	50%	30%
Nutrient/Waste Management	60%	90%	80%	85%	-
Stream Restoration	75%	75%	75%	-	-
Water and Sediment Control Basins	60%	20%	30%	35%	20%
Wetland Restoration	65-85%	35-65%	20-55%	65%	15 - 30%

Urban Best Management Practices

BMP/Measure	Estimated Load Reductions				
	Suspended Sediment	Phosphorus	Nitrogen	Fecal coliform	Chloride
Bioretention Practices	50 – 80%	45 - 65%	45 – 65%	25 – 55%	15 – 30%
Constructed Wetland/ Naturalized Detention Basin	65 - 85%	35 - 65%	20 - 55%	40 - 65%	15 – 30%
Filtration Basin	65 - 90%	40 - 85%	45 - 50%	55%	35 – 55%
Green Roofs	85%	Up to 80%	60%	-	-
Infiltration Trench	75%	65 - 70%	40 - 65%	90%	55 – 95%
Manufactured Products for Stormwater Inlets	20 - 90%	0 - 20%	0 - 5%	0 – 20%	0 – 25%
Naturalized Stream Buffer	55-85%	40 - 65%	40 - 50%	45 – 55%	35 – 55%
Pervious Pavement/ Permeable Pavers	65-80%	35-65%	35-65%	25 – 50%	45 – 60%
Rain Barrels/Cisterns	-	-	-	-	-
Road Salt Application and Storage reduction in lost/wasted	-	-	-	-	20-30%
Stream Restoration	75%	70%	60%	0 – 25%	10 – 50%
Vegetated Swale/Bioswale	80%	30-85%	35-50%	40 – 55%	35 – 50%

4.1.6 Best Management Practices: Technical and Construction Costs Summary

The actual efficiency of each BMP is based on several variables making it difficult to accurately determine the number required to equal the reduction goals (e.g. the location in the watershed, tributary area, soils, etc), therefore specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind.

Conceptual implementation cost estimates for each identified BMP is summarized in Table 4-2. This cost estimate is based on standard BMP costs and may vary based on specific site information.

Table 4-2: Summary of costs associated with each BMP.

Agricultural/Rural Best Management Practices		
BMP/Measure	**Technical Costs**	**Construction Costs**
Buffer/Filter Strips	5% of total project cost	$5,000- $10,000/ac
Cover Crops	Minimal technical assistance required	$100/ac
Conservation Tillage	Minimal technical assistance required	N/A
Grassed Waterways	5% of total project cost	$5,000- $10,000/ac
Nutrient/Waste Management	Minimal technical assistance required	$5-$30/ac
Stream Restoration	15% of total project cost	$100-250/lf
Water and Sediment Control Basins	5% of total project cost	$250-$500/ac
Wetland Restoration	15% of total project cost	$5,000- $10,000/ac
Urban Best Management Practices		
BMP/Measure	**Technical Costs**	**Construction Costs**
Bioretention Practices	5% of total project cost	$3-$40/sq ft
Constructed Wetland/ Naturalized Detention Basin	15% of total project cost	$15,000- $30,000/ac
Filtration Basin	15% of total project cost	$2.50- $7.50/cf of stormwater treated
Green Roofs	15% of total project cost	$15- $20/sq ft
Infiltration Trench	15% of total project cost	$5/cf of stormwater treated
Manufactured Products for Stormwater Inlets	5% of total project cost	$400- $10,000/ea
Naturalized Stream Buffer	5% of total project cost	$5,000- $10,000/ac
Pervious Pavement/ Permeable Pavers	5% of total project cost	$2-$10/sq ft
Rain Barrels/Cisterns	Minimal technical assistance required	$100- $250/ea
Road Salt Application and Storage	Minimal technical assistance required	N/A
Stream Restoration	15% of total project cost	$100-250/lf
Vegetated Swale/Bioswale	15% of total project cost	$5,000- $15,000/ac

4.2 Recommendations to Reduce Point Source Pollutant Loads

As stated previously and shown in Figure 3-1, point sources are a significant source of watershed pollutant loading. The permitted facilities within the Lower DuPage River watershed include municipal wastewater treatment plants, mining operations and private utility operations. According to the point source loading estimates, it is evident that the point sources within the watershed contribute a substantial portion of the nutrient loading as shown in Table 4-3.

Table 4-3: The percentages of pollutants contributed by point sources within the watershed.

Parameter	% of Overall Loading
Chloride	1.3%
Total Suspended Sediment	1.5%
Total Nitrogen	64.3%
Total Phosphorus	71.0%
Fecal Coliform	15.0%

4.2.1 Recommended Point Source Best Management Practices

The watershed restoration and management techniques described in this section, when applied to the Lower DuPage River watershed, can help achieve the watershed goals and objectives to decrease the concentrations of nutrient loads identified in this plan. The following BMP summaries are typical BMPs and are provided as a reference and generally describe each measure and its design components, it is not meant to be all inclusive list but only a guide.

Some point source BMPs that may benefit this watershed include:

- Side Stream Nutrient Removal
- Partial Land Application of Treated Effluent
- Treatment Wetlands

Side Stream Nutrient Removal

Significant amounts of nutrients can be found in the reject water (side streams) of many wastewater treatment processes. Most of these side streams are conventionally returned to the headworks, where they are combined with the normal influent. The use of side stream treatment is intended to decrease the loading on the main nutrient removal process, resulting in lower effluent nutrient concentrations. Several relatively new processes have been developed to remove nitrogen in high-concentration side streams from biosolids processing.

Partial Land Application of Treated Effluent

Partial land application of treated effluent is using the water that has been treated by a wastewater treatment plant to irrigate crops. Municipal effluent is often used to irrigate farmland and golf courses in the area. Because of the nature of the effluent and its potential exposure to humans, certain specific treatment requirements may apply including monitoring and bacterial sampling. Other specific measurable criteria must also be met, depending on whether the effluent may come into contact with raw food crops, fruit, seed, or processed food crops. Irrigation is usually only allowed during periods of non-use, and public access is restricted.

Treatment Wetlands

Tougher state clean water standards are on the horizon for nutrient loads from wastewater treatment plant effluent. Municipalities are also beginning to take interest in reducing nutrient loads from stormwater runoff to protect downstream water quality.

Treatment wetland systems are manmade systems designed for improved treatment capacity. The three main types of wetlands include: Free Water Surface (FWS), Subsurface Flow (SF) and Vertical Flow (VF).

Treatment wetlands use biogeochemical processes that occur naturally to remove nutrients and other constituents of concern. They are typically a series of treatment cells (often terraced) with hydraulic controls to optimize retention time.

Treatment wetlands can also be used to temporarily store runoff and release it at a reduced rate. Native wetland and prairie vegetation help to improve water quality by trapping sediment and other pollutants found in runoff, and are aesthetically pleasing. Wetlands have the ability to reduce bacteria concentrations, nutrient loading and sediment concentrations.

Technological Phosphorus Treatment

The removal of phosphorous from wastewater involves the incorporation of phosphate into solids and the subsequent removal of these solids. Phosphorous can be incorporated into either biological solids or chemical precipitates.

As discussed previously, some of the permitted facilities within the Lower DuPage River watershed provided additional information to help refine the point source pollution estimates. During this data gathering process, six facilities were identified as currently not having phosphorus treatment at the facility. Table 4-4 summarizes the current estimated phosphorus load and the reductions expected if phosphorus treatment were incorporated into the facilities. The estimated phosphorus reduction from the addition of phosphorus treatment is 104,979 pounds per year. Adding this technology alone exceeds the overall phosphorus reduction goal of 22,713 pounds per year.

Technological phosphorus treatment may require significant upfront capital costs and will increase annual operating and maintenance expenses. The capital and operational costs vary depending on each individual situation. Based on correspondence with several of the wastewater treatment facilities in the watershed, the IEPA has recently instituted phosphorus treatment requirements upon permit renewals. This situation may be presented in the future as the facilities identified in Table 4-4 renew their NPDES permits.

Table 4-4: Estimated phosphorous loads and reductions expected if treatment is incorporated.

Permit #	Name	Average Daily Discharge (mgd)	Current Phosphorus Load (lbs/yr)	Estimated Phosphorus Load w/ Treatment (lbs/yr)	Estimated Total Phosphorus Reduction (lbs/yr)
IL0034061	Naperville - Springbrook WRC	21	144,970	63,968	81,002
IL0069744	Village of Bolingbrook STP #3	2.8	21,598	8,529	13,069
IL0049166	IL American Water - Essington	0.01	66	30	36
IL0076414	Joliet Aux Sable Creek WWTP	1.1	8,161	3,351	4,810
IL0021121	City of Crest Hill West STP	1.3	9,453	3,960	5,493
IL0045381	Camelot Utilities Inc STP	0.1	874	305	569
				Total Estimated Reduction with Treatment	104,979

4.3 Estimated Costs of Best Management Practices to Achieve Load Reduction Goals

4.3.1 Cost Estimate Methodology

Tables 4-5, 4-6, and 4-7 portray the pollutant load reductions and approximate BMP costs to achieve the reductions for the Lower DuPage River watershed. The reductions were calculated by applying the urban and agricultural BMPs selected by the Steering Committee to the watershed. An average BMP reduction value was derived from the BMPs for each pollutant parameter. Cost estimates of BMPs needed to be implemented within each of the critical areas in order to accomplish the five, ten, and twenty year goals were determined using the lowest cost BMPs for each land cover; $400/acre for urban and $15/acre for cropland and then averaging these values relative to the proportion of each land use within the watershed. Based on this analysis, the average cost per acre for BMP implementation was determined to be approximately $275. The costs and reductions were also calculated assuming that the applied BMPs benefit an upland drainage area. Cost estimates are generalized for watershed-scale planning purposes and these estimates should not be used to estimate costs for individual projects, as costs will range significantly.

The estimates also do not account for load reductions from Education and Outreach and Policy/Regulation BMPs since direct impacts are not easily determined. Therefore these costs could vary significantly if extensive education and policy changes are implemented.

To determine the total cost required to meet the interim goals, the lowest efficiency BMP should be used. For example, the average BMP efficiency for Chloride is 30% and the total cost to meet the 5 year target would be approximately $2,611,125. It can be assumed that the BMPs used to meet the chloride target will also reduce the loading of the other parameters and therefore the total cost to meet this target would be $2,611,125. Also, the costs provided below are cumulative between the goals. For example, the total cost to remove chloride to meet the 10 year target would be approximately $10,445,050. Assuming that the 5 year targets had been met, the additional cost to meet the 10 year target would only be $7,833,925.

There are various grants available to assist in cost sharing for BMP implementation including IEPA's 319 program and the new Green Infrastructure program. Both are cost sharing grants that require local match which can be met either through local contributions, such as a municipality contributing, or through additional grants secured through private foundations or others.

5 Year Target Loading Estimated Costs

Table 4-5: Estimated costs to meet 5 year target load reductions.

Parameter	Total Current Loading	5-Year Target Load Reduction	BMP Average Efficiency	Current Loading (per acre)	Treatment Acres Required	Total Cost ($275/ac)
Chloride (lb/yr)	36,131,709	954,292	30%	335	9,495	$2,611,125
Sediment (ton/yr)	16,430	314	70%	0.15	2,990	$822,250
Nitrogen (lb/yr)	1,550,467	48,691	50%	14.4	6,763	$1,859,825
Phosphorus (lb/yr)	293,032	2,271	55%	2.7	1,529	$420,475
Fecal Coliform (CFU in billions/yr)	394,658	7,304	50%	3.7	3,948	$1,085,700
					Total Cost	$6,799,375

10 Year Target Loading Estimated Costs

Table 4-6: Estimated costs to meet 10 year target load reductions.

Parameter	Total Current Loading	10-Year Target Load Reduction	BMP Average Efficiency	Current Loading (per acre)	Treatment Acres Required	Total Cost ($275/ac)
Chloride (lb/yr)	36,131,709	3,817,168	30%	335	37,982	$10,445,050
Sediment (ton/yr)	16,430	1,254	70%	0.15	11,943	$3,284,325
Nitrogen (lb/yr)	1,550,467	194,766	50%	14.4	27,051	$7,439,025
Phosphorus (lb/yr)	293,032	9,085	55%	2.7	6,118	$1,682,450
Fecal Coliform (CFU in billions/yr)	394,658	29,218	50%	3.7	15,794	$4,343,350
					Total Cost	$27,194,200

20 Year Target Loading Estimated Costs

Table 4-7: Estimated costs to meet 20 year target load reductions.

Parameter	Total Current Loading	20-Year Target Load Reduction	BMP Average Efficiency	Current Loading (per acre)	Treatment Acres Required	Total Cost ($275/ac)
Chloride (lb/yr)	36,131,709	9,542,919	30%	335	94,954	$26,112,350
Sediment (ton/yr)	16,430	3,136	70%	0.15	29,867	$8,213,425
Nitrogen (lb/yr)	1,550,467	486,915	50%	14.4	67,627	$18,597,425
Phosphorus (lb/yr)	293,032	22,713	55%	2.7	15,295	$4,206,125
Fecal Coliform (CFU in billions/yr)	394,658	73,044	50%	3.7	39,483	$10,857,825
					Total Cost	$67,987,150

5. Vision for the Watershed

This chapter presents the "Vision for the Watershed" or what the Coalition envisions the watershed would look like with the implementation of structural, policy, and education and outreach BMPs. In the first section, issues, opportunities and beneficial initiatives that are being undertaken by local stakeholders are presented. Next, a vision for land use in the watershed is presented, with a tiered green infrastructure plan and recommendations from the code and ordinance review are detailed. Then the Vision for Wastewater and Water Quality are presented.

5.1 Issues, Opportunities, and Beneficial Initiatives by Local Government

Staff from The Conservation Foundation and Geosyntec met with most stakeholder groups to find out about what each group is undertaking individually to improve water quality within their area. The areas of each entity within the watershed, types of land use, the state of development, BMPs, erosion, and restoration projects were some of the topics discussed in these meetings. The intent of this section is to highlight positive individual actions so that other stakeholders might be able to "borrow" ideas that have been proven to work in neighboring jurisdictions. Although some of the projects described below might seem small, cumulatively they add up to large change and the small projects allow stakeholders to test the acceptance of residents. Although this section is organized by municipality, each subsection incorporates other stakeholder entities that are most closely tied with that municipality. For example, the subsection on Naperville incorporates the City of Naperville, the Naperville Park District, the Forest Preserve District of DuPage County, and the Naperville Area Homeowners Confederation.

Naperville

The City of Naperville has just under 10,000 acres in the watershed, making up 9% of the watershed. A portion of Naperville is in both DuPage and Will Counties in the watershed and is located within Subwatersheds 1 and 2. Land in these subwatersheds is mostly older residential, both low and medium to high density, with little detention provided. A large portion of Subwatershed 1 is made up of the Springbrook Prairie Forest Preserve (1,867 acres) which is owned and managed by the Forest Preserve District of DuPage County (FPDDC). The FPDDC has undertaken a series of remeandering and bank stabilization projects along Springbrook Creek. Since the subwatershed is mostly built out, they were able to calculate and model the effects of stormwater runoff from the watershed and plan accordingly. Subwatershed 2 is also residential, with more detention provided, but most often in the form of dry or wet bottom basins.

There are many retrofit opportunities within the portions of the City in the watershed. Detention basins could be redesigned to be wetland bottoms, rain gardens installed on individual lots and in pocket parks, and stream bank restoration and naturalization of buffers can be undertaken, especially along the main stem.

The Naperville Area Homeowners Confederation is a coalition of homeowners associations, representing homeowners, condominium and tenant associations within the City. Part of their mission is to share information and resources on how to manage and maintain common areas. They are participating in the Illinois Rain Garden Initiative which is a small grant program that offers funds for entities to build rain gardens on public property. The Confederation would be an excellent way to reach residents and talk about opportunities for detention basin retrofits, ways in which residents individually can improve water quality on their property, and other education and outreach opportunities.

The Naperville Springbrook Water Reclamation Center is the largest wastewater treatment plant in the watershed, discharging approximately 22 million gallons a day into Spring Brook.

Naperville currently participates in the River Sweep, although in the East and West Branches DuPage River.

Bolingbrook

The Village of Bolingbrook, located within Subwatersheds 3 and 5, has the second largest area within the watershed at just under 14,000 acres, making up 12.75% of the watershed. The majority of Lily Cache Creek is within Bolingbrook. The land use is mixed use, with a large portion being older residential subdivisions with some detention, all wet or dry bottomed. There are also large format commercial and industrial uses, along major thoroughfares including Interstate 55 and Weber Road. There are areas served by underground detention without pretreatment. The upper portion of Lily Cache Creek passes through the older portion of town, with little to no detention; sump pumps and downspouts are often tied directly into the storm sewer system, and little buffer space surrounding the creek.

The Lily Cache Creek corridor has various owners, from the Village to individual homeowners whose property abuts the creek. There are also a handful of on-line ponds on this tributary. The watershed would benefit from a single owner that is able to manage and maintain the stream banks and associated buffers, where they exist, as well as either taking the ponds off-line or using native vegetation to improve water quality.

Romeoville

The Village of Romeoville is mostly located within Subwatersheds 5 and 7, with a small portion in Subwatershed 3. Land in the watershed within the village is mostly tributary to Mink Creek, a larger tributary, as well as Lily Cache Creek. It is worth noting that the portion of Lily Cache that is tributary to Romeoville is not impaired. Romeoville has over 6,000 acres in the watershed. Land use is a mixture of large format industrial, commercial, and residential. There is a wetland bank on Mink Creek. There is also Hines Emerald dragonfly habitat located in the Village. This has required coordination with agencies including U.S. Fish and Wildlife when development occurs, resulting in infiltration BMPs being required. Detention basins and other stormwater BMPs are maintained by Homeowners Associations, with some exceptions.

Lewis University Airport recently underwent expansion. Additional detention was needed and because of the Federal Aviation Administration and local requirements, detention was provided within the Lockport Township Park District's Hassert Park. The detention basins have infiltration trenches within the bottom.

Plainfield

The Village of Plainfield has the third largest land area within the watershed, covering over 13,000 acres, mostly within Subwatersheds 4 and 6, but also extending into Subwatersheds 2 and 5. Plainfield is centered on the upper and middle portion of the mainstem of the DuPage River. The land use is mixed, including residential, commercial and some industrial, particularly centered on the West Norman Drain. The lower portion of Lily Cache Creek flows through Plainfield with the surrounding land use residential and a variety of ownership of the land surrounding the creek.

Most areas within the Village have stormwater detention, with a move towards naturalized detention in newer developments, both with wet bottom with wetland fringes and wetland bottom detention. However, there are subdivisions with on-line detention such as Century Trace, Crossings at Creek, and Wolf Creek as well as areas with traditional detention, both dry and wet bottomed. Many naturalized detention and floodplain areas are maintained by the Plainfield Township Park District, although there are also cases of homeowner association management. There are issues of flooding because of the existence of former gravel pits and hydric soils as well as the location of development in close proximity to the floodplain. A sewer line crossing the mainstem on its way to the wastewater treatment plant effectively serves as a dam, due to the change in elevation.

Plainfield's "Green Village" initiative encompasses plans and ordinances within the Village and is aimed at enhancing the Village's green network through preserving land and linking these preserved areas. The initiative encourages native landscaping and the Village has developed several documents to assist residents with the installation and maintenance of native plants. The Village allows for conservation design development and outlines Best Management Practices.

In 2007, the Village commissioned a river front master plan with the intent of planning development along the two mile stretch of river front property that runs from Route 59 to Renwick Road. The plan does take into account the environmentally sensitive nature of the area and calls for some restoration, bank stabilization, and additional trail and park space.

Conservation Plainfield is a cooperative entity between various government entities and residents that serves to increase the public's awareness on environmental issues and to offer educational opportunities to children and adults. Through Conservation Plainfield, residents have participated in an annual River Sweep of the DuPage River and tributaries, removing trash and debris from the water and its banks.

The Plainfield Township Park District maintains a variety of natural areas including detention basins, floodplain, and greenways throughout the Village of Plainfield, the northern part of the City of Joliet, and in unincorporated Will County. Their holdings cover approximately 1500 acres, of which 700 acres are maintained in native vegetation. The Park District has mapped some of their properties using a Geographic Information System and uses that to assist in tracking management activities.

Joliet

The City of Joliet has the largest area within the watershed, covering over 16,000 acres, almost 15% of the total watershed. Joliet is mostly in Subwatersheds 8, 10 and 12 with smaller portions extending into Subwatersheds 6 and 9. The mainstem flows through the northern portion of the city and the lower portion of Rock Run Creek flows through the east side. Land use within the City is widely varied, from older residential to new, with commercial and industrial areas located along major roadways. The City is responsible for the grey infrastructure or piping with detention basins, but does not manage vegetation. Joliet has recently undertaken a variety of green initiatives including a rain garden on City owned vacant lots and a rain barrel program where the City offers recycled barrels for citizens to retrofit into rain barrels.

Within the Revised Zoning Ordinance, Joliet has developed watershed protection areas for Aux Sable Creek, Cedar Creek, Sugar Creek, Jackson Creek, and Jackson Branch requiring a Special Use Permit for development within these areas. The permit requires that the applicant not detrimentally affect the watershed protection areas and take into consideration topography, erosion, water quality, and other factors.

Crest Hill

The City of Crest Hill has under 4,000 acres in the watershed located in Subwatersheds 7, 8 and 10. Crest Hill is one of the smaller municipalities within the watershed, which translates into fewer resources available to deal with water quality issues. The land use within the portions of Crest Hill that are within the watershed are diverse and mostly older developments, including residential, commercial and industrial. Sunnyland Drain flows through Subwatershed 8, with large format industrial land use in the headwaters.

There are some subdivisions that have online detention along Mink Creek. Additionally, there are residents throughout Crest Hill that have down spouts and sump pumps directly connected to the storm sewer system. There are also examples of good stormwater BMPs in the Carillon Lakes development and Arbor Glen, with native vegetation in detention basins that are maintained by homeowners associations.

Theodore Marsh is a Forest Preserve District of Will County property on Rock Run within portions of Crest Hill and Joliet. The preserve is surrounded by residential and commercial land use, providing a nearby education opportunity. There is active restoration taking place and controlled burning is being used as a management tool. There are reported problems of localized flooding surrounding the preserve. Additional coordination and education is needed between the managing partners of the preserve and the community and local residents and business owners.

The City is trying to focus on the redevelopment of the Route 30 and Broadway commercial corridor, presenting opportunities for BMP retrofits.

Minooka

The Village of Minooka has less than 2,500 acres in the watershed in the southernmost portion of the watershed in Subwatershed 11. Land use is mostly newer residential with traditional detention basins consisting of wet bottoms with grass side slopes. In general, the Village owns and maintains turf detention basins on behalf of the residents/HOAs. Village employees mow, apply algaecide, and install aerators in the basins. Residents like to use the basins for recreational activities such as fishing. In general, the Village prefers one large detention basin as opposed to several smaller basins. The Village expressed that residents do not like the appearance of native vegetation.

Within River's Edge Landing, a residential subdivision on the west side of the river, the Village owns and maintains a swale that leads from the detention basin to the river, for overland conveyance. The swale has washed out in the past, likely due to a large storm event leading to high amount of runoff entering the pond. Rip rap was placed in the swale to stabilize it, but this is likely to occur time and time again if actions are not take to reduce the amount of runoff and therefore the flashiness of this system.

The Village is incorporating permeable pavement and a rain garden in the new Wapella Street Park. This will be a good way to expose and further examine residents' perceptions of native vegetation, stormwater BMPs, and water quality.

Shorewood

The Village of Shorewood has just over 5,000 acres in the watershed, mostly consisting of newer residential development in the Hammel Creek subwatershed, Subwatershed 9. Older development is located closed to the mainstem of the DuPage, with the development becoming newer as one moves west. Newer developments tend to have detention basins with native vegetation that are managed by homeowners associations. The Village owns and maintains a variety of detention basins as well, mostly in older developments. Detention basins that are Village owned tend to serve dual purposes, functioning as park space when dry and detention basins when wet. Older developments tend to have incorporated little or no park space into subdivisions, so retrofit opportunities will have to take into consideration the residents' use of the open space for recreational purposes. The Village also has purchased a series of floodplain properties along the DuPage River for park space, partly due to flooding in 1996.

The Village commissioned a Riverfront Master Plan which envisions "a collection of venues" along a Riverwalk trail. The plan cautions that many "obstacles" are in place, including floodplain and wetlands. However, the plan does encourage partnerships and creative thinking and recognizes the resources of the DuPage River. This is an excellent opportunity to integrate green infrastructure into the development of this corridor through the incorporation of many BMPs described previously, which can bring additional funding opportunities and create another reason for residents to use this area. There are specific projects detailed in the plan which call for IEPA 319 funding. This is an excellent opportunity for a municipal and Coalition partnership to assist in moving this project forward.

Channahon

The Village of Channahon has approximately 3,700 acres within the watershed, in Subwatersheds 11 and 12. The land use within the portion of the Village within the watershed is mostly residential. Detention within this portion of the watershed tends to be accomplished with large open water ponds with mowed grass on the side slopes. The McKinley Oaks Subdivision has naturalized detention basins that are in need of maintenance.

The Channahon Park District maintains a number of parks along the river including Community Park, Heritage Bluffs Public Golf Course (a certified Audubon Cooperative Sanctuary Awardee), Highlands Overlook, Greenwald Bluffs, DuPage Park, and DuPage River Access (Chanooka Canoe Access, shared with the Village of Minooka).

Unincorporated Will County

The Will County Stormwater Management Committee has developed a list of stream maintenance projects that they plan on completing within the County through partnership with municipalities. A handful of these projects are located within the watershed: Cumberland Pond in Bolingbrook, Lily Cache Creek Bank Stabilization in Bolingbrook, Hammel Creek bank stabilization in Shorewood, and others. A permit from the USACE has been requested for the Hammel Creek Bank Stabilization project. The proposed stabilization method uses a hard armoring product that has voids in which native plant material is proposed. Cooperation between the Coalition and the Stormwater Management Committee could lead to projects with water quality improvements and the ability to tap into other funding sources such as IEPA's 319 and Green Infrastructure grant programs.

Forest Preserve District of Will County

The Forest Preserve District of Will County owns and maintains numerous properties as forest preserves within the watershed. The District is actively engaged in restoring a number of properties through the creation of wetlands and prairies, reforestation, and management activities such as removing invasive species and operating controlled burns. Numerous trails have been created throughout the watershed at the impetus of the District, which also actively participates in the DuPage River Trail Planning Committee along with other watershed stakeholders including Bolingbrook, the Forest Preserve District of DuPage County, Joliet, Naperville, Naperville Park District, Plainfield Township Park District, Shorewood, Channahon, and Channahon Park District. The trail system helps to provide access to the river and recreation opportunities to watershed residents and visitors. The cooperation between entities on the trail project provides the framework for cooperation on other similar projects. The District has shown a willingness to work with neighbors, allowing for green infrastructure to be constructed and maintained on their property where appropriate.

5.2 Vision for Land Use

The land use visions for the plan consists of two components: a green infrastructure plan and policy recommendations from the Code and Ordinance review completed by Cowhey Gudmundson and Leder. In combination, these two components will improve nonpoint source pollution and therefore water quality.

5.2.1 Green Infrastructure Plan

The Coalition examined overall land use in the watershed and has come up with the following recommendations regarding green infrastructure. Green infrastructure is the use and preservation of natural resources and features to assist in filtering out pollutants, prevent flooding, help maintain biodiversity, provide open space, and provide other functions. A tiered system, as shown in Figure 5-1 below, is envisioned with some area being prioritized for protection, others being developed using environmentally sensitive design, and a final classification of retrofits of existing development to improve water quality and implement green infrastructure principles.

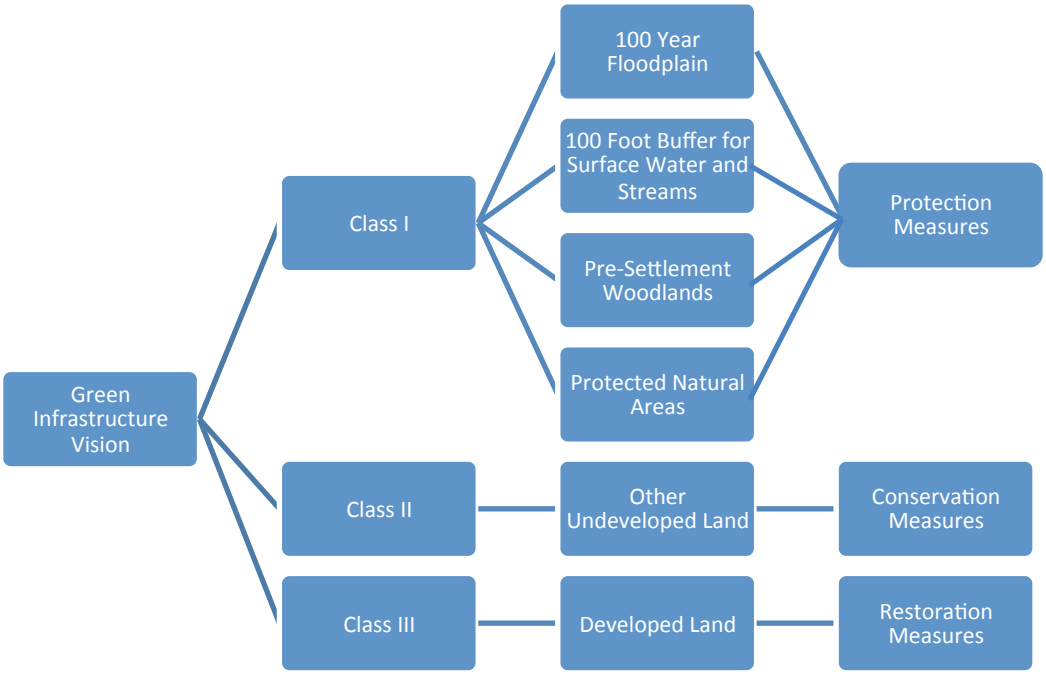
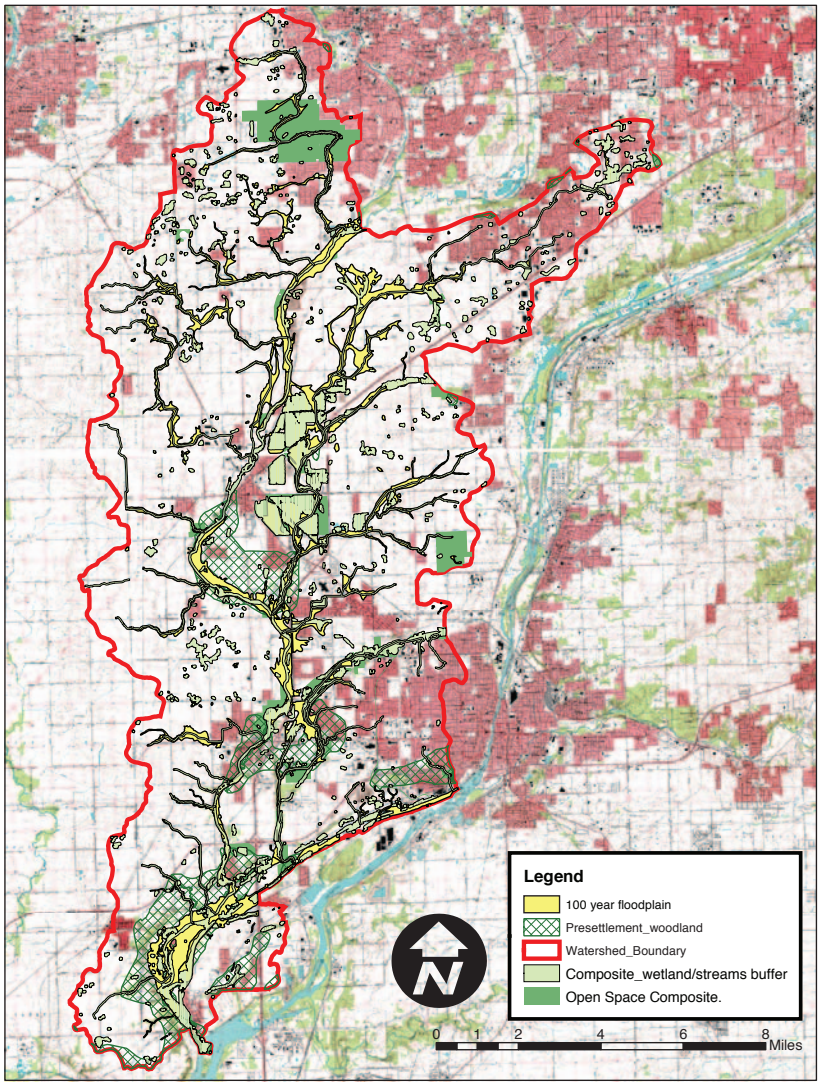


Figure 5-1: Tiered green infrastructure classification for the watershed.

Class I, as shown in Figure 5-2, represents the area that is recommended for protection or restoration to its natural land cover, either by acquisition or easement by a public agency or land conservancy. This class consists of 100 year floodplain, a 100 foot buffer area extending upland from surface waters and streams, pre-settlement woodlands, and existing open space. There is existing development within this area and it will be impossible to prevent all further development. It is strongly recommended that future development within the Class I corridor use conservation design principles and Best Management Practices (BMPs). The existing open space represents private and public holdings including Illinois Natural Area Inventory sites (INAI), Forest Preserve District properties, and others. INAI sites are locations of significant natural resources identified by the IDNR that are either currently protected or qualify for protection. These sites may contain specific habitat for threatened or endangered species, geological features, unusual flora and fauna and high quality streams.[1] Lake Renwick East, Lake Renwick Heron Rookery, Rock Run, Rock Run Botanical Area and Theodore Street Marsh are INAI sites within the watershed. The 100-year floodplain is from digitized Flood Insurance Rate Maps provided by the

[1]Illinois Nature Preserves Commission, 2008.



Federal Emergency Management Agency. Wetlands were taken from the U.S. Fish and Wildlife Service's National Wetland Inventory. The stream network itself is within the 100 foot buffer. The Forest Preserve Districts of Will County and DuPage County both have land holdings within the watershed. The table below summarizes the layers that comprise the Class I map (Figure 5-2).

Figure 5-2: Class I of the Green Infrastructure Vision.

Table 5-1: Summary of land areas in Class I.

Layer	Name	Source Files	Modification	Area (mi2)
1	Watershed			168
2	100 year flood plain		Area Calculation	19.2
3	Composite surface water and streams 100 foot buffer	V3 Companies potential wetland treatment sites on the Illinois River atlas (polygon file) Streams (source)	100 foot buffer applied to all categories and area calculated to include) surface water polygons	19.55
4	Pre-settlement woodland		Extracted area and area calculated	16.6
5	Open space Composite	INAI - polygon CMAP 2005 Land use polygon (Private and public open space) DuPage County Forest Preserve District-Holdings fee simple polygon Will County Forest Preserve District Holdings fee simple polygon	Target area sextracted and joined. Area calculated.	9.7
	Aggregate Total (total all layers 2-5 individually)			65.05
	Corrected Total (composite layer 2-5 actual coverage)			45.2

Lands within Class I are the most important, in terms of water quality, in the watershed and should be protected and managed for conservation purposes. Acquisition would generally be carried out by the Forest Preserve District of Will County or the park districts. In some cases, land may be transferred through developer donations. The Class I corridor shows the area where it is most important to preserve land from the perspective of this plan.

Class II, as shown in Figure 5-3, represents developable land within the watershed. It is recommended that BMPs and conservation design strategies be incorporated when this land is developed. This will help prevent the further degradation of the watershed and may offset some existing problems. Conservation design is also viewed as a hierarchical system, with the preservation of the natural resources of a site being most important, then looking at lot clustering and the reduction of impervious surfaces in order to accomplish the preservation of natural resources.[2]

Class III, the final class and as shown in Figure 5-4, represents developed land where restoration measures may be appropriate. The watershed has many developments that are not that old, but would benefit from BMP retrofits, including buffer and wetland creation and modifying traditional pond detention basins to wetland bottom detention basins.

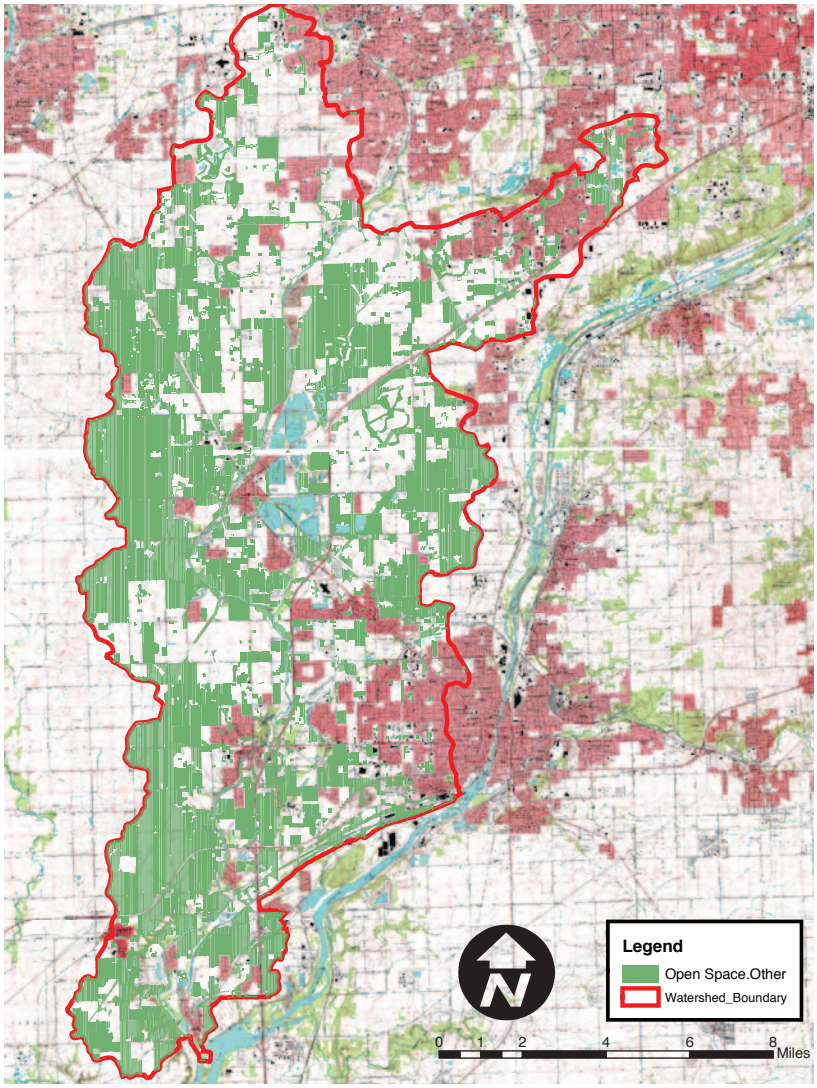


Figure 5-3: Class II of the Green Infrastructure Vision.

[2] *Conservation Design Resource Manual.* http://www.chicagowilderness.org/sustainable/conservationdesign/Manual/Conservation_Design_Resource_Manual.pdf

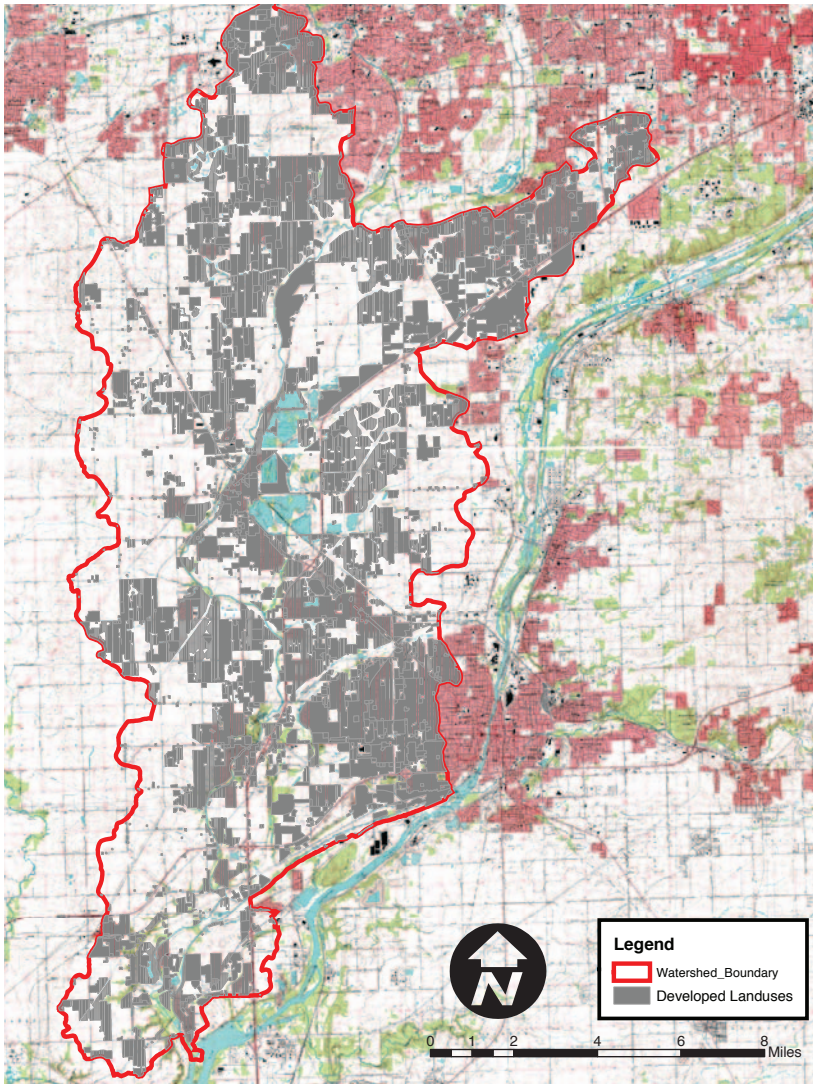


Figure 5-4: Class III of the Green Infrastructure Vision.

5.2.2 Recommendations from Municipal Codes and Ordinances Review

As mentioned in Chapter 2, Cowhey Gudmundson Leder, Ltd. completed a review of the municipal codes and ordinances as they pertain to water quality. The following recommendations come from that report, which is located in Appendix D.

Stormwater Management

All communities should strive to adopt comprehensive standards for the protection of water resources and related aquatic resources. In particular, ordinances should go beyond a core emphasis on stormwater rate and quantity, as required in the countywide *Will County Stormwater Management Ordinance,* to also emphasize holistic protection of water quality, natural hydrology, and aquatic habitat. These items can be addressed through an integrated approach to stormwater drainage and detention, soil erosion and sediment control, floodplain management, and stream and wetland protection.

This can largely be achieved by the adoption of the provisions of the following Northeastern Illinois Planning Commission (NIPC) model ordinances, as some watershed communities have already done. These ordinances can be found on the website CMAP at: http://www.cmap.illinois.gov/wastewater-committee/about-fpa-requests.

Model Stormwater Drainage and Detention Ordinance
Model Soil Erosion and Sediment Control Ordinance, 1991.
Model Floodplain Ordinance for Communities within Northeastern Illinois, 1996.
Model Stream and Wetland Protection Ordinance, 1988.

Communities can also acquire copies of ordinances from their neighboring municipalities. Alternatively, communities may wish to consider the provisions of the countywide stormwater ordinances of DuPage, Kane, Lake, and/or McHenry Counties. All of these countywide ordinances, to varying degrees, incorporate provisions addressing water quality, hydrology, and aquatic habitat. If this latter approach is taken, it may be appropriate to for the Lower DuPage River watershed communities to coordinate with other Will County communities to discuss possible changes and improvement to the countywide *Will County Stormwater Management Ordinance*. As a point of interest, the communities in the Hickory Creek watershed also are engaging in an ongoing watershed planning process and may be supportive of this approach.

Natural Area Protection

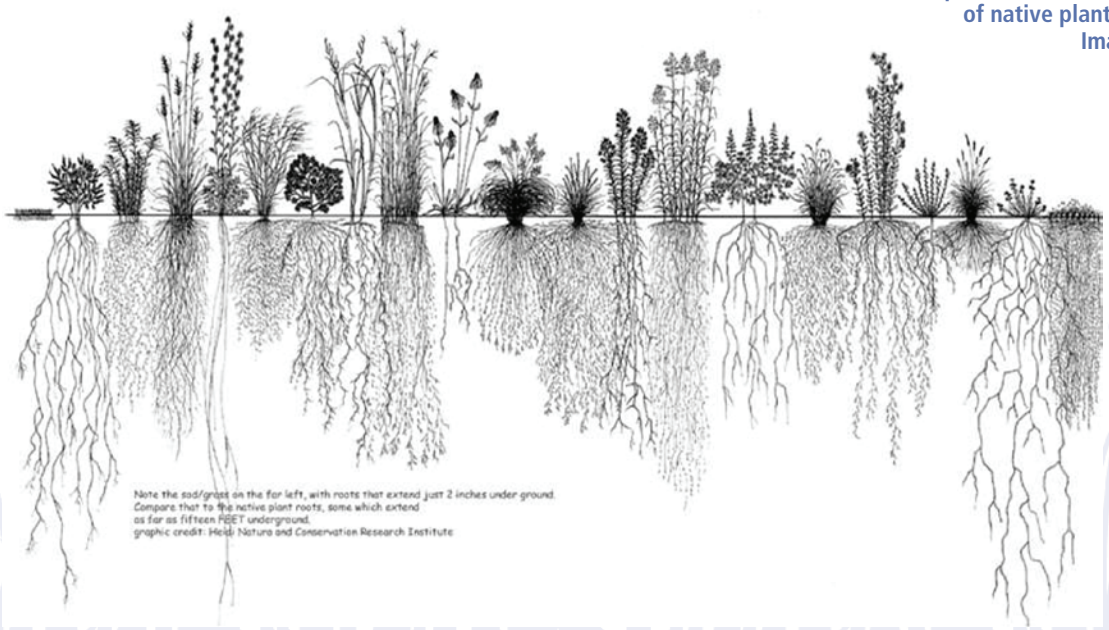
All communities are encouraged to identify and inventory their natural resources and open spaces, including the various features referenced above. This can lead to the mapping of a community-wide (or watershed-wide) "green infrastructure" network that identifies aquatic and upland resources to be protected, along with appropriate buffers. This could be accomplished, for example, via a series of "natural area overlay districts." Identified natural areas could be protected via strict development prohibitions or through flexible zoning that allows for clustering around sensitive natural areas. Specific standards should address natural area identification, allowable uses and cover within the natural area, buffer transitions, and other design elements. These regulatory protections could be supplemented by the acquisition programs of park and forest preserve districts.

In addition, preparation of short- and long-term management plans should be required for designated natural areas. Further, vegetative performance criteria, qualified ownership and management entities, conservation easement provisions, and revenue sources for management activities should be clearly spelled out. Watershed communities should consider the progressive ordinance provisions of neighboring communities, such as Plainfield and Will County. Alternatively, a recently adopted conservation design ordinance in McHenry County is an excellent model to follow. See: http://www.co.mchenry.il.us/departments/planninganddevelopment/Documents/Ordinances/Conservation%20Design%20Addendum.pdf . This subject is further addressed below under Conservation Design Standards.

Landscaping

Landscaping ordinances should encourage the use of deep-rooted natural landscaping, where appropriate, in lieu of conventional, shallow-rooted turf grass landscaping. Figure 5-5 shows the dramatic difference in root depth and breadth of native plants versus turf grass. In particular, it is recommended that natural landscaping be required in detention basins and natural area buffers and encouraged in common areas and open spaces such as in conservation developments. Further, ordinances should include specific provisions for the maintenance of natural landscapes, including performance criteria. As a starting point, communities interested in upgrading their natural landscaping requirements should consider the Will County landscape maintenance provisions. A more detailed reference for natural landscape design and maintenance criteria is *Natural Landscaping for Local Officials: Design and Management Guidelines* (NIPC, 2004), which can be found at http://www.chicagowilderness.org/sustainable/naturallandscaping/installation_maintenance_guide.pdf.

Figure 5-5: Roots diagram showing the depth and breadth of the root system of native plants versus turf grass. Image credit U.S. EPA.



Landscaping ordinances also should encourage and/or require the integration of pervious, landscaped areas with the impervious areas of the site to facilitate the routing of runoff across and through landscaped areas. Language to specifically allow or require integration of bio-infiltration into parking lot islands and street side landscape strips is recommended. Unfortunately, there are relatively few local ordinances that address this topic effectively. A suggested reference for ordinance approaches is the *Conservation Design Resource Manual* (NIPC, 2003), which can be found at:

http://www.chicagowilderness.org/sustainable/conservationdesign/Manual/Conservation_Design_Resource_Manual.pdf .

Tree protection language is recommended to provide protection of desirable (e.g., native) trees and shrubs. Flexibility should be provided to allow removal of trees where appropriate for proper forest/natural area management, along with the inclusion of replacement criteria for the unavoidable removal of desirable species. There are a number of good local tree protection ordinances to model, including those referenced in the full report in Appendix D.

Impervious Area Reduction Recommendations

It is recommended that communities evaluate their ordinances and consider revised design standards for narrower street widths, along with allowances for street designs that utilize naturalized stormwater infiltration and conveyance systems. Also, since stream crossings can cause significant stream impacts, recommended standards related to the number of crossings and the design of crossings should be considered.

Parking standards should be updated to allow for shared parking, parking credit programs (i.e., purchasing credits for public parking in lieu of creating private spaces), and preferred parking for compact cars and non-motorized vehicles. Parking stall dimensions should also be reevaluated, along with consideration of reducing required stall length to account for vehicle overhang onto landscape islands or perimeter landscaping. Specific language to allow permeable paving technology, such as interlocking concrete pavers, porous asphalt, and porous concrete, should be considered for parking lots, driveways, and streets.

With the exceptions noted above, there are relatively few local ordinances that address this topic effectively. A suggested reference for ordinance approaches is the *Conservation Design Resource Manual* (NIPC, 2003), which can be found at:

http://www.chicagowilderness.org/sustainable/conservationdesign/Manual/Conservation_Design_Resource_Manual.pdf .

Conservation Design

Conservation design should be encouraged or required in community zoning and/or subdivision codes, particularly in communities where development is projected in areas that contain significant natural resources. Communities should also consider offering density bonuses to encourage conservation design elements that exceed minimum ordinance requirements.

Communities choosing to embrace conservation design should evaluate existing ordinances, such as the Will County and Plainfield ordinances that allow conservation development by right. Communities should also consider more aggressive approaches that mandate conservation design for some types of development. One suggested approach is the Homer Glen conservation design ordinance that mandates conservation design and common open space for most new residential development. Another approach, embodied in recent ordinances adopted by McHenry County, Woodstock, and Algonquin, mandated conservation design on sites that contain significant natural resources. These ordinances contain a specific trigger mechanism. The McHenry County conservation design ordinance is perhaps the most thorough and can be found at:

http://www.co.mchenry.il.us/departments/planninganddevelopment/Documents/Ordinances/Conservation%20Design%20Addendum.pdf . The previously referenced Conservation Design Resource Manual also should be evaluated for ordinance suggestions.

5.3 Vision for Wastewater Treatment

The Vision for Wastewater includes wastewater assisting in achieving the goals set out by the Coalition in the beginning of the plan, implementing the recommended point source BMPs, state nutrient standards, limiting changes to stream flow, and encouraging water conservation and reuse.

5.3.1 Projected Growth

Using CMAP's 2040 Forecast of Population, the future population in households in municipalities and unincorporated Will County was estimated. The percent increase in population was directly applied to average daily flow for municipalities. The result is shown in the last column in terms of average daily flow for wastewater treatment plants in 2040. There are many caveats with this rough estimate at how much daily average flow of effluent will increase by 2040. Not all of thepopulation of the municipalities listed is within the watershed, nor will all of the growth be within the watershed. Some municipalities, Bolingbrook for example, have multiple facilities. Facilities may treat waste from other jurisdictions. However, the results do show that daily average flow from wastewater treatments is currently just under 31 million gallons a day and is estimated to increase to over 45 million gallons a day by 2040.

Table 5-2: Estimated population growth and resultant proportional increase in daily average flow for wastewater treatment plants.

Municipality	Population in Households in 2010[a]	Population in Households in 2040[c]	% Increase	Average WWTP Daily Discharge 2010 (MGD)	Average WWTP Daily Discharge 2040 (MGD)
Bolingbrook	73,366	116,463	58%	2.80	4.28
Channahon	12,560	26,071	107%	--	--
Crest Hill	20,837	30,537	47%	1.30	2.03
Joliet	147,433	241,219	64%	1.10	1.52
Minooka	10,924	14,790	35%	1.03	1.04
Naperville	141,853	207,611	46%	21	28.35
Plainfield	39,581	82,490	52%	3.60	7.87
Romeoville	39,680	74,068	87%	--	--
Shorewood	15,615	40,266	61%	0.10	0.22
Unincorporated	57,318[b]	98,967	73%	--	--
Total	**559,167**	**932,482**	**67%**	**30.93**	**45.31**

[a] 2010 population data was taken from the 2010 census.

[b] 2010 unincorporated Will County population provided by CMAP.

[c] 2040 population estimates was taken from CMAP estimates and does not necessarily reflect municipal development plans.

5.3.2 Watershed Goals

The wastewater treatment industry is highly regulated and operators take great care in making sure that their facilities meet their permit requirements. Many wastewater treatment operators have assisted throughout the process of creating this plan and were instrumental in setting the goals of the Lower DuPage River watershed. In general, these people and the industry care about water quality and do what they can to prevent degradation. However, more can be done through regulation and education.

5.3.3 Nutrient Standards

The wastewater treatment plants, especially the larger facilities, contribute substantially to the nutrient loading of the river. Point sources currently account for over 70% of the total phosphorus loading and over 60% of the total nitrogen loading as shown by the pollutant load analysis. Treatment practices are anticipated to become more protective with plant expansions in the future. Wastewater treatment plant operators expressed positive anticipation in reaction to state-driven nutrient standards. This will allow for them to plan for nutrient removal because the standards will be set as opposed to the moving target that they are currently experiencing, with the requirements changing between plants and permits. State nutrient standards will also help to justify the costs of expensive additional treatment.

5.3.4 Changes to Stream Flow

Many streams in the area have changed from their historical conditions to effluent dominated streams. In part this is due to land development altering the natural flow of water. Wetlands and headwater areas have been developed, impacting the sources of these streams. Although the Lower DuPage is not a headwater fed stream, it has become effluent dominated over a number of years. It is not practical to revert back to historical conditions, however it is unclear how additional effluent will impact the river. There are several available technologies that could help reduce the amount of effluent, as described below.

Water conservation measures can help reduce wastewater volumes. By having municipalities adopt water use conservation measures, the amount of wastewater that needs to be treated can be reduced. As previously discussed, rain barrels, rain gardens and native vegetation can all help conserve potable water. Inside buildings, high efficiency fixtures including toilets, showerheads and faucets prevent unnecessary water from being flushed down the pipes. Some municipalities already promote water conservation measures or have undertaken them on their own. For example, the City of Naperville has lined many of their sewer pipes to prevent infiltration and treat only waste water at the plant. This has been a very effective solution to reduce their influent. CMAP's Go to Water 2050 plan has additional recommendations, including the promotion of the WaterSense label program, a U.S. EPA sponsored partnership program that promotes water efficiency in part by promoting high efficiency products.

If stream flow is predicted to increase due to additional effluent discharge, an option that is currently not being used in the watershed but has been used in neighboring watersheds is land application. This practice is often put in place through the permit renewal system.

It is also recommended that ground water dependent communities adopt a voluntary wellhead protection plan, allowing communities to get in front of potential contaminants. Infiltration BMPs are recommended throughout this plan. A wellhead protection plan requires forethought and planning which will help ensure that communities have clean drinking water.

5.3.5 Septic Systems

The number and condition of septic systems within the watershed is relatively unknown. Most septic systems seem to be located within unincorporated portions of the watershed. IEPA is in the process of developing a GIS based procedure to help stakeholders map areas served by septic systems. In the future, it is anticipated that these areas will at a minimum be mapped due to NPDES requirements, and may even be connected to sewer systems as municipal boundaries expand.

5.4 Vision for Protection and Restoration of Water Quality

5.4.1 Current Loading

The reductions needed to meet five year goals with all point sources removed are shown in Table 5-3. Limiting point sources to contribute zero loads for the parameters of interest is financially and technically impractical if not impossible. In addition, it is apparent and well known that point sources cannot contribute much to reducing the loading for chloride and sediment. However, nutrient treatment at wastewater treatment facilities would greatly help meet the target loadings for nitrogen and phosphorus.

Table 5-3: Remaining 5 year target load reductions with point sources removed.

Parameter	Total Current Loading	5-Year Target Load (10% of Total Reduction)	Estimated Point Source Loading	Remaining Load to be Reduced by NPS BMPs
Chloride (lb/yr)	36,131,709	35,177,417	479,617	474,675
Sediment (ton/yr)	16,430	16,116	252.6	61.4
Nitrogen (lb/yr)	1,550,467	1,501,776	997,633	--
Phosphorus (lb/yr)	293,032	290,761	208,086	--
Fecal Coliform (CFU in billions/yr)	394,658	387,354	59,324	--

Chapter 6 lays out the BMP implementation plan, including agricultural, urban, policy and education and outreach recommendations. Recommended projects are based on the availability of funding, along with other caveats, such as public and municipal support and feasibility once the project is further developed. Projects were selected partly based on their likelihood of being implemented and their visibility, with the intent that these projects will serve as example projects which will inspire others. Since wastewater treatment plants are regulated by a completely different set of requirements, only recommendations for nonpoint source pollutant reduction implementation projects can be made. The load reductions expected from implementing all of the projects are shown in Table 5-4. Installation of the recommended agricultural and urban BMP projects will not result in meeting the recommended load reductions. In part, this is the reason for policy and education and outreach projects. While BMP implementation projects might fix a problem, the problem needs to be prevented before it occurs. In addition, point sources will need to contribute to load reductions in order for watershed goals to be met.

Table 5-4: Additional load reductions necessary to meet 5 year targets with BMP implementation.

	Chloride (lb/year)	Sediment (ton/yr)	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Fecal Coliform (CFU in billions/yr)
Existing Load	36,131,709	16,430	1,550,467	293,032	394,658
Total Reduction from BMPs	103,224	140.2	2,198	415	3,010
Remaining Load	36,028,485	16,289.8	1,548,269	292,617	391,648
5 Year Target	35,177,417	16,116	1,501,776	290,761	387,354
Remaining Reduction Needed to Meet 5 Year Target	851,068	179.8	46,493	1,856	4,294

5.4.2 Future Loading

In order to limit additional future pollutant loading a variety of approaches are recommended. Future pollutant loading can be accomplished in a variety of ways, but it likely requires a multifaceted approach to be successful. A combination of wastewater treatment nutrient removal and BMPs, required agricultural and urban BMPs, conservation design, and/or a reduction in projected development are all necessary to help to reduce future pollutant loading.

6. Plan for Implementing the Vision

This chapter describes the opportunities for water quality improvements through BMP project implementation including agricultural, urban, policy, and education and outreach projects. It also describes a monitoring plan that is suggested to be used as a way to measure the success of the implementation projects, develop new projects and effectively adaptively manage water quality improvements. Locations, cost estimates, and expected pollutant load reductions are included.

6.1 Best Management Practices Implementation Plan Overview

Hot spots, or areas that were shown to contribute more pollutants than others, were identified from the pollutant load analysis. V3, the consultant hired to do the analysis, then developed a list of 40 potential BMP Implementation Projects to treat those hot spots. The list was presented to stakeholders in order to receive feedback, taking into consideration location, property ownership, development or redevelopment of the property, local history, and other factors. The list was narrowed down to consist of projects that treat the hot spots identified and are likely to be able to be implemented within the next five years. The full list of locations and potential projects identified from the pollutant load analysis is available in Appendix E.

In order to make the list more complete and further reduce pollutant loads, stakeholders were then asked for additional BMP Implementation Projects that do not necessarily treat hot spots identified in the model, but instead are opportunities due to factors such as timing or location of a project. The Blackhawk and Cumberland Pond projects, as well as the Hammel Woods Black Road to Sunset Ridge project were added to the list in this way.

Lastly, additional projects were considered from the field reconnaissance. Although these projects can have significant influence on the quality of the river, most are maintenance projects in nature and involve a single jurisdiction. Stakeholders will be presented a list of these projects that are particular to their jurisdiction with the intent that, now that the problem areas have been brought to their attention, these projects will be integrated into traditional maintenance measures.

The majority of the projects listed are retrofits, intended to address areas of older development with little or no detention and few or no other water quality BMPs. They are focused on urban areas throughout the watershed, although there are some agricultural BMPs listed. The projects are intended to serve as examples within the respective community, subwatershed and watershed as a whole, with the intent that once these types of projects gain more public acceptance and people gain experience funding and implementing them, the process will be easier to repeat.

The Coalition also has determined that policy and education and outreach "BMPs" are necessary to improve water quality in the watershed. Policy and education and outreach may reach a far wider audience and be less expensive than structural BMP projects.

Table 6-1: BMP implementation projects with estimated costs and pollutant load reductions.

Property Location	*Municipality*	*County*	*BMP Type*	*Landowner*	*Nitrogen (lb)*	*Phosphorous (lb)*	*Sediment (tons)*	*Chloride (lb)*	*Fecal coliform (CFU in billions)*	*Project cost*
Southeast of Emerson Lane and Fieldcrest Drive	Naperville	DuPage	Wetland Creation	Ivy Ridge Homeowners Association	390	78	9.2	23,291	755	$463,750
Northeast of Rickert Drive and South River Road	Naperville	DuPage	Wetland Creation	The Fields Community c/o 1st United Property Management	55	9	0.6	3,586	120	$218,750
Southwest of 87th Street and Book Road	Naperville	Will	Wetland Creation	Stillwater Homeowners Association c/o Rowell Inc.	49	8	0.6	3,700	122	$75,800
Southwest of 87th Street and Foxboro Lane	Naperville	Will	Wetland Creation	Stillwater Homeowners Association c/o Rowell Inc.	75	12	0.9	5,929	194	$135,625
Southeast of 95th Street and Naperville./Plainfield Road	Naperville	Will	Streambank Stabilization	Naperville Park District	31	5	0.4	3,314	42	$126,750
th Street and Knoch Knolls Road	Unincorporated	Will	Wetland Creation	Mark R. & Denise L. Burke	69	11	0.9	3,267	66	$157,500
Southeast of Route 53 and Rockhurst Road	Bolingbrook	Will	Streambank Stabilization	Bolingbrook Park District	111	28	16.9	6,528	61	$120,375
Northwest of Heggs Road and West Kelly Court	Unincorporated	Will	WASCB or Grassed Waterway	J. Greene TR 1099397	151	20	19	23	42	$47,875
Southeast of Wooley Road and Stewart Road	Unincorporated	Kendall	Grassed Waterway	J. Greene TR 1105082	214	39	36.8	1,216	71	$286,888
Southwest of 119th Street and Naper Plainfield Road	Plainfield	Will	Wetland Creation	Plainfield CC Schools School District 202	49	10	2.2	2,308	26	$367,500
Northwest of Frontier Land and Mustang Road	Unincorporated	Will	Concrete Ditch Removal and Wetland Creation	Plainfield Township Park District	73	11	0.8	3,532	76	$164,794
Feeney Drive and Lexington Drive	Unincorporated	Will	Wetland bottom detention basin retrofit	Plainfield Township	320	62	8.7	18,351	477	$25,463
Northwest of Feeney Drive and Howard Street	Plainfield	Will	Wetland Creation	Plainfield Property Management LLC	320	62	8.7	18,351	477	$25,463
West of County Line Road and Reflection Drive	Unincorporated	Kendall	WASCB	Schroeder Agricultural Invest	121	29	27.1	17	24	$2,813
Northwest of Green Trails Drive and Phelps Land	Joliet	Will	Wetland Creation	First Midwest Bank TR6697 c/o Vangaurd Community Management	154	28	2.1	12,327	401	$275,625
East of Rushwood Avenue and Greenfield Road	Shorewood	Will	Stream Enhancement and Wetland Creation	Village of Shorewood Countrywest Park	56	10	0.7	4,341	142	$81,250
Southwest of Ravinia Drive and Oxford Land	Shorewood	Will	Wetland Creation	Village of Shorewood dry bottom detention	225	45	12.6	7,051	246	$39,375
Southwest of Seil Road and South River Road	**Shorewood**	**Will**	**Wetland Creation**	**Kipling Estates Homeowners Association Karen's association people concerned about pond**	**55**	**10**	**0.7**	**4,443**	**145**	**$118,125**
Between Cumberland Lane and Canterbury Lane	Bolingbrook	Will	Streambank Stabilization/ Constructed Wetland	Village of Bolingbrook	26	13	12.8	0	0	$200,000
Blackhawk Drive west of Schmidt Road	Bolingbrook	Will	Constructed Wetland	Village of Bolingbrook	12	6	6.0	0	0	$172,000
East of Bronk from Black Road to Sunset Ridge Drive	**Joliet**	**Will**	**Constructed Wetland**	**City of Joliet/FPDWC**	**458**	**89**	**8.7**	**18,060**	**5,725**	**$2,981,000**
25334 W Eames Street	Channahon	Will	Permeable Parking Lot with Depressed Islands	Channahon Park District	2	0	0.1	219	5	$500,000
East of DuPage River, north of US 6, west of Bell	Channahon	Will	Streambank stabilization	Channahon Park District	153	77	76.5	0	0	$28,750
Southeast of I-55, west of Weber Road	Unincorporated	Will	Wetland Bottom Detention Basin Retrofit	Lakewood Falls Homeowners Association	1080	201	16	28656	16414	$172,000
				Total Reduction and Cost	**3013**	**585**	**176**	**139635**	**9212**	**$6,787,471**

Table 6-2: Proposed policy projects.			
Action	*Cost*	*Potential Funding Source*	*Responsible Party*
Monitoring Program	$82,570	IEPA 319, Coalition	Coalition, TCF, subcontractor
Green Infrastructure Map Implementation	Per entity	IEPA 319, Coalition, CMAP, MPC	Municipality
Code and Ordinance Protection Recommendations	Per entity	CMAP, MPC	Municipality
Stream Access Map	$4,000	IEPA 319, Coalition, ESRI	Coalition, TCF, subcontractor
Well Head Protection Plan	Per entity	CMAP, MPC	Municipality

Table 6-3: Education and outreach projects.			
Action	*Cost*	*Potential Funding Source*	*Responsible Party*
Conservation @ Home	$28,000	IEPA 319, Coalition	Coalition, TCF
Mighty Acorns	$28,000	IEPA 319, Coalition	Coalition, TCF
River Sweep	$8,000	IEPA 319, Coalition, Illinois American Water grant	Coalition, TCF
Storm Drain Stenciling	$4,000	IEPA 319, Coalition, Illinois American Water grant	Coalition, TCF
Events	$2,000	IEPA 319, Coalition	Coalition, TCF
Public Service Announcements	$8,000	IEPA 319, Coalition	Coalition, TCF
Chloride Education Program	$10,000	IEPA 319, Coalition	Coalition, TCF

6.2 Proposed Implementation Projects

The proposed implementation projects consist of a number of BMPs, some with multiple BMPs proposed per location. Tables 6-1, 6-2 and 6-3 list the proposed BMPs, the cost, potential sources of funding, and landowners, municipalities and/or responsible party. Two projects, the Hammel Woods Black Road to Sunset Ridge and Project #39, were selected by stakeholders to have conceptual plans drawn up.

6.2.1 Landowner Identification

Landowners were identified through Property Index Number (PIN) maps and conversations with stakeholders. Landowners have been contacted by the municipality, the Coalition, or The Conservation Foundation about the potential project.

6.2.2 Load Reduction Estimates

Nonpoint source pollution reductions were estimated for each proposed project. These estimates were calculated using the previously completed pollutant load model. Drainage areas to each parcel were delineated based on available site topography and field observations. The efficiency of each BMP was based on the review of EPA's Stormwater Menu of BMPs, EPAs National Management Measures to Control Nonpoint Source Pollution from Agriculture, The Nature Conservancy of Illinois, and the Center for Watershed Protection and STEPL. Table 6-1 shows the expected load reduction for each pollutant parameter identified.

6.2.3 Cost Estimates

A preliminary, conceptual engineer's estimated opinion of probable construction cost was developed for each BMP. The detailed cost estimate for each location is included in Appendix E and is summarized in Table 6-1.

The conceptual cost estimate was based on unit costs for typical projects and general site information and should be used for planning purposes only. Actual construction costs may vary significantly due to value engineering or site constraints

not identified during the conceptual level planning. For example, when wetland creation was proposed as a site BMP, it was assumed that the entire parcel would be converted to a wetland and excavation would be required. Variations of this BMP that would impact the cost estimate include pocket wetlands rather than one large wetland or dryer hydrologic wetlands that would not require excavation.

6.2.4 Schedule for Implementation

The following, Table 6-4, is a generalized schedule for implementing the Lower DuPage River Watershed Plan based on the expectation that the plan will be updated starting five years form adoption and provided that funding is available.

Table 6-4: Timeline for plan implementation.

Year	Action	Party
2011	Plan adoption, presentation of municipality specific project list Determine future structure of Coalition Formalize structure and dues of Coalition IEPA 319 application for Monitoring, other Hammel Woods Black Road to Sunset Ridge	Municipal stakeholders Coalition members Coalition members TCF Joliet, FPDWC, and partners
2012	Begin monitoring program Education and Outreach programs Policy changes IEPA 319 and GI applications for BMP projects	Subcontractor TCF Coalition, TCF Coalition
2013	Use monitoring plan to initiate adaptive management and prioritize projects Education and Outreach programs Policy changes Implement BMP projects funded	Coalition, subcontractor, TCF
2014	Implement BMP projects funded	Coalition
2015	Implement BMP projects funded	Coalition
2016	Begin plan update	Coalition/TCF
2017	Monitoring program cycle 2	Subcontractor

6.2.5 Summary of Recommended Implementation Projects

Table 6-5 identifies the number of each structural BMP that the plan recommends. The number was reached by compiling the BMP Implementation Projects (as shown in Table 6-1) and the results from the Geosyntec field assessment. Although a number of projects are identified, the list is by no means complete and it should not be interpreted that these are the only projects within the watershed that will provide water quality improvements. Rather with limited data and resources, this is a summary of what projects could be done over the next five years, when it is recommended that the plan be revised and updated. Associated pollutant load reductions are detailed in Chapter 5 and are shown in Table 6-1. Priority was based on whether concept plans have been developed, as is the case for two types of recommended BMPs, whether the BMP will assist in meeting the TMDLs, or whether the BMP will assist in water quality improvements. Projects should be completed as funds and ability become available, within the next five year period.

Table 6-5: Summary of recommend BMPs.

Recommended BMP	Units Recommended	Unit Size	Total Area/ Length	Cost/Unit	Total Cost	Priority
Wetland Creation	11	5 acres	55 acres	$86,000-172,000	$946,000-1,892,000	Plans developed
Streambank Stabilization	16	100 linear feet	1600 linear feet	$11,500-28,750	$184,000-460,000	Plans developed
Water and Sediment Control Basin	2	5 acres	10 acres	$150,000-172,500	$300,000-345,000	TMDL assistance
Grassed Waterway	23	1 acre	23 acres	$5,250-11,500	$120,750-264,500	TMDL assistance
Wetland Bottom Detention Basin Retrofit	34	Variable	–	$86,000-172,000	$2,924,000-5,848,000	Water quality improvement
Permeable Pavement	1	25,000 ft^2	25,000 ft^2	$200,000-2,625,000	$200,000-2,625,000	Water quality improvement
Buffer Creation	27	5 acres	135 acres	$26,250-52,500	$708,750-1,417,500	Water quality improvement

6.3 Metrics for Evaluation

The U.S. EPA's nine elements and the regional criteria both require metrics for evaluation to be considered as part of the watershed planning process. In this section, interim, measureable milestones are outlined, as well as criteria for determining progress and a monitoring plan. The plan recommends three types of projects: structural BMPs, policy changes, and education and outreach activities. The project implementation is on a five year timeline, as funds are available. The proposed water quality monitoring program should be conducted next year in order to establish a baseline and then at a minimum, every five years thereafter to help determine the extent to which the recommended projects are achieving the goal of water quality improvement. The plan should be evaluated and updated after the five year cycle has been completed.

6.3.1 Monitoring Program

The data available for the Lower DuPage are inadequate except for a preliminary, baseline analysis of the watershed and pollutant loading. In part, this is simply due to a lack of data collection. Data is available through IEPA's Intensive River Basin Surveys, completed in cooperation with IDNR. The data includes water chemistry and fish and macroinvertebrate surveys. Data are also available through the compilation of wastewater treatment plants' Daily Monitoring Reports for NPDES compliance.

However, as previously stated, the Lower DuPage River Watershed is also rather unique in that it has no actual headwaters, since the East and the West Branches DuPage River are considered a separate watershed. It is recommended that the Lower DuPage River Watershed Coalition, in partnership with IEPA, collect additional data to further calibrate the water quality model and to serve as a baseline with which to further monitor the watershed for improvements. Although the pollutant load analysis model was calibrated with actual data, it was not recently collected data from the Lower DuPage. This step should be done as soon as possible to further calibrate the model and enable the Coalition to track water quality targets accurately.

A monitoring plan must be developed and implemented that not only examines the basic chemical and physical parameters in the watershed, but that also looks at the biological and habitat parameters in the watershed, at a more intense spatial scale than conducted by IEPA. A watershed is not healthy unless it is supporting aquatic life, as measured by the Index of Biotic Integrity (IBI). It is likely that this more extensive monitoring program will identify even more impairments; however the problem cannot be solved if it's not understood first.

A volunteer monitoring program, such as RiverWatch, would enhance the efforts of any monitoring program through volunteer stewardship. Area colleges including Joliet Junior College and the University of St. Francis as well as not-for-profit organizations like The Conservation Foundation would be excellent partners. The colleges could integrate this program into their environmental science curriculum. The Conservation Foundation already assists RiverWatch volunteers within the Upper DuPage River Watershed, and would be well-positioned to extend it into the Lower DuPage watershed.

6.3.1.1 Physical, Chemical, Biological Data Collection

A monitoring study should be undertaken to collect data including the following tasks, using a geometric and targeted sample design. The geometric sites would be located by balancing watershed coverage with available funding. Targeted sites would be incorporated into the design to examine the impact of points of particular interest, such as wastewater treatment plants and dams.

- QAPP approval
- Collect fish and macroinvertebrate samples
- Collect habitat data using the Qualitative Habitat Evaluation Index (QHEI)
- Collect field chemistry and physical data including water and sediment chemistry
- GPS and photographic documentation should be taken at each sampling point
- Data management
- Detailed assessment report

The study should be conducted as soon as funding is secured as a baseline of existing conditions, documenting current and past environmental impacts from both point and nonpoint sources. The data will be analyzed in such a way as to guide management decisions for effectively implementing the recommendations found in this report and the forthcoming TMDLs, as well as other possible management goals. The study should then be repeated on a periodic basis thereafter, a minimum interval of every five years, to measure the effect other implementation projects throughout the watershed are having on water quality. The work as outlined above has been completed for the DuPage River Salt Creek Workgroup and a proposal to complete the work within the Lower DuPage was received from the Midwest Biodiversity Institute and Suburban Laboratory Incorporated after a Request For Proposals process.

6.3.1.2 Discharge Monitoring Reports

All wastewater treatment plants within the watershed are required to monitor and report total nitrogen, total phosphorous, and total fecal coliform levels on their discharge monitoring reports (DMRs) as a requirement of the their NPDES permits. These can be used to monitor the point source loadings of pollutants in the watershed. This does not take into account the loading from the non point sources.

6.3.1.3 Fecal Coliform Monitoring

In order to determine the level of contribution of septic systems to fecal coliform levels, IEPA has recently undertaken a study using GIS layers to map septic areas. This first step in looking at fecal coliform levels will help guide further action for fecal coliform monitoring. If the process is determined to be relatively easy and straight forward, the mapping process will be used in other municipalities and unincorporated areas to create maps of areas serviced by septic systems.

Additional monitoring of fecal coliform is also recommended. Collected data could be used to determine the source of fecal coliform and reduce loadings.

6.4 Milestones for Plan Implementation

Milestones for tracking whether plan recommendations are being completed are described in the Implementation Schedule in Section 6.2.4. Target load reductions were discussed in Chapter 5.

6.5 Ensuring Load Reductions Are Being Achieved

Monitoring data will be used to determine whether load reductions are being achieved. The monitoring plan will produce data at a much greater resolution throughout the watershed and, if done on a five year iterative basis, on a more refined temporal scale as well. The data collection effort will enable the Coalition to take an adaptive management approach, targeting projects that will produce the greatest water quality benefit.

Acknowledgements

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The planning process was coordinated by The Conservation Foundation. Contributors to the plan include Andrea Cline, James Adamson and Jessica Spurlock of V3 Companies, Matt Bardol from Geosyntec, and Dennis Dreher of Cowhey Gudmundson Leder, Ltd. The plan would not have been completed without the assistance of many TCF staff members and stakeholders: Brook McDonald, Dan Lobbes, Lori Wolf, Jill Johnson, Stephen McCracken, Tara Neff, and Jennifer Hammer from TCF as well as the staff of Village of Bolingbrook, Village of Channahon, Channahon Park District, City of Joliet, Village of Minooka, City of Naperville, Naperville Park District, Village of Plainfield, Plainfield Township Park District, Village of Romeoville, Village of Shorewood, Forest Preserve District of Will County and a volunteer from the City of Crest Hill as well as a handful of local land owners.

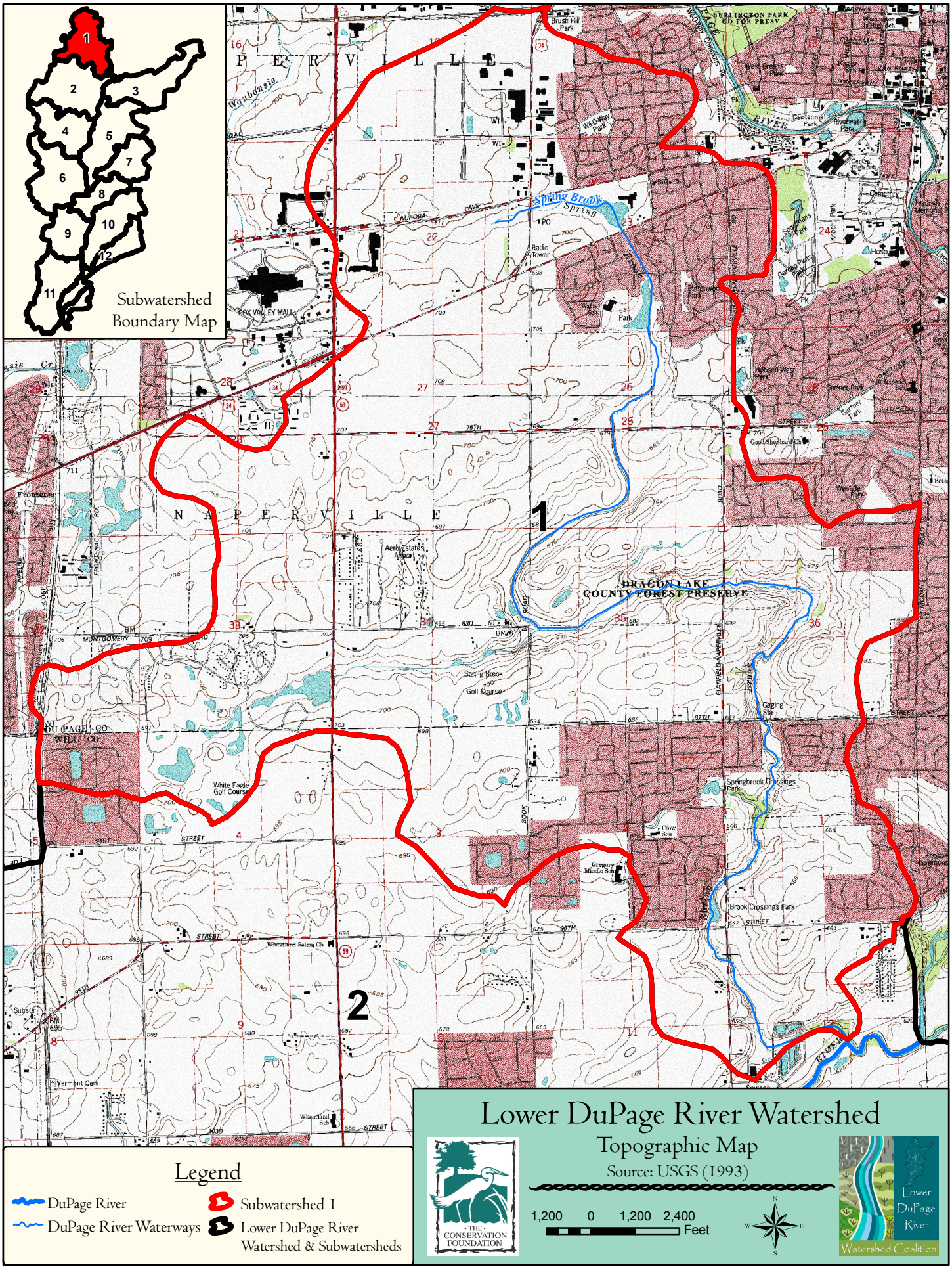
The watershed plan, as well as appendices and further information, can be found at www.dupagerivers.org.

About The Conservation Foundation

Established in 1972 by business and community leaders, The Conservation Foundation is a not-for-profit land and watershed protection organization. Our headquarters are located in Naperville, Illinois, on a 60-acre working farm, and a program office is located in Montgomery, Illinois.

The mission of the Foundation is to preserve open space and natural lands, protect rivers and watersheds, and promote stewardship of our environment. The Foundation maintains a support base of over 5,000 members and donors and 500 volunteers in DuPage, Kane, Kendall and Will Counties, Illinois. Although we work throughout Northeastern Illinois, these are the counties in which we focus our efforts.

APPENDIX A



Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)

1,200 0 1,200 2,400 Feet

N W E S

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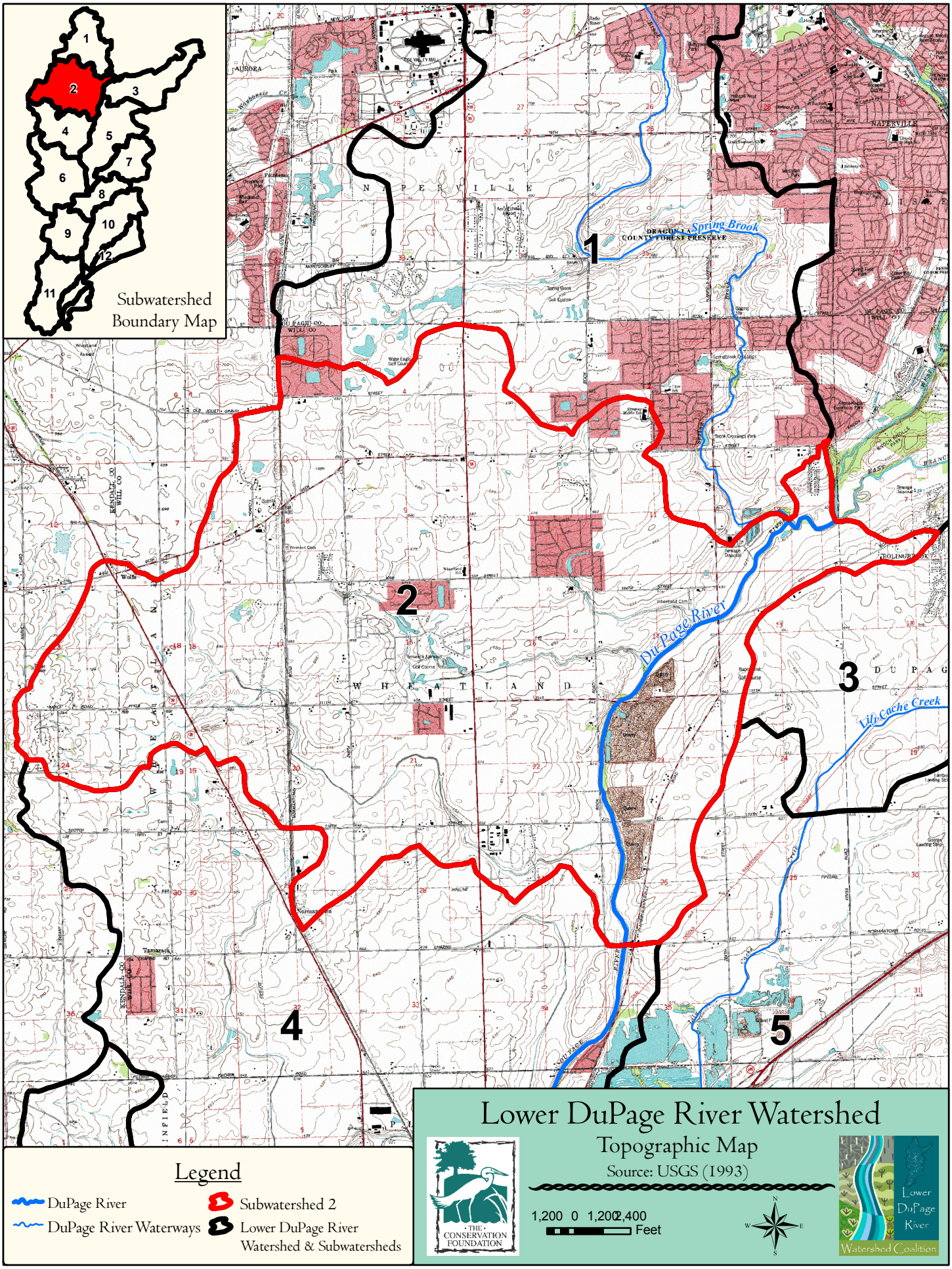
Lower DuPage River Watershed Coalition

Legend

- DuPage River
- DuPage River Waterways
- Subwatershed 1
- Lower DuPage River Watershed & Subwatersheds



Lower DuPage River Watershed

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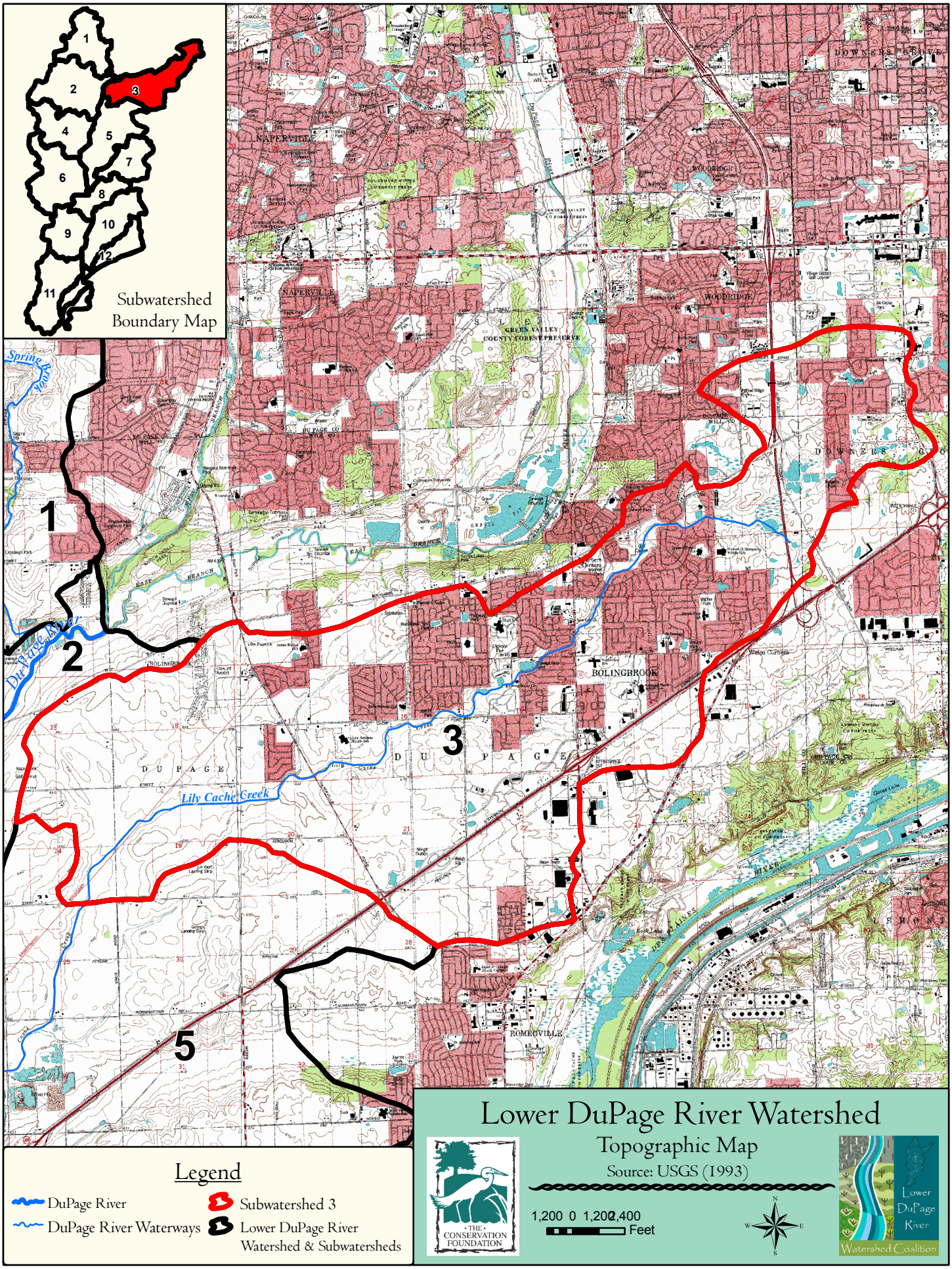
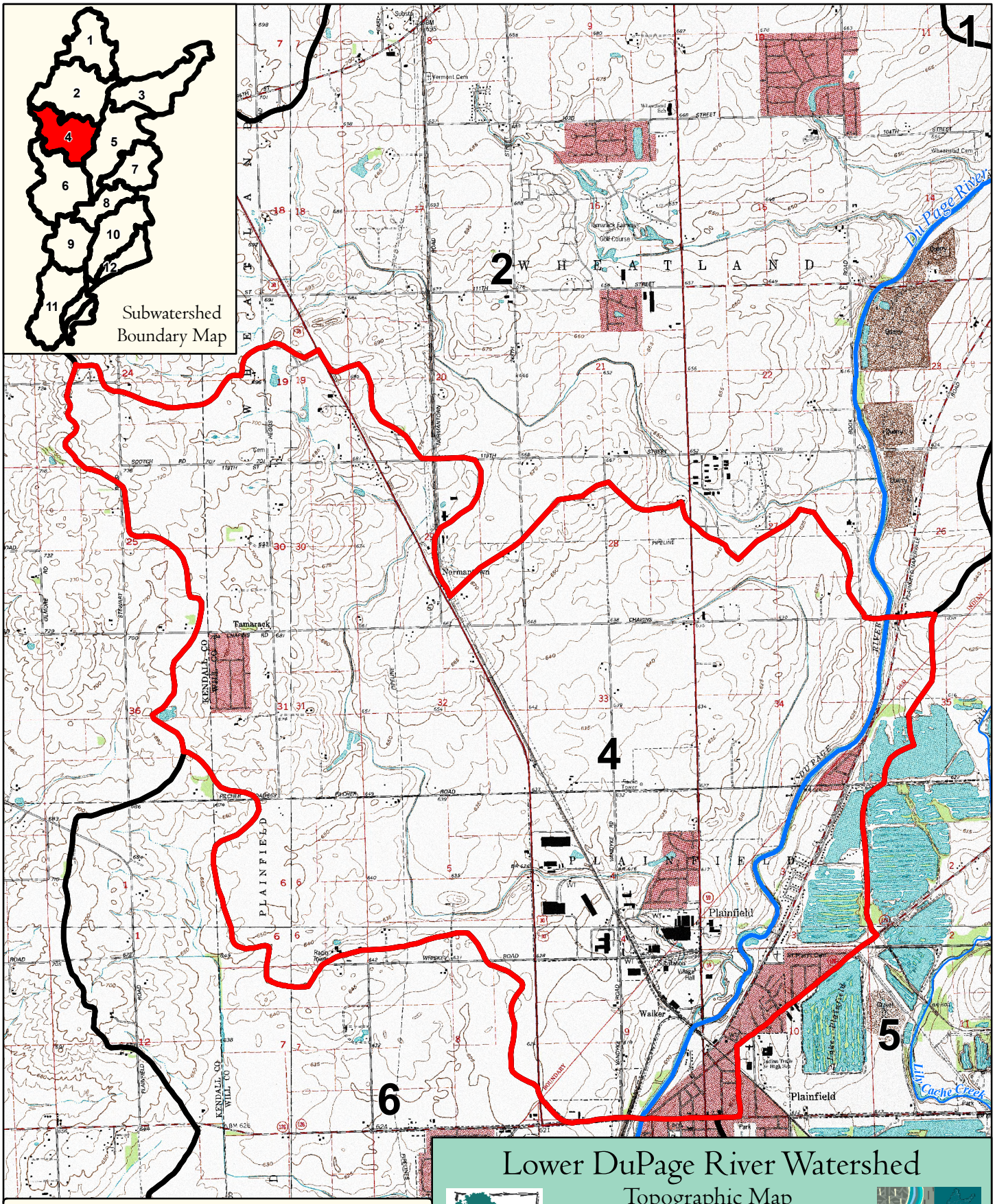


Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)



Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)

1,200 0 1,200 2,400 Feet

Legend

- DuPage River
- DuPage River Waterways
- Subwatershed 4
- Lower DuPage River Watershed & Subwatersheds

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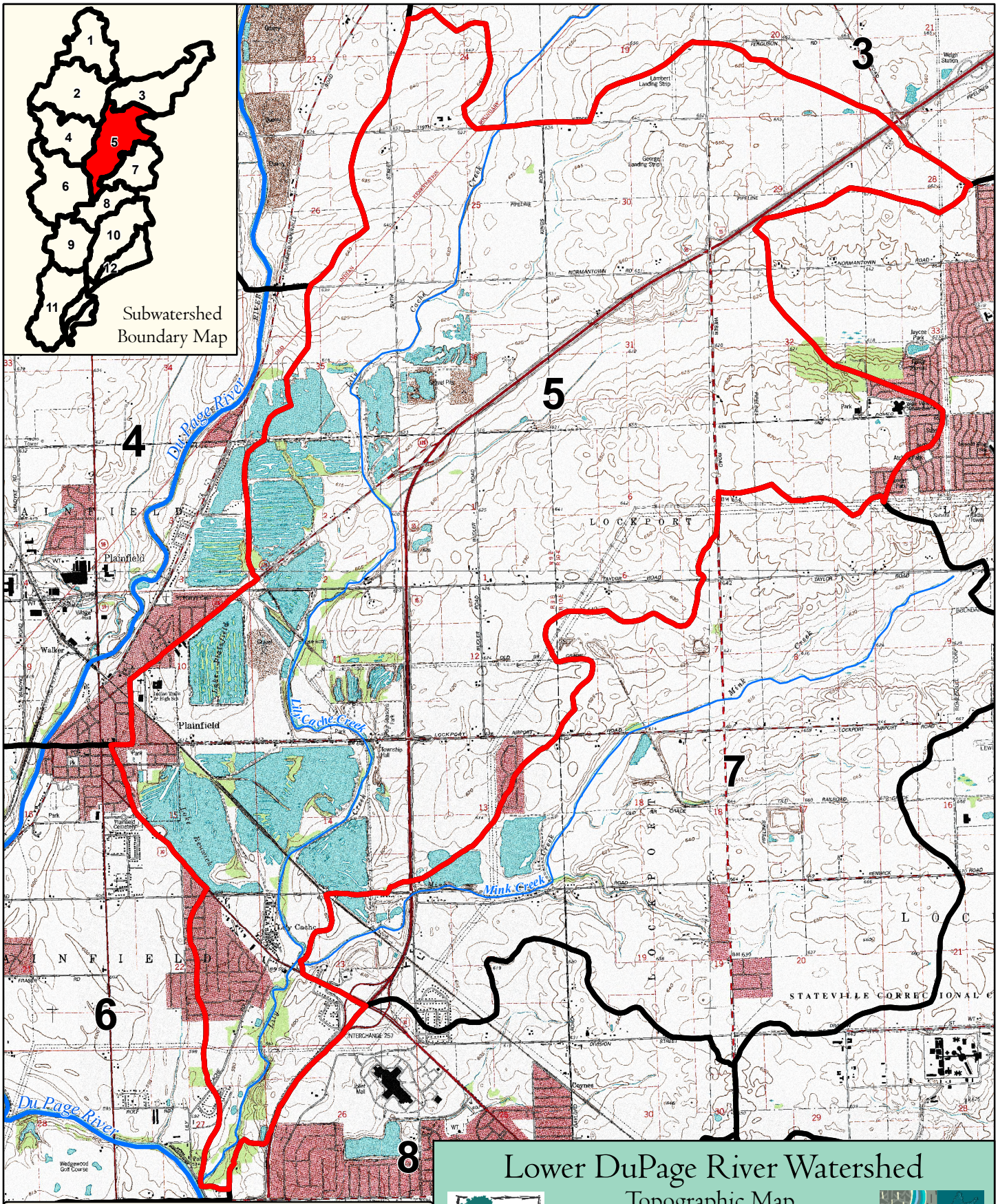

Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)

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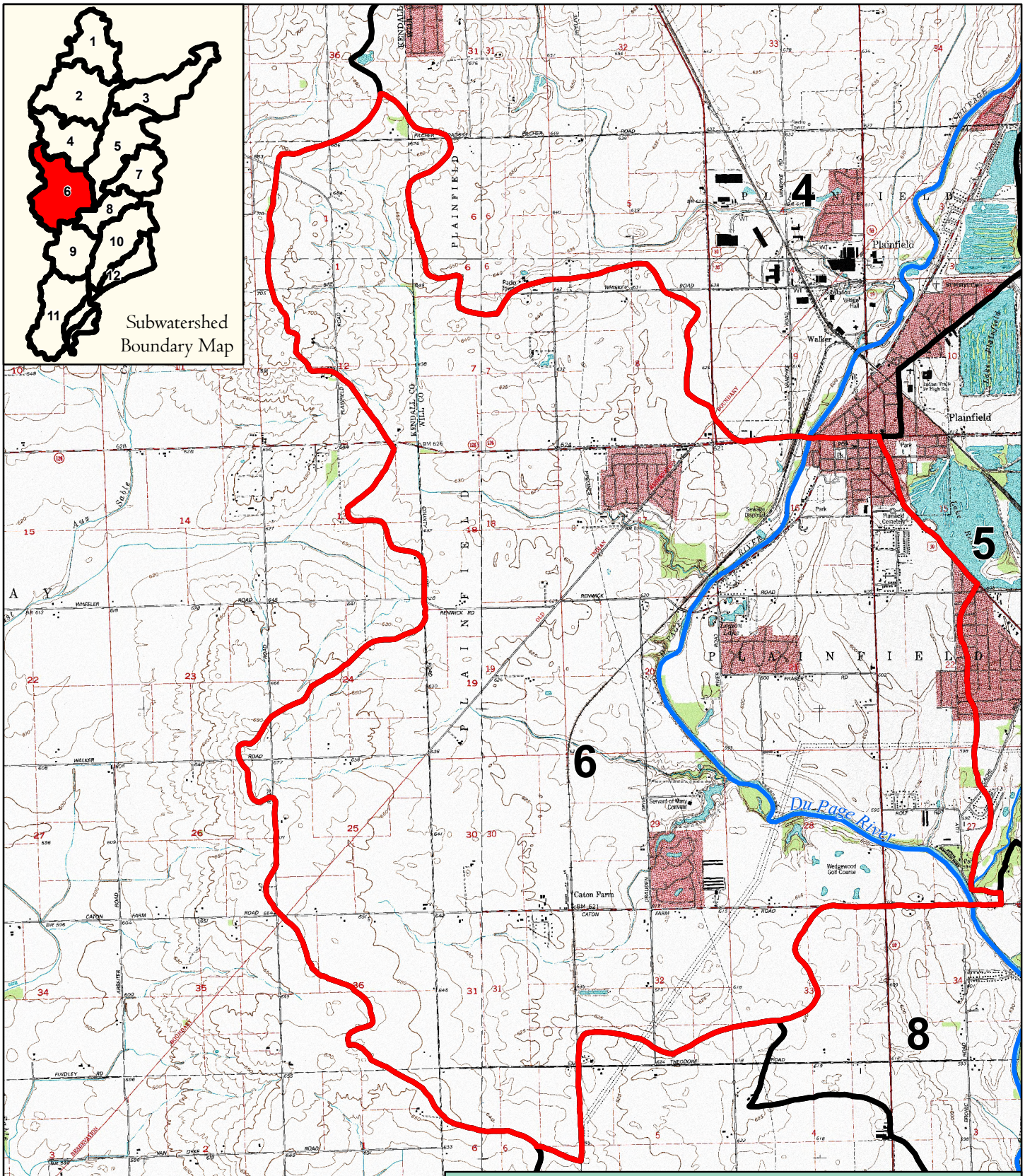
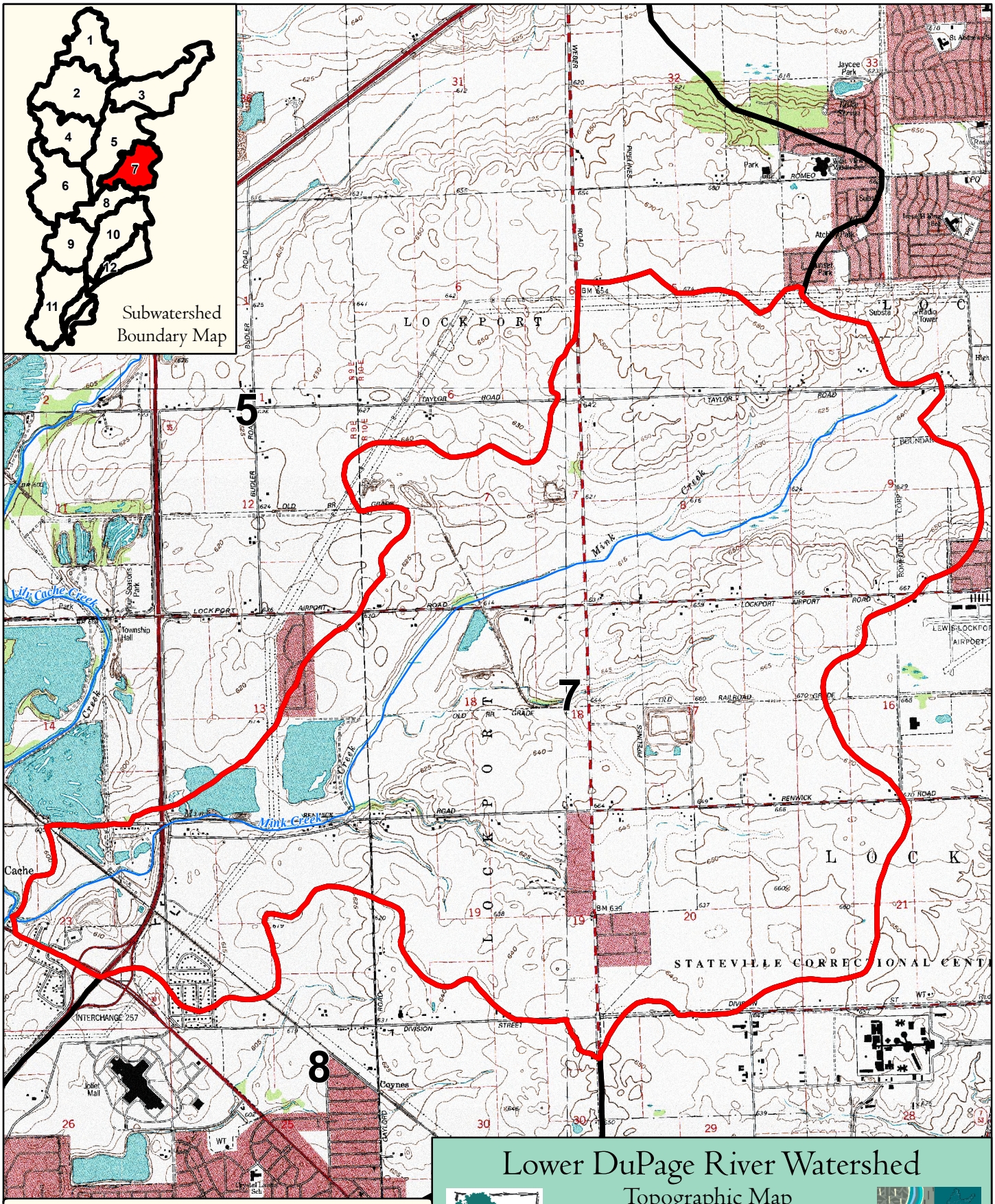
- Subwatershed 5
- Lower DuPage River Watershed & Subwatersheds



Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)



Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)

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Lower DuPage River Watershed Coalition

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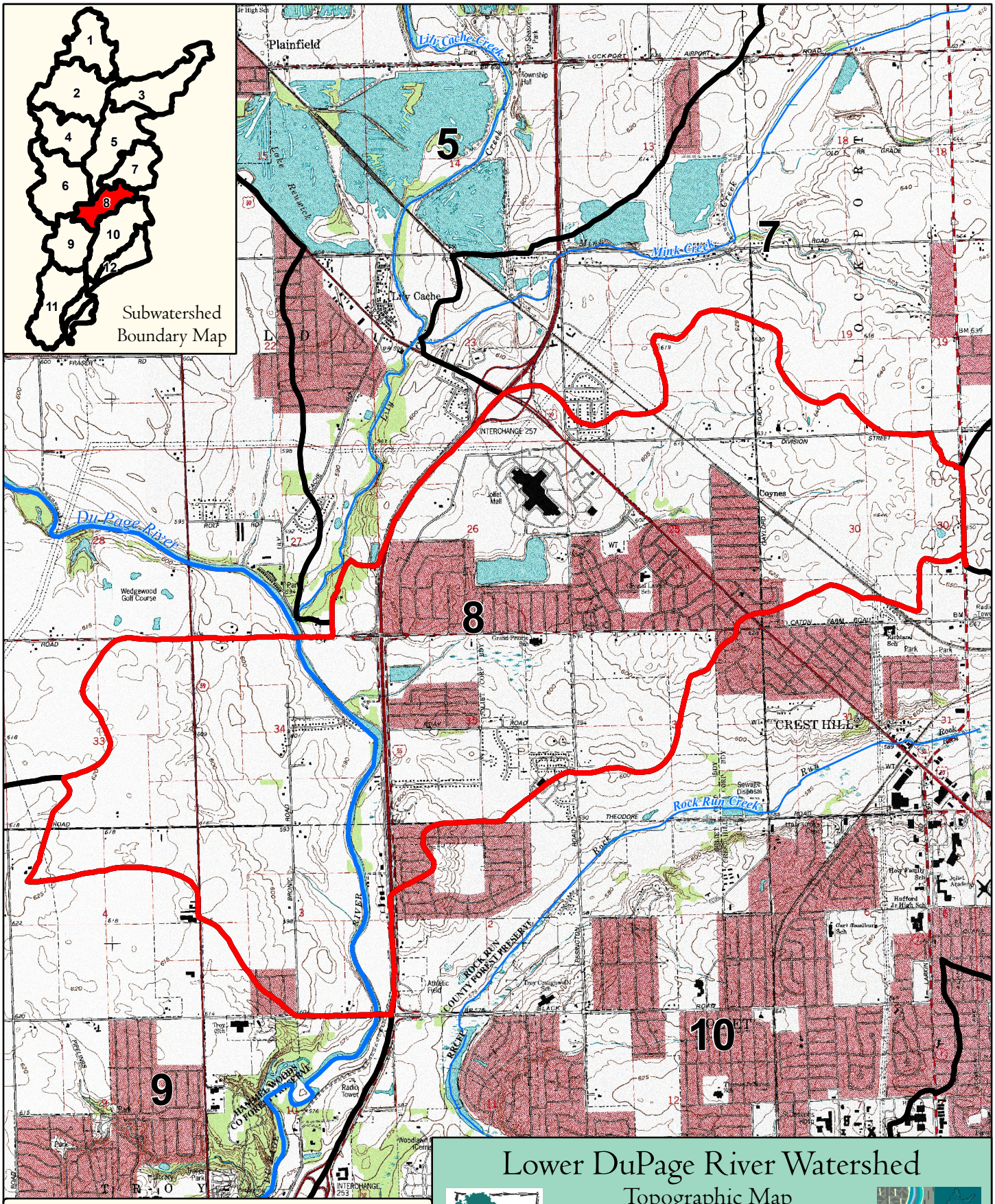
- DuPage River
- DuPage River Waterways
- Subwatershed 7
- Lower DuPage River Watershed & Subwatersheds



Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)

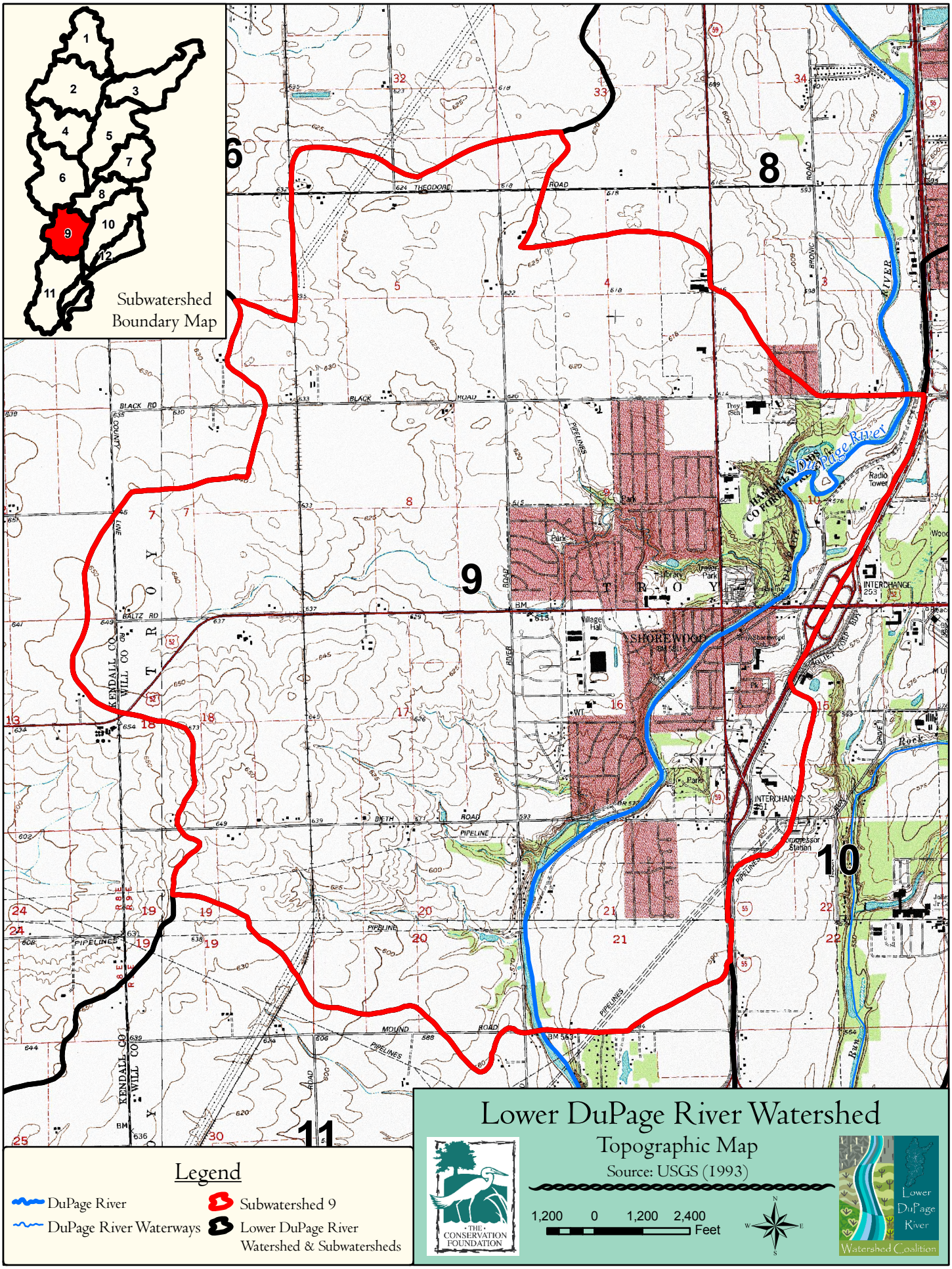
1,200 0 1,200 2,400 Feet

Legend

- DuPage River
- DuPage River Waterways
- Subwatershed 8
- Lower DuPage River Watershed & Subwatersheds

THE CONSERVATION FOUNDATION

Lower DuPage River Watershed Coalition


Subwatershed Boundary Map
1
2
3
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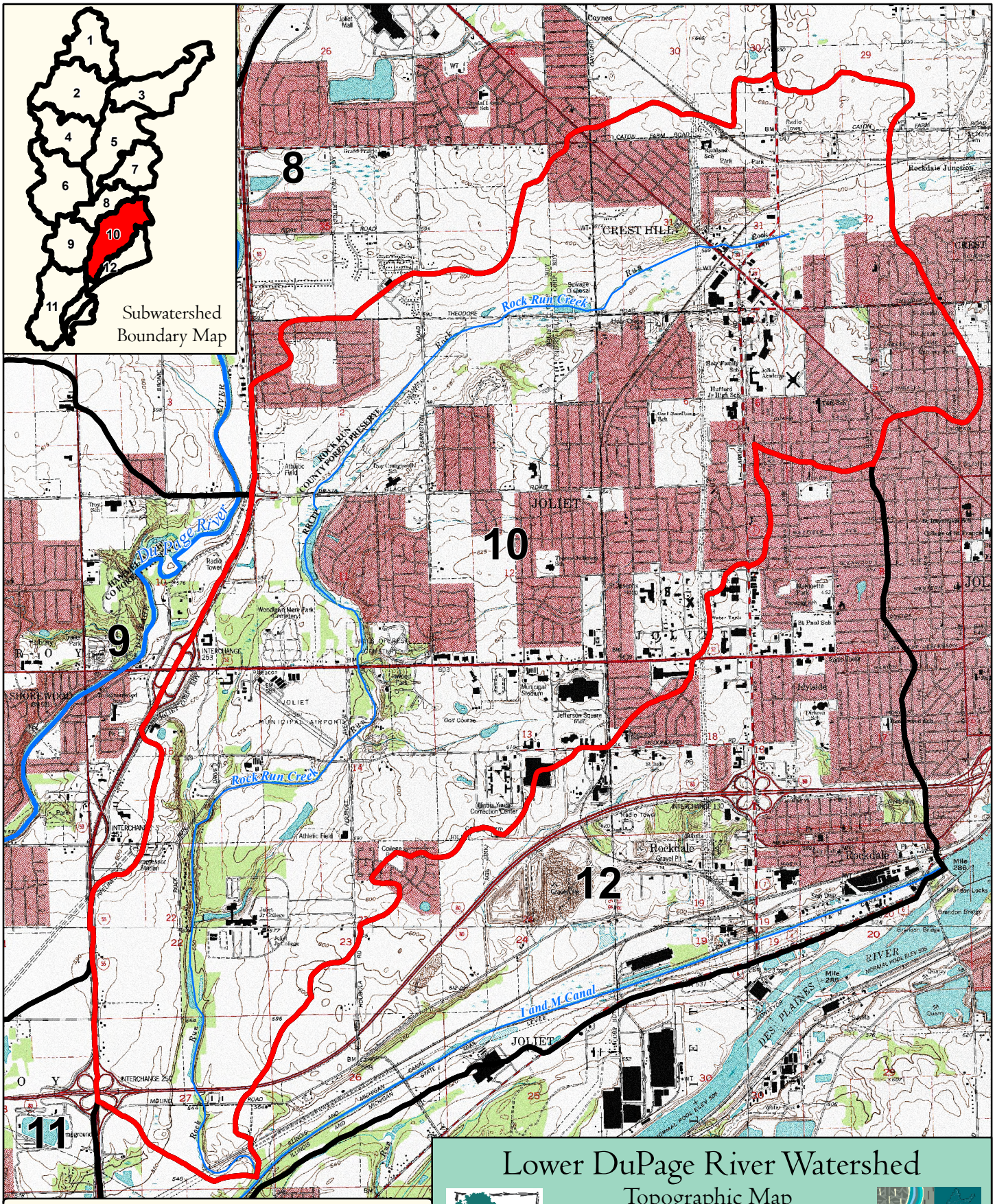
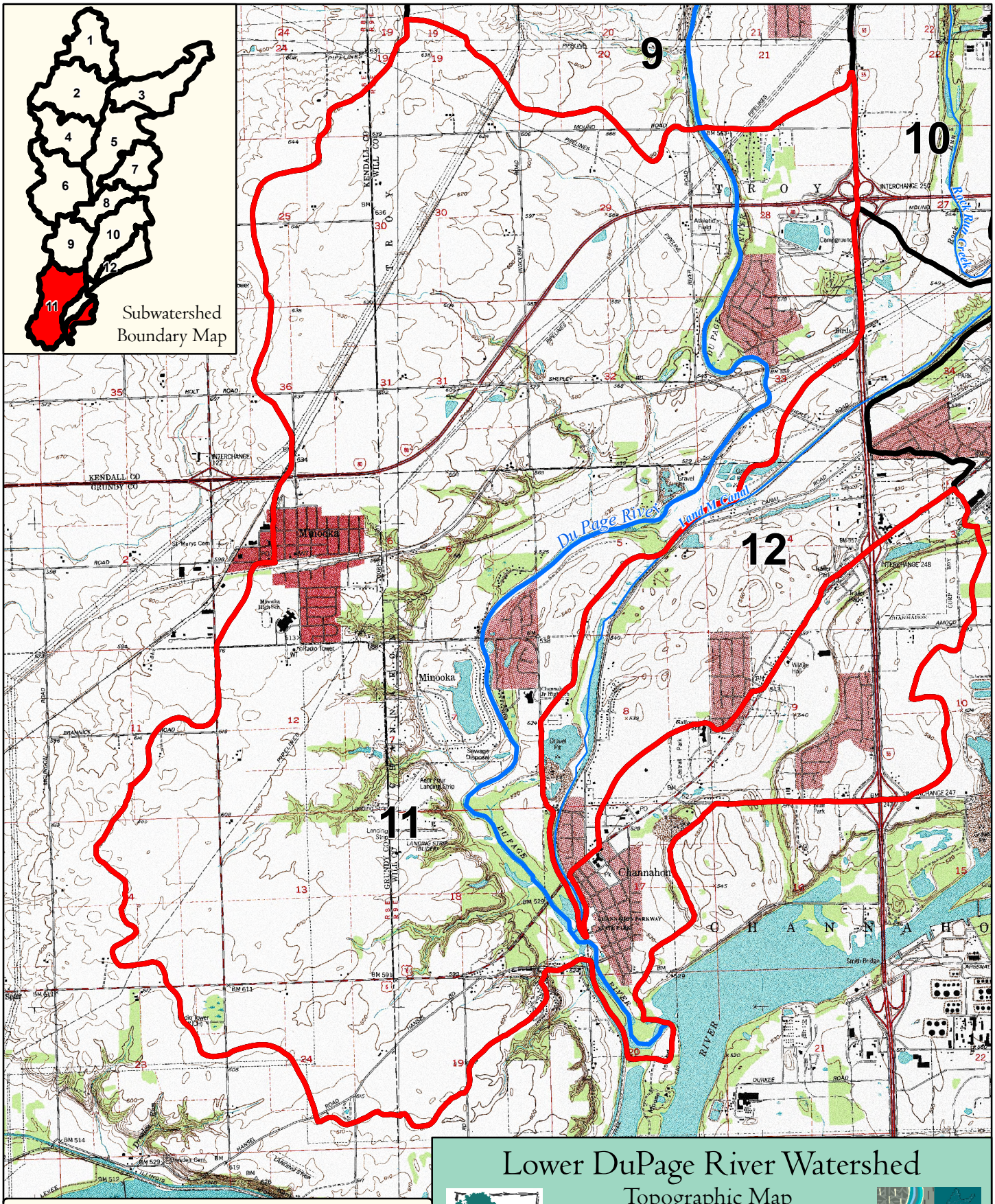
Lower DuPage River Watershed
Topographic Map
Source: USGS (1993)
1,200 0 1,200 2,400 Feet
THE CONSERVATION FOUNDATION
Lower DuPage River Watershed Coalition
Legend
DuPage River
DuPage River Waterways
Subwatershed 9
Lower DuPage River Watershed & Subwatersheds
DuPage River
SHOREWOOD
TROY
KENDALL CO
WILL CO
THEODORE ROAD
BLACK ROAD
BALTZ RD
BETH ROAD
MOUND ROAD
PIPELINE
PIPELINES
INTERCHANGE 253
INTERCHANGE 251
Radio Tower
Village Hall
Park
Compressor Station



Lower DuPage River Watershed

Topographic Map

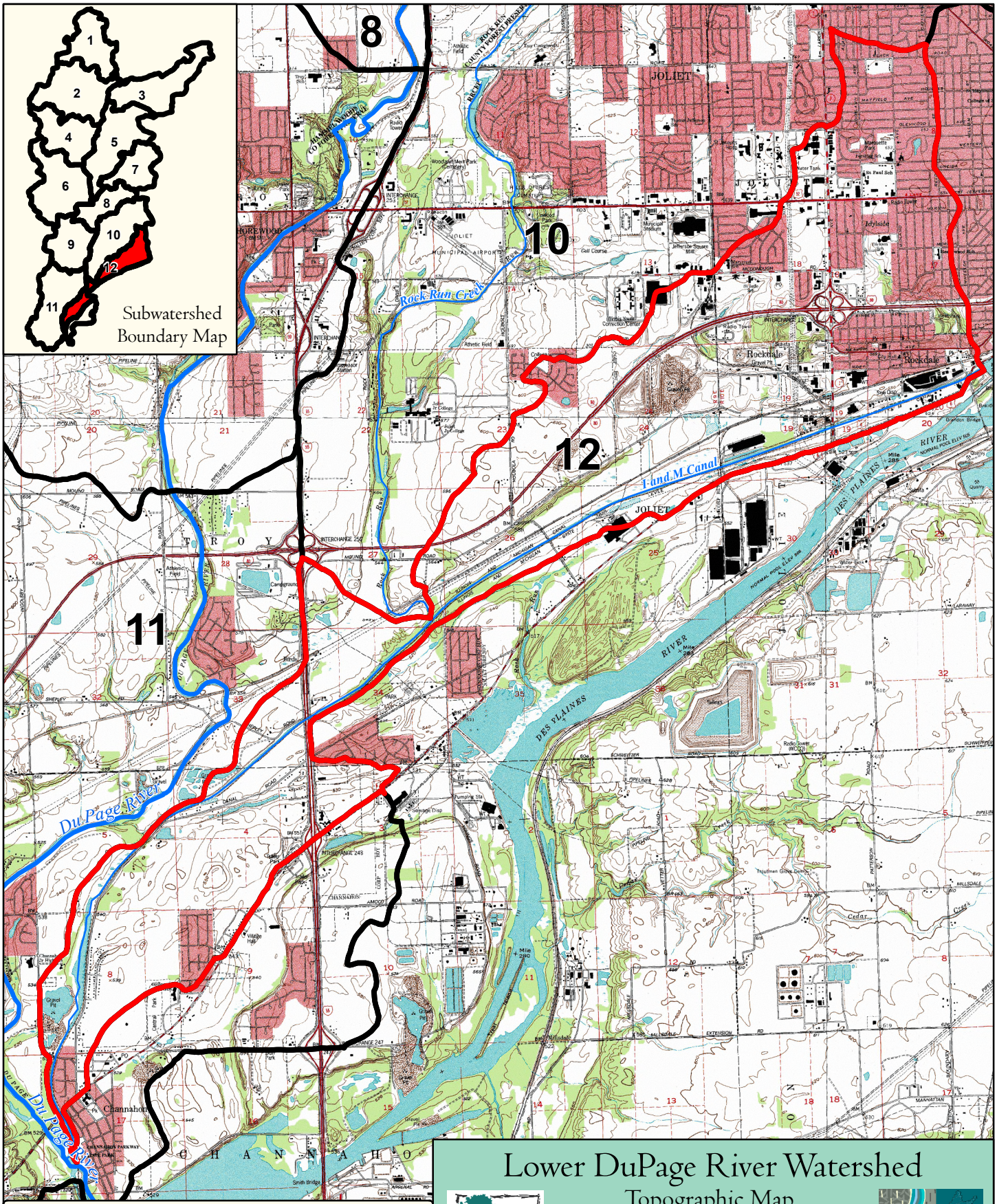
Source: USGS (1993)



Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)



Lower DuPage River Watershed

Topographic Map

Source: USGS (1993)

APPENDIX B

Prepared for

The Conservation Foundation
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Lower DuPage Watershed

Watershed Assessment & Reconnaissance

Prepared by

Geosyntec consultants
engineers | scientists | innovators

Project Number: CWR8255

January 31, 2011

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File of Photographs
GIS Database & Shapefiles
Google Earth point locations of Upper Watershed locations
Google Earth point locations of Instream locations

WATERSHED ASSESSMENT & FIELD RECONNAISSANCE

1. Overview of Watershed Field Reconnaissance and Assessment

The watershed resource inventory (WRI) is a critical step in the development of a watershed plan. An important component of the WRI is field reconnaissance, through which a visual inventory of the watershed characteristics is conducted. The catalogue of observed conditions provides a source of information for the various stakeholders to become more familiar and aware of the watershed resources. These inventories also provide an opportunity to assess the current conditions of the watershed, provide reference information for future comparison, and identify project opportunities.

Traditionally, watershed reconnaissance and assessments have focused primarily on the stream corridor. Visually evaluating the streams, waterways, and riparian areas provide a wealth of information; however, excluding an assessment of upper watershed areas results in an incomplete picture. Runoff from the surrounding tributary areas transports pollutants from the various land uses to stream corridors and water bodies. There is a complex, yet inseparable link between stormwater management in the upland tributary areas of the watershed and the quality of the receiving waters.

Lower DuPage River in Shorewood

Strategic watershed reconnaissance was performed to complement the initial WRI and the BMP implementation strategy for the Lower DuPage River Watershed Plan. The reconnaissance effort included the evaluation of areas that were potential sources of non-point pollution and the identification of potential retrofit opportunities. The field reconnaissance and the assessments were guided by a process to target priority locations, both in the stream and throughout the upper watershed areas. The work conducted under the watershed plan development project was intended to be only the first step in an ongoing evaluation program. The reconnaissance and assessment methodology selected needed to have clear guidance documents to establish a standardized approach for future efforts. For this reason, the field observations were recorded following the Center for Watershed Protection's (CWP) Unified Subwatershed and Site Reconnaissance (USSR) methodology for the upper watershed areas and the Unified Stream Assessment (USA) methodology for stream corridors. The data from these two assessments provided a comprehensive picture of the watershed's possible sources of pollution along with potential curative opportunities. Together, the assessments provide the information to build an understanding of the long-term relationship between the practices within the upper watershed to the conditions observed along the stream corridors. As this relationship is studied along with future

assessments, the watershed coalition can use this information to prioritize BMP Implementation projects.

The watershed reconnaissance effort achieved two goals. First, extensive effort was invested in the collection and assessment of current conditions of the watershed. The approach balanced the assessment of locations that were representative of conditions across the watershed, as well as the identification of unique locations that merited individual attention. Secondly, a standardized procedure for conducting future assessments within the Lower DuPage was established. The reconnaissance performed as part of this initial effort provides a solid framework for the watershed coalition to continue the endeavor to assess and monitor the watershed.

2. Approach Methodology

A systematic approach was employed to efficiently conduct the watershed-wide reconnaissance to assess the threats of the variety of nonpoint pollutant sources throughout the watershed. The approach consisted of four phases to progressively hone down strategically selected targets within the watershed.

The first phase was to solicit information from the stakeholders via a combination of individual interviews and submitted reports. Stakeholder involvement established a bottom up approach to the watershed assessment, fostering a collaborative approach to harness the knowledge of the local stakeholders. The stakeholders included the various municipalities and other governmental agencies such as the Forest Preserve District of Will County, Will County Land Use Department, and local park districts. The stakeholders shared their insight into priority locations and representative areas within their respective jurisdictions. The second phase was to conduct a desktop reconnaissance of the watershed. By capitalizing on the availability of resources such as Google Earth, with recent aerial imagery, an efficient broad evaluation of the watershed was conducted. Through this process, representative locations were identified and evaluated for various land uses. This broad assessment provided insight into common stormwater management techniques used throughout the watershed. The assessed locations also provides the watershed coalition members insight into how current and past ordinances have influenced development and the techniques associated with implementing stormwater management. Many of the current ordinances encourage the use of stormwater best management practices (BMPs), such as the use of filter strips, riparian buffers, and native vegetation around stormwater basins; however, several very recent developments have rock-lined shorelines, mowed turf banks, and directly connected impervious areas (e.g. roof drains and pavement directly connected to storm sewers). The desktop reconnaissance also provided a means to identify specific locations where stream corridors or natural resources have been “boxed” in by development, which is not easily

discernable during ground level reconnaissance. These locations are identified as "Areas of Interest" (Table C2). These locations present unique opportunities for corridor protection or low impact development. The locations identified during the desktop reconnaissance, along with those identified by the stakeholders, were evaluated to determine which merited follow-up field reconnaissance. The

Buffer encroachment identified in desktop reconnaissance
Images courtesy of Microsoft bing maps, acquired on Jan 5, 2011

third phase was conducting field reconnaissance to document and evaluate current field conditions at select locations. This was a critical step to validate conditions as well as to develop potential approaches or techniques to improve water quality. The final phase was to organize the data for inclusion in the Watershed Plan. The field data was organized within a searchable geographical information system (GIS) database. Additional support files were prepared as part of the reconnaissance effort, including a Microsoft Access database of the Stream Assessment, Microsoft Excel table of the upper watershed assessment, and organized file folders of the nearly 1,000 photographs. All of the photographs were geographically referenced with the latitudes and longitudes of the locations at which the photographs were taken. The photographs have been formatted for the option of uploading to a common platform such as Google Picasa web albums for easy viewing by stakeholders. These files are provided within the appendices of this report.

3. Stream Assessment

The approach used for the stream corridor assessment was a modified version of the CWP's USA methodology. The majority of the assessment was conducted by field staff entering the stream corridors at strategic access points (e.g., road crossings); however, a portion of the Lower DuPage River from the confluence of the East and West Branches down to Route 126 in Plainfield was observed during a canoe-based reconnaissance. The focus of the stream corridor assessment was to evaluate problem areas within the Lower DuPage River and its

Canoe Reconnaissance

tributaries. Assessments were categorized into one of eight categories: Channel Modification, Erosion, Impacted Buffer, Outfall, Stream Crossing, Trash and Debris, Utility Impacts, and Miscellaneous. At a few locations, more than one form was used to classify the conditions at that location. No utility impacts were observed. For the majority of the assessments, the form that coincided with the primary condition was used to document the conditions. Annotations were made within the comment field to document other visible conditions.

Bank erosion

Agricultural channel

All observed conditions were cataloged within a detailed Microsoft Access database created by the CWP. The database includes field forms for each of the eight aforementioned categories. Summary tables have been extracted from this data for inclusion into this report; however, the intent is for the database to be a living document that is routinely updated by the watershed group. As part of the management of the field reconnaissance data for the watershed plan, a GIS database was created to link the geographic locations of the assessments with the data contained within the database. This allows the data to be searched both by data entries and spatial information. A total of sixty-seven assessments were completed at sixty locations in the field. Summary tables (Tables A1 through A7) for each category, except the "Utility Impacts" category, are included in Appendix A.

Category	Channel Modification	Erosion	Impacted Buffer	Outfall	Stream Crossing	Trash & Debris	Utility Impacts	Miscellaneous
Occurrences	1	10	9	10	9	9	0	19

4. Stream Habitat Assessment

Lower DuPage River

The Stream Assessment outlined in the previous section, focused on problem area identification to support the implementation and planning of water quality improvement initiatives. The quality of the physical habitat of a stream has a close relationship to the biological community that can be sustained. The structure of the CWP Unified Stream Assessment (USA) methodology does not incorporate this relationship within the evaluation. To complement the information gathered as part of the stream assessments, a limited stream habitat assessment was performed at three locations along the Lower DuPage River. These habitat assessments provide a record of the current condition of ten habitat parameters of the DuPage River at each location. This information can be compared to future data when a thorough, geographically dispersed assessment is conducted of the stream's habitat. These initial assessments offer a snapshot of the stream's condition, drawing attention to the need to incorporated both problem area assessments and habitat evaluations.

The approach used for the stream corridor assessment was the Stream Habitat Assessment Project Procedure developed by the Missouri Department of Natural Resources. The protocol is applicable for community-level surveys of aquatic macroinvertebrates in wadeable streams. This protocol includes the assessment of a very inclusive set of habitat parameters that can be easily transferred to other assessment approaches. This protocol was also used in the extensive habitat assessment for the Hickory Creek watershed plan, which was being developed concurrently. The table below presents a summary of the assessment. Each habitat parameter is assessed a final rating. In order of highest quality to the lowest the ratings are: Optimal, Suboptimal, Marginal, and Poor.

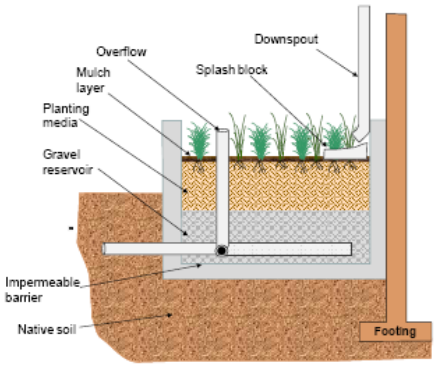
Assessment Location	Epifaunal substrate/ available cover	Embeddedness	Velocity/ depth regime	Sediment deposition	Channel flow status	Channel alteration	Riffle quality	Bank stability (left/right)	Vegetative protection (left/right)	Riparian vegetative zone width (left/right)
03	Suboptimal	Suboptimal	Marginal	Suboptimal	Suboptimal	Optimal	Marginal	Suboptimal	Suboptimal	Marginal
17	Suboptimal	Suboptimal	Marginal	Suboptimal	Suboptimal	Optimal	Marginal	Suboptimal	Suboptimal	Marginal
30	Suboptimal	Suboptimal	Marginal	Suboptimal	Suboptimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Marginal

5. Upper Watershed Assessment

Rock-lined swale in residential complex

The approach used for the upper watershed assessment was a modified version of the CWP's USSR methodology. The USSR manual is intended for conducting a "windshield" survey of the entire watershed by driving every street within the watershed. The resources for this watershed plan did not allow for this level field reconnaissance. However, with the advancement of GIS analysis software tools, availability of high resolution aerials, and the availability of detailed municipal GIS data sets, the need to perform windshield reconnaissance to collect data was minimized. Much of the data, such as percent impervious, location of combined sewers, floodplain encroachment, or location of detention can be easily obtained from available GIS data sets. The methodology was employed to efficiently, yet thoroughly assess the watershed. The focus of the upper watershed assessment was to identify and then evaluate possible locations of nonpoint sources of pollution and potential restoration opportunities. During this effort, Geosyntec staff accessed its extensive knowledge of stormwater BMPs for both new developments and retrofits to evaluate opportunities for water quality improvements within the watershed. Resources such as the BMP international database http://bmpdatabase.org/ features over 400 BMP studies, offers a wealth of information that is maintained under a cooperative agreement between the U.S. Environmental Protection Agency (USEPA) and the American Society of Civil Engineers (ASCE), as well as a broad coalition of partners including the Water Environment Research Foundation (WERF), ASCE Environmental and Water Resource Institute, Federal Highway Administration (FHWA) and the American Public Works Association (APWA). Wright Water Engineers, Inc. and Geosyntec Consultants are the entities maintaining and operating the database, including conducting analysis of newly submitted BMP data.

Roof runoff retrofit opportunity



Planter Box for downspouts

A total of forty-seven locations were assessed throughout the watershed. In addition, eleven locations were identified as areas of interest, primarily as locations that offer unique opportunities for corridor protection or low impact development. Observed conditions were cataloged in a Microsoft Excel table that was customized to meet the needs of the Lower DuPage watershed effort. As with the stream assessment data, a GIS database was created to link the geographic location of the assessment with the collected data. Summary tables are included at the end of this chapter. As with the stream assessment data, the Microsoft Excel table and the GIS database are intended to be living documents. The information should be updated as needed by the watershed coalition. The documents provide a tool to assess the condition of the watershed and prioritize potential restoration opportunities. A "priority" column is included in the summary table for use by the coalition to indicate the relative priority of projects with an "H" for high, "M" for medium, "L" for low, and "NA" for non-applicable for non-project related observations. Based on the initial reconnaissance and assessment, twenty four locations are recommended as a high priority. The database will also be used to evaluate the effectiveness of ordinances on the improvement of water quality from potential nonpoint sources of pollution. Future assessments should evaluate the prominence or the effectiveness of stormwater BMPs in the watershed after target projects or ordinance revisions are implemented. A summary table of structural BMP opportunities is shown below. Full summary tables (Tables C1 and C2) are included in Appendix B.

Swale through urban neighborhood

Upper Watershed Assessment Summary Table of Structural BMP Opportunities

Land Use	Basin Retrofit	Filtration	Conveyance	Infiltration-Bioretention	Rooftop Retrofits	Buffer Establishment
Single Family Residential	12	8	6	7	2	8
Multi Family Residential	6	5	3	2	3	2
Commercial / Institutional	4	7	2	1	3	5
Recreational (Parks, Golf Courses, etc.)	0	1	2	0	0	3

6. Summary of Findings

Overall, the watershed reconnaissance effort revealed ample opportunity for improvements in water quality through the implementation of the stream restoration projects, stormwater BMP retrofits, conservation design, and low impact development. Consistent with current stormwater regulations (e.g. the Will County Stormwater Ordinance), the stormwater management approach observed in much of the developed areas within the watershed appears to focus predominantly on stormwater discharge rate control (i.e. detention) with minimal attention given to water quality treatment. Additionally, several areas exist where neither rate control or water quality treatment measures were observed. These locations appear to have been developed prior to the establishment of the County Wide ordinance. The results of needed improvements in stormwater management and natural resources stewardship were also observed within the stream corridors of the Lower DuPage River and its tributaries. The findings presented in the attachments provide a brief representation of water quality improvement opportunities that exist within the watershed. Stakeholders are encouraged to use the information contained within the list of representative opportunities to evaluate other developed areas and stream segments to identify additional opportunities for water quality improvements and increased stewardship.

Appendix A

Stream Reconnaissance Summary Tables

Table A1
Channel Modification
Summary Table

SiteID	Outfall Tracking ID	Watershed	Date	Name	Survey Reach ID	Time	PhotoID:Camera#	PhotoID:Pic#s	SiteID	Notes
5	4	Lower DuPage	10/21/2010	JV,TA	dupage	2:39 PM	1	12,13,14	005	Resident placed gravel on shoreline,

Table A2
Erosion
Summary Table

SiteID	Outfall Tracking ID	Watershed	Date	Name	OutfallReachID	Time	PhotoID:Camera#	PhotoID:Pic#s	SiteID	Severity	Access	Notes
10	7	Lower DuPage	10/22/2010	JV,TA	hammel	9:14 AM	2	29,30,31	010	4	4	Resident's yard slumping into the creek, good canidate for stabilzation
17	8	Lower DuPage	10/22/2010	JV,TA	dupage	3:00 PM	2	54	017	3	3	River reach under power line corridor
25	9	Lower DuPage	10/23/2010	JV,TA	lilley cache	11:41 AM	3	78	025	3	4	
29	10	Lower DuPage	10/23/2010	JV,TA	lilley cache	1:30 PM	3	88,89,90,91	029	4	4	Good site for bank stabilization
36	11	Lower DuPage	10/20/2010	MRB	dupage		6	170-172	36	1	5	New trail crossing, bridge, was being installed at the time. Silt fence was at top of bank. Footings were installed extremly close to wetland edge. Also refer to point 37
37	12	Lower DuPage	10/20/2010	MRB	dupage		6	166-169	37	2	5	Construction was ongoing, possibley associated with trail. Silt fence was installed too close to river, at top of bank. The silt fence was hanging over top of bank.
39	13	Lower DuPage	10/20/2010	MRB	dupage		6	154-158	39	4	4	Center of bank erosion reach is at the power line corridor. Severe erosion at tower footing
41	14	Lower DuPage	10/20/2010	MRB	dupage		6	138-146	41	4	3	There are several properties that have installed walls or concrete; others have allowed the natural forces of erosion to impact the manicured bank. Native veg. buffer would dramatically improve conditions. From points 42 through 40
42	15	Lower DuPage	10/20/2010	MRB	dupage		6	136-137	42	4	3	There are several properties that have installed walls or concrete; others have allowed the natural forces of erosion to impact the manicured bank. Native veg. buffer would dramatically improve conditions.
58	16	Lower DuPage	10/20/2010	MRB	dupage		6	27-32, 36	58	4	3	A few sections appear to have been stabililized with large, round boulders (not limestone rip-rap). This might have been done by farmers/past land owners with local stone. These sections appear relatively good, Picture #37

SiteID	Outfall Tracking ID	Watershed	Date	Name	OutfallReachID	Time	PhotoID:Camera#	PhotoID:Pic#s	SiteID	Restoration Area Length LT	Restoration Area Length RT	Notes
36	4	Lower DuPage	10/20/2010	MRB	dupage		6	170-172	36	500	500	New trail crossing is being installed on left bank. Footings are very close to river, top of bank.
38	5	Lower DuPage	10/20/2010	MRB	dupage		6	160-163	38	600	800	The right bank restoration would be associated with ER-39
40	6	Lower DuPage	10/20/2010	MRB	dupage		6	143-146	40	650	700	Left bank is private residential, combination of hardscape wall & lack of veg on banks with turf grass above. Right bank is unmanaged area between river and agricultural fields. Section upstream (IB-41) is primarily several homeowners, where this is one
41	7	Lower DuPage	10/20/2010	MRB	dupage		6	136-142	41	1100	1100	This section is upstream of IB-40. Section consists of several residential lots, banks vary from concrete faced wall (not formed) to eroding banks of turf grass. Restoration may receive acceptance with education, current fixes not working well
45	8	Lower DuPage	10/20/2010	MRB	dupage		6	124-128	45	250	300	The primary focus of this location is the concrete revetment wall being built on left (east) bank of residential lot. The wall consists of quick crete concrete bags places haphazard along the bank, which appears to have been disturbed.
46	9	Lower DuPage	10/20/2010	MRB	dupage		6	113-123	46	1600	0	The left bank is impacted, maintained as "manicured" turf grass banks. Majority of lots (approx 13) along S. Rivercrest Dr. are deep lots with room for at least a narrow buffer along the river to stabilize the bank.
48	10	Lower DuPage	10/20/2010	MRB	dupage		6	106-107	48	300	0	The farm lot downstream of W 127 bridge could serve as example for residential lot north of roadway. The buffer is actively mowed to bank, with very narrow (10ft) of buffer. It appears this could be easily increased to 50 ft.
54	11	Lower DuPage	1/5/2011	MRB	no name				54	1400	1400	It is unclear as to the ownership fo the stream buffer, west of Brook Road. It appears that several residents mow & landscape upto stream's top of bank. Others have left a wider stream buffer.
60	12	Lower DuPage	1/5/2011	MRB	no name		7	122-131,137,145-154;	60	3500	3500	The immediate stream buffer is not mowed, does not appear to be activly managed as native habitat. There is an area between homes & buffer that is mowed. Opportunity to restore & manage wider buffer. Area is west of Brook Rd and extends to Rt 59

Table A4
Outfall
Summary Table

SiteID	Outfall Tracking ID	Watershed	Date	Name	OutfallReachID	Time	Photo ID (Camera-Pic#)	#	SiteID	Notes
8	9	Lower DuPage	10/21/2010	JV,TA	dupage	4:00 PM	1	21,22,23,24	008	Potential strom water monitoring location
9	10	Lower DuPafe	10/22/2010	JV,TA	no name	8:50 AM	2	25,26,27	009	Sediment buildup in outfall culvert, retention pond above
10	11	Lower DuPage	10/22/2010	JV,TA	hammel	9:23 AM	2	32	010	
21	12	Lower DuPage	10/23/2010	JV,TA	mink	9:45 AM	3	64,65,66,67	021	Beaver dam upstream from Airport road approx. 100ft, potential for removal.
2	13	Lower DuPage	10/23/2010	JV,TA	lilley cache	12:15 PM	3	79,80,81	02	
31	14	Lower DuPage	10/24/2010	JV,TA	spring	9:50 AM	4	94,95,96	031	
49	15	Lower DuPage	10/20/2010	MRB	dupage		6	95,96	49	
52	16	Lower DuPage	10/20/2010	MRB	dupage		6	85,86	52	Two CMP outfalls, one submerged and one above waterline. CMP bent. Maybe old draintile outfall or outfall to adjacent wetland detention owned by Riverview Farm Forest Preserve.
56	17	Lower DuPage	10/20/2010	MRB	dupage		6	56	56	The outfall should be repaired. The FES protruded out from bank. It should be pulled back and bank should be stabilized.
57	18	Lower DuPage	10/20/2010	MRB	dupage		6	51, 52, 53	57	No problems noted. Form completed to annotate outfall and pictures.

Table A5
Stream Crossing
Summary Table

SiteID	Outfall Tracking ID	Watershed	Date	Name	OutfallReachID	Time	PhotoID:Camera#	PhotoID:Pic#s	SiteID	Notes
1	6	Lower DuPage	10/21/2010	JV, TA	dupage	12:16 PM	1	1,2,3	001	
11	7	Lower DuPage	10/22/2010	JV,Ta	hammel	10:14 AM	2	33,34,35	011	
12	8	Lower DuPage	10/22/2010	JV,TA	rock run	11:30 AM	2	36,37,38,39	012	Snag upstream of the culvert could be removed
16	9	Lower DuPage	10/22/2010	JV,TA	rock run	1:31 PM	2	49,50,51	016	Bridge was fine, no blockage
23	10	Lower DuPage	10/23/2010	JV,TA	lilley cache	10:49 AM	3	70,71,72	023	
26	11	Lower DuPage	10/23/2010	JV,TA	lilley cache	12:15 PM	3	82	026	Move rip-rap to the bank
44	12	Lower DuPage	10/20/2010	MRB	dupage		6	129	44	Bridge is for W 135th St. Free Span bridge with concrete piers. Wood debris was lodged against left (east) pier.
47	13	Lower DuPage	10/20/2010	MRB	dupage		6	102, 104	47	Bridge is for W 127th St. Free Span bridge with concrete piers. Wood debris was lodged against left (east) and center pier.
51	14	Lower DuPage	10/20/2010	MRB	dupage		6	909,91	51	Bridge is for Rodeo Dr. Free Span bridge with concrete piers. Wood debris was lodged against right (west) bank.

Table A6
Trash & Debris
Summary Table

SiteID	Outfall Tracking ID	Watershed	Date	Name	OutfallReachID	Time	PhotoID:Camera#	PhotoID:Pic#s	SiteID	Material:OtherDescription
4	4	Lower DuPage	10/21/2010	JV,TA	dupage	2:09 PM	1	9.10,11	004	Trash: Can and bottles
18	5	Lower DuPage	10/22/2010	JV,TA	lilley cache	4:20 PM	2	55,56,57	018	
19	6	Lower DuPage	10/23/2010	JV,TA	lilley cache	8:30 AM	3	58,59,60	019	
25	7	Lower DuPage	10/23/2010	JV,TA	lilley cache	11:42 AM	3	75,76,77	025	
28	8	Lower DuPage	10/23/2010	JV,TA	lilley cache	1:15 PM	3	85,86,87	028	Log jam
44	10	Lower DuPage	10/20/2010	MRB	dupage		6	129	44	Natural woody debris
47	11	Lower DuPage	10/20/2010	MRB	dupage		6	102, 104	47	Natural woody debris
51	12	Lower DuPage	10/20/2010	MRB	dupage		6	90,91	51	Natural woody debris
55	13	Lower DuPage	10/20/2010	MRB	dupage		6	57,58	55	Woody debris with trash

Table A7
Miscellaneous
Summary Table

SiteID	Outfall Tracking ID	Watershed	Date	Name	OutfallReachID	Time	PhotoID:Camera#	PhotoID:Pic#s	SiteID	Restoration:Other Desc	Describe
2	3	Lower DuPage	10/21/2010	TA,JV	dupage	12:38 PM	1	4,5,6	002	Bank stablization	Not severe, but has potential for improvement
6	4	Lower DuPage	10/21/2010	JV,TA	dupage	3:15 PM	1	15,16,17	006	Stream bank stablization	not severe but could use reinforcing
7	5	Lower DuPage	10/21/2010	JV,TA	dupage	3:40 PM	1	18,19,20	007	Large snag removal	some trash on the bank, possible clear up
13	6	Lower DuPage	10/22/2010	JV,TA	rock run	12:00 PM	2	41,42,43	013		potential to improve storm water channel and surrounding riparian zone
14	7	Lower DuPage	10/22/2010	JV,TA	rock run	12:20 PM	2	44,45,46	014	Snag and trash removal	Very strong canidate for snag and trash removal for improved stream flow and fish movement
15	8	Lower DuPage	10/22/2010	JV,TA	rock run	1:06 PM	2	47,48	015		Site in good condition
20	9	Lower DuPage	10/23/2010	JV,TA	mink	8:40 PM	3	61,62,63	020	Sediment build up	large amount of sediment build up at crossing and in the channel
22	10	Lower DuPage	10/23/2010	JV,TA	lilley cache	10:18 AM	3	68,69	022		stream site in good condition
24	11	Lower DuPage	10/23/2010	JV,TA	lilley cache	11:17 AM	3	73,74	024		man made pond upstream of 127th on a golf course, rip-rap downstream of 127th. Culvert may impead fish movement
27	12	Lower DuPage	10/23/2010	JV,TA	lilley cache	12:47 PM	3	83,84	027		channel dry durig survey, banks appear in good condition, stormwater culvert at Veterns Highway crossing
32	13	Lower DuPage	10/23/2010	JV,TA	spring	10:19 AM	3	97,98	032		stream in good condition
33	14	Lower DuPage	10/24/2010	JV,TA	spring	10:42 AM	4	99,100,101	033		retention pond and under ground culverts, stream not exposed
34	15	Lower DuPage	10/24/2010	JV,TA	spring	10:55 AM	4	102,103	034		retention pond and storm water basin
35	16	Lower DuPage	10/24/2010	JV,TA	no name	11:28 AM	4	104,105	035		Storm water retention pond and underground culverts
40	17	Lower DuPage	10/20/2010	MRB	dupage		6	147-148	40		This section, upstream of the bend has nice riffle. Would benefit from riparian managmeent. The overbanks, especially surrounding the basin could serve as nice habitat if properly established with native veg. & maintained. Associated with IB-40.
43	18	Lower DuPage	10/20/2010	MRB	dupage		6	130-138	43		Pleasant stretch of the river (s. of 135th). Water was fairly clear a the time, long fiberous alge was visible. Banks were dense wit woody growth. River banks would benefit from riparian management of invasive species management.
50	19	Lower DuPage	10/20/2010	MRB	dupage		6	94,97	50	Large Temporary pump and fuel tan	Large pump running with adjacent fuel tank on right bank (west). Pump was running with large (8 inch+) hose from river. Probably was used to flood fields for duck hunting. Fuel tank had no containment. Field was farmed very close to top of bank.
53	20	Lower DuPage	10/20/2010	MRB	dupage		6	69-74	53		Numerous duck blinds are present from S. Naper Plainfield Rd downstream to Hassert Blvd on right (west) bank. Opposite bank is mine.
59	21	Lower Dupage	10/20/2010	MRB	dupage		6	19-24	59		Confluence of East & West Branch, start of Lower DuPage. Form completed to document pictures.

Appendix B

Missouri Habitat Assessment Forms

003

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Riffle/Pool Habitat Assessment Form

Date: 10/21/10	Analyst: SW, JA	Station #: @ Pumpage River Sample #: 003	Location: DEF of

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
A. Epifaunal substrate/ available cover	Greater than 50% mix of cobble, large gravel, submerged logs, undercut banks, or other stable habitat. 20-16 _____	A 50-30.1% mix of cobble, large gravel, or other stable habitat. Habitat adequate for maintenance of populations. 15-11 14	A 30-10.1% mix of cobble, large gravel, or other stable habitat. Habitat less than desirable. Substrate frequently disturbed or removed. 10-6 _____	Less than 10% mix of cobble, large gravel, or other stable habitat. Lack of habitat is obvious. Substrate unstable or lacking. 5-0 _____
B. Embeddedness	Gravel, cobble, or boulders are between 0-25% surrounded by fine sediment or sand. 20-16 _____	Gravel, cobble, or boulders are between 25.1-50% surrounded by fine sediment or sand. 15-11 14	Gravel, cobble, or boulders are between 50.1-75% surrounded by fine sediment or sand. 10-6 _____	Gravel, cobble, or boulders are over 75% surrounded by fine sediment or sand. 5-0 _____
C Velocity/ depth regime	All four velocity/depth regimes present. Slow(< 0.3 m/s) - deep (> 0.5 m) ; slow- shallow (< 0.5 m) ; fast(> 0.3 m/s) - deep ; fast-shallow. 20-16 _____	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than if missing other regimes). 15-11 _____	Only 2 of the 4 regimes present (if fast-shallow or slow-shallow are missing receive lower score). 10-6 10	Dominated by one velocity/depth regime (usually slow-deep). 5-0 _____
D. Sediment deposition	Little or no enlargement of islands or point bar and less than 5% of bottom affected by sediment deposition. 20-16 _____	Some new increase in bar formation, mostly from coarse gravel, sand or fine sediment From 5-30% of bottom affected by sediment deposits. Slight sediment deposition in pools. 15-11 13	Moderate deposition of new gravel, sand, or sediment on old and new bars; pools partially filled with silt. From 30.1-50% of bottom affected. Deposits at obstructions, constrictions, and bends. Moderate deposition of pools prevalent 10-6 _____	Heavy deposits of fine material, increased bar development. More than 50% of the bottom changing frequently. Pools almost absent due to substantial deposition. 5-0 _____
E. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed 20-16 _____	Water fills 99.9-75% of the available channel; or <25% of channel substrate exposed. 15-11 15	Water fills 74.9-25% of the available channel, and/or riffle substrates are mostly exposed 10-6 _____	Very little water in channel (<25%) and mostly present as standing pools 5-0 _____
F. Channel alteration	Channelization or dredging absent or minimal (<5%) stream with normal pattern 20-16 16	Some channelization present (5-39.9%), usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 years) may be present, but recent channelization is not present. 15-11 _____	Channelization may be extensive; embankments or shoring structures present on both banks; and 40- 80% of stream reach channelizes or disrupted. 10-6 _____	Banks shored with gabion or cement; over 80% of the stream reach channelized or disrupted. Instream habitat greatly altered or removed entirely 5-0 _____

G. Riffle Quality	Well developed riffle and run; riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20-16 _____	Riffle is as wide as stream but length is less than two times width; abundance of cobble; gravel common. 15-11 _____	Run area may be lacking; riffle not as wide as stream and its length is less than 2 times the stream width; gravel or bedrock prevalent; some cobble present. 10-6 7	Riffles or runs virtually nonexistent; bedrock prevalent; cobble lacking. 5-0 _____
H. Bank stability - Score each bank	Bank stable; evidence of erosion or bank failure absent or minimal; little potential for future problems; <5% of bank affected.	Moderately stable; infrequent, small areas of erosion, mostly healed over; 5-29.9% of bank in reach has areas of erosion.	Moderate unstable; 30-59.9% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "Raw" areas frequent along straight sections and bends; obvious bank sloughing ; 60- 100% of bank has erosion scars.
Left Bank	10-9 ~~9~~ 31	8-6 8	5-3 _____	2-0 _____
Right Bank	10-9 ~~9~~ 31	8-6 8	5-3 _____	2-0 _____
I. Vegetative protection – Score each bank	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory, or herbaceous growth; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	90-70% of the streambank surface covered by native vegetation; but one class of plants is not well represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	69.9-50% of the streambank surface covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surface covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
Left Bank	10-9 _____	8-6 7	5-3 _____	2-0 _____
Right Bank	10-9 _____	8-6 7	5-3 _____	2-0 _____
J. Riparian vegetative zonewidth - Score each bank	Width of riparian zones > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zones 17.9-12 meters; human activities have impacted zone minimally.	Width of riparian zones 11.9-6 meters; human activities have impacted zone a great deal.	Width of riparian zones <6 meters; little or no riparian vegetation due to human activities.
Left Bank	10-9 _____	8-6 _____	3-5 4	2-0 _____
Right Bank	10-9 _____	8-6 _____	3-5 5	2-0 _____

Total _____

[redacted]

Worksheet for Riffle/Pool or Glide/Pool Habitat Assessment Forms

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Worksheet for Riffle/Pool or Glide/Pool Habitat Assessment Forms

Date: 10/21/10	**Analyst:** JU, TA	**Station #:** Purpage **Sample #:** 003	**Location:** off of Road

A. Epifaunal Substrate\Available Cover

Section	1	2	3	4	5	6	7	8	9	10
%	50	45	50	55	50	40	55	40	50	50

Total _____ (Sections 1-10) x .1 = Total Stream Reach Percentage _____

B. Embeddedness

Cobble	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
% Emb	30	20	40	50	40	50	60	40	75	25	50	50	60	40	40	30
Cat.	II	I	II	II	II	II	III	II	IV	II	II	II	III	II	II	II

Category I = 0-25% Embedded
Category II = 25.1-50% Embedded
Category III = 50.1-75% Embedded
Category IV = > 75% Embedded

Predominant Category II

D. Sediment Deposition

Section	1	2	3	4	5	6	7	8	9	10
%	25	30	25	25	20	25	30	25	30	25

Total _____ Sections (1-10) x .1 = Total Stream Reach Percentage _____

H. Bank Stability

LB Section	1	2	3	4	5	6	7	8	9	10
Category	IV	III	III	III	III	III	III	III	III	III

RB Section	1	2	3	4	5	6	7	8	9	10
Category	IV	III	III	III	III	III	III	III	III	III

Category I = Stable. < 5% bank affected.
Category II = Moderately stable. 5-29.9% of bank reach has erosion.
Category III = Moderately unstable. 30-59.9% of bank reach has erosion.
Category IV = Unstable. Many eroded areas; 60-100% of bank reach has erosion.

LB Predominant Category III
RB Predominant Category III

I. Vegatative Protection

LB Section	1	2	3	4	5	6	7	8	9	10
%	70	80	70	80	70	70	70	70	70	80
RB Section	1	2	3	4	5	6	7	8	9	10
%	70	70	70	80	80	80	80	80	80	80

LB Total _____ Sections (1-10) x 0.1 = LB Stream Reach Percentage _____
RB Total _____ Sections (1-10) x 0.1 = RB Stream Reach Percentage _____

J. Riparian Vegetative Zone Width

LB Section	1	2	3	4	5	6	7	8	9	10
Category	IV	IV	III	III	IV	IV	III	III	III	III
RB Section	1	2	3	4	5	6	7	8	9	10
Category	III	III	III	III	III	III	III	III	III	III

Category I = > 18 meters
Category II = 17.9-12 meters
Category III = 11.9-6 meters
Category IV = < 6 meters

LB Predominant Category III
RB Predominant Category III

Lower bank width measurements are used to figure the 20X width sampling reach and the 10 transect segments for the Riffle/Pool or Glide/Pool worksheet. Five well-spaced measurements are taken within a stream segment.

Transect	1	2	3	4	5
Lower Bank Width	106	90	100	110	106

Average Width = 100
Average width x 20 = 2000 sampling reach length
Average width x 2 = 208 transect segment length

[redacted]

Physical Characterization/Water Quality Data Form

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Physical Characterization / Water Quality Data Form

General Information

Waterbody Name: Du page River
Station #: 003
Investigators: JV, TA
Date: 10/21/10
Time: 13:30
Latitude: 41° 27' 49"
Longitude: 88° 44' 3"
Acc. 4m
GPS Point #221
USGS#:
Reach #:
MDNR Reach #:
Legal Coordinates:

Physical Features

Drainage Area (sq. mi.):
Gradient (ft./mi.):
Velocity (ft./sec.)
Discharge (cu. ft./sec.)

Average Riffle Width (ft.) N/A
Average Run Width (ft.) ~ 166 ft
Average Pool Width (ft.) ~ 35 ft ~ 40 ft

Average Riffle Depth (ft.) N/A
Average Run Width (ft.) ~ 100 ft
Average Pool Depth (ft.) ~ 3 ft

High Water Mark (ft.) ~ 5 ft
Stream Order:

Predominant Land Use: ☑ Forest ☐ Hayfield ☐ Row Crop ☑ Pasture ☐ Animal Confinement
☐ Urban Commercial ☐ Urban Industrial ☑ Suburban Residential ☐ Suburban Commercial
Other:

Human Disturbance: ☐ Access Roads ☑ Footpaths ☐ Trash ☐ Livestock Watering ☐ RV Tracks
☐ Gravel Mining ☐ Camping Sites Other: Docks, houses

Local Watershed Erosion:
☐ None
☒ Moderate
☐ Heavy

Canopy Cover:
☐ Open
☒ Partly Shaded
☐ Shaded

Estimated Water Level:
☐ Low Flow
☒ Within Lower Bank
☐ Over Lower Bank

Stream Bank Vegetation:
☐ Raw ☐ Bare Areas
☒ Grasses and Forbes
☐ Large Trees ☒ Trees and Shrubs

Major Habitats Present: ☒ Flow Coarse Substrate ☐ Non-flow over Deposition ☒ Snags/Woody Debris
☒ Flow Fine Substrate ☒ Leaf Packs ☐ Root Mats

Channel: ☐ Dam Present ☐ Dam Absent ☐ Channelized ☒ Natural

Point Source Pollution: ☐ Discharge ☐ No Discharge Estimated Flow:
Type of Discharge:

Non-point Source Pollution (excluding erosion): ☐ Obvious ☐ Potential ☒ No Observable
Type of NPS Pollution: from residential and Ag.
Source of NPS Pollution: Stormwater

Sediment

Sediment Deposits: ☐ No Deposits ☐ Sewage Sludge ☒ Silt ☒ Sand ☐ Gravel
Other Types of Deposits:
Deposit thickness:
Deposit Area:

Sediment Odors: ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic
Other:

Sediment Odor Severity: ☒ Not Offensive ☐ Moderately Offensive ☐ Grossly Offensive

Substrate

Type	Approximate % of Area	Type	Approximate % of Area
Bedrock	0%	Woody Debris (< 6 inch in diameter and 36 inches long)	~~5%~~ 30 95%
Boulder (>10 inch diameter)	5%		
Cobble (2.5 - 10 inch diameter)	15%	Snags (> 6 inches in diameter and 36 inches in length)	5%
Gravel (0.1 – 2.5 inch diameter)	20%		
Sand (< 0.1 inch diameter, gritty)	50%	Muck (Black with very fine organic Matter)	
Silt	10%		
Compact Clay		Total	100%

Water Quality

Temperature (C):	Dissolved Oxygen (mg/L):	pH:	Conductivity (umos/L):
Alkalinity (mg/L):	Hardness (mg/L):	Other:	

N/A

Water Odors: ☒ No Odor ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Other

Water Surface Oils: ☒ No oils ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks

Turbidity: ☒ Clear ☐ Slightly Turbid ☐ Moderately Turbid ☐ Opaque

Water Color: Clear

Periphyton

Substrate: ☐ Detached ☒ Epilithic (on rocks) ☐ Epipelic (on mud) ☐ Epiphitic (on plants)

Growth Form: ☐ Prostrate ☐ Strands Less Than 2 Inches ☒ Strands From 2 – 12 Inches ☐ Strands > 12 Inches

Density: ☐ Low Density (<25% of Substrate) ☐ Moderate Density (25-75% of Substrate) ☒ High Density (>75%)

Taxa: ☒ Green Filamentous ☐ Diatoms ☐ Blue-green

Macrophytes

Growth Form: ☒ Floating ☒ Submerged ☐ Emergent ☐ No Macrophytes

Density: ☐ Rare (<10% of Area) ☒ Common (10-50% of Area) ☐ Abundant ((> 50% of Area)

Length of Bank Having Emergent Vegetation:

Taxa:

Photography/Sketches

☒ Photos Taken ☐ Photos Recorded in Data Log ☐ Frame Numbers: ☐ Sketch Drawn

Subject:
Direction:

Miscellaneous Information: Photos: 007 upstream; 008 downstream

017

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Riffle/Pool Habitat Assessment Form

Date: ~~11/23/2010~~ 10/22/2010	Analyst: JV, TA	Station #: Dupage R Sample #: 017	Location: off McKenna St.

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
A. Epifaunal substrate/ available cover	Greater than 50% mix of cobble, large gravel, submerged logs, undercut banks, or other stable habitat. 20-16 _____	A 50-30.1% mix of cobble, large gravel, or other stable habitat. Habitat adequate for maintenance of populations. 15-11 14	A 30-10.1% mix of cobble, large gravel, or other stable habitat. Habitat less than desirable. Substrate frequently disturbed or removed. 10-6 _____	Less than 10% mix of cobble, large gravel, or other stable habitat. Lack of habitat is obvious. Substrate unstable or lacking. 5-0 _____
B. Embeddedness	Gravel, cobble, or boulders are between 0-25% surrounded by fine sediment or sand. 20-16 _____	Gravel, cobble, or boulders are between 25.1-50% surrounded by fine sediment or sand. 15-11 15	Gravel, cobble, or boulders are between 50.1-75% surrounded by fine sediment or sand. 10-6 _____	Gravel, cobble, or boulders are over 75% surrounded by fine sediment or sand. 5-0 _____
C Velocity/ depth regime	All four velocity/depth regimes present. Slow(< 0.3 m/s) - deep (> 0.5 m) ; slow- shallow (< 0.5 m) ; fast(> 0.3 m/s) - deep ; fast-shallow. 20-16 _____	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than if missing other regimes). 15-11 ~~13~~ 14	Only 2 of the 4 regimes present (if fast-shallow or slow-shallow are missing receive lower score). 10-6 ~~9~~ TA 9	Dominated by one velocity/depth regime (usually slow-deep). 5-0 _____
D. Sediment deposition	Little or no enlargement of islands or point bar and less than 5% of bottom affected by sediment deposition. 20-16 _____	Some new increase in bar formation, mostly from coarse gravel, sand or fine sediment From 5-30% of bottom affected by sediment deposits. Slight sediment deposition in pools. 15-11 ~~TA 12~~ 12	Moderate deposition of new gravel, sand, or sediment on old and new bars; pools partially filled with silt. From 30.1-50% of bottom affected. Deposits at obstructions, constrictions, and bends. Moderate deposition of pools prevalent 10-6 _____	Heavy deposits of fine material, increased bar development. More than 50% of the bottom changing frequently. Pools almost absent due to substantial deposition. 5-0 _____
E. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed 20-16 _____	Water fills 99.9-75% of the available channel; or <25% of channel substrate exposed. 15-11 15	Water fills 74.9-25% of the available channel, and/or riffle substrates are mostly exposed 10-6 _____	Very little water in channel (<25%) and mostly present as standing pools 5-0 _____
F. Channel alteration	Channelization or dredging absent or minimal (<5%) stream with normal pattern 20-16 16	Some channelization present (5-39.9%), usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 years) may be present, but recent channelization is not present. 15-11 _____	Channelization may be extensive; embankments or shoring structures present on both banks; and 40- 80% of stream reach channelizes or disrupted. 10-6 _____	Banks shored with gabion or cement; over 80% of the stream reach channelized or disrupted. Instream habitat greatly altered or removed entirely 5-0 _____

G. Riffle Quality	Well developed riffle and run; riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20-16 _____	Riffle is as wide as stream but length is less than two times width; abundance of cobble; gravel common. 15-11 12	Run area may be lacking; riffle not as wide as stream and its length is less than 2 times the stream width; gravel or bedrock prevalent; some cobble present. 10-6 _____	Riffles or runs virtually nonexistent; bedrock prevalent; cobble lacking. 5-0 _____
H. Bank stability - Score each bank	Bank stable; evidence of erosion or bank failure absent or minimal; little potential for future problems; <5% of bank affected.	Moderately stable; infrequent, small areas of erosion, mostly healed over; 5-29.9% of bank in reach has areas of erosion.	Moderate unstable; 30-59.9% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "Raw" areas frequent along straight sections and bends; obvious bank sloughing ; 60- 100% of bank has erosion scars.
Left Bank	10-9 _____	8-6 6	5-3 _____	2-0 _____
Right Bank	10-9 _____	8-6 6	5-3 _____	2-0 _____
I. Vegetative protection – Score each bank	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory, or herbaceous growth; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	90-70% of the streambank surface covered by native vegetation; but one class of plants is not well represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	69.9-50% of the streambank surface covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surface covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
Left Bank	10-9 _____	8-6 7	5-3 _____	2-0 _____
Right Bank	10-9 _____	8-6 7	5-3 _____	2-0 _____
J. Riparian vegetative zonewidth - Score each bank	Width of riparian zones > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zones 17.9-12 meters; human activities have impacted zone minimally.	Width of riparian zones 11.9-6 meters; human activities have impacted zone a great deal.	Width of riparian zones <6 meters; little or no riparian vegetation due to human activities.
Left Bank	10-9 _____	8-6 _____	3-5 4	2-0 _____
Right Bank	10-9 _____	8-6 _____	3-5 4	2-0 _____

Total ~~13~~ 14
127

[redacted]

Worksheet for Riffle/Pool or Glide/Pool Habitat Assessment Forms

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Worksheet for Riffle/Pool or Glide/Pool Habitat Assessment Forms

Date: 10/22/2010	Analyst: TA, JV	Station #: Dupage R. Sample #: 017	Location: Off McKenna Rd.

A. Epifaunal Substrate\Available Cover

Section	1	2	3	4	5	6	7	8	9	10
%	35	40	40	35	35	35	45	40	40	40

Total 385 (Sections 1-10) x .1 = Total Stream Reach Percentage 38.5%

B. Embeddedness

Cobble	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
% Emb	30	30	25	35	50	50	25	25	50	25	30	50	30	25	50	30
Cat.	II	II	I	II	II	II	I	I	II	I	II	II	II	I	II	II

Category I = 0-25% Embedded
Category II = 25.1-50% Embedded
Category III = 50.1-75% Embedded
Category IV = > 75% Embedded

Predominant Category II

D. Sediment Deposition

Section	1	2	3	4	5	6	7	8	9	10
%	20	25	20	20	30	30	20	25	30	20

Total 240 Sections (1-10) x .1 = Total Stream Reach Percentage ~~24%~~ 24%

H. Bank Stability

LB Section	1	2	3	4	5	6	7	8	9	10
Category	II	—	—	—	—	—	—	—	—	—

RB Section	1	2	3	4	5	6	7	8	9	10
Category	II	—	—	—	—	—	—	—	—	—

Category I = Stable. < 5% bank affected.
Category II = Moderately stable. 5-29.9% of bank reach has erosion.
Category III = Moderately unstable. 30-59.9% of bank reach has erosion.
Category IV = Unstable. Many eroded areas; 60-100% of bank reach has erosion.

LB Predominant Category II
RB Predominant Category II

I. Vegatative Protection

LB Section	1	2	3	4	5	6	7	8	9	10
%	75	80	75	75	80	80	80	75	80	75
RB Section	1	2	3	4	5	6	7	8	9	10
%	80	80	75	80	80	80	75	75	75	80

LB Total 775 Sections (1-10) x 0.1 = LB Stream Reach Percentage 77.5 %
RB Total 780 Sections (1-10) x 0.1 = RB Stream Reach Percentage 78 %

J. Riparian Vegetative Zone Width

LB Section	1	2	3	4	5	6	7	8	9	10
Category	III									
RB Section	1	2	3	4	5	6	7	8	9	10
Category	III									

Category I = > 18 meters
Category II = 17.9-12 meters
Category III = 11.9-6 meters
Category IV = < 6 meters

LB Predominant Category III
RB Predominant Category III

Lower bank width measurements are used to figure the 20X width sampling reach and the 10 transect segments for the Riffle/Pool or Glide/Pool worksheet. Five well-spaced measurements are taken within a stream segment.

Transect	1	2	3	4	5
Lower Bank Width	100				

Average Width = 100
Average width x 20 = 2000 sampling reach length
Average width x 2 = 200 transect segment length

[redacted]

Physical Characterization/Water Quality Data Form

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Physical Characterization / Water Quality Data Form

General Information

Waterbody Name: DuPage River	Station #: 017 Investigators: JV, TA
Date: 10/22/2010 Time: 1640	Latitude: 41° 34' 22.8" Longitude: 88° 12' 48.3" Acc 13.2m

USGS#: Reach #:	MDNR Reach #:	Legal Coordinates:

Physical Features

Drainage Area (sq. mi.):	Gradient (ft./mi.):	Velocity (ft./sec.)	Discharge (cu. ft./sec.)

Average Riffle Width (ft.)	Average Run Width (ft.) 100 ft	Average Pool Width (ft.)
Average Riffle Depth (ft.)	Average Run Width (ft.) 2.5 ft	Average Pool Depth (ft.)

High Water Mark (ft.)	Stream Order:

Predominant Land Use: ☐ Forest ☐ Hayfield ☑ Row Crop ☐ Pasture ☐ Animal Confinement
☐ Urban Commercial ☐ Urban Industrial ☑ Suburban Residential ☐ Suburban Commercial
Other:

Human Disturbance: ☐ Access Roads ☑ Footpaths ☑ Trash ☐ Livestock Watering ☐ RV Tracks
☐ Gravel Mining ☐ Camping Sites Other:

Local Watershed Erosion:	Canopy Cover:	Estimated Water Level:	Stream Bank Vegetation:
☐ None ☑ Moderate ☐ Heavy	☐ Open ☑ Partly Shaded ☐ Shaded	☑ Low Flow ☐ Within Lower Bank ☐ Over Lower Bank	☐ Raw ☑ Bare Areas ☑ Grasses and Forbes ☐ Large Trees ☑ Trees and Shrubs

Major Habitats Present: ☑ Flow Coarse Substrate ☐ Non-flow over Deposition ☑ Snags/Woody Debris
☑ Flow Fine Substrate ☑ Leaf Packs ☑ Root Mats

Channel: ☐ Dam Present ☐ Dam Absent ☐ Channelized ☑ Natural

Point Source Pollution: ☐ Discharge ☑ No Discharge Estimated Flow: ~~Ag Fields, Streets, Yards~~ TA
Type of Discharge:

Non-point Source Pollution (excluding erosion): ☐ Obvious ☑ Potential ☐ No Observable
Type of NPS Pollution: Storm Water Run-Off Source of NPS Pollution: Ag Fields, Streets, Yards

Sediment

Sediment Deposits: ☐ No Deposits ☐ Sewage Sludge ☑ Silt ☐ Sand ☐ Gravel
Other Types of Deposits: Deposit thickness: Deposit Area:

Sediment Odors: ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic
Other:

Sediment Odor Severity: ☑ Not Offensive ☐ Moderately Offensive ☐ Grossly Offensive

Substrate

Type	Approximate % of Area	Type	Approximate % of Area
Bedrock		Woody Debris (< 6 inch in diameter and 36 inches long)	5
Boulder (>10 inch diameter)	10		
Cobble (2.5 - 10 inch diameter)	~~42~~ 15	Snags (> 6 inches in diameter and 36 inches in length)	
Gravel (0.1 – 2.5 inch diameter)	~~30~~ 25		
Sand (< 0.1 inch diameter, gritty)	35	Muck (Black with very fine organic Matter)	
Silt	10		
Compact Clay		Total	100%

Water Quality

Temperature (C):	Dissolved Oxygen (mg/L):	pH:	Conductivity (umos/L):
Alkalinity (mg/L):	Hardness (mg/L):	Other:	

Water Odors: ☑ No Odor ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Other

Water Surface Oils: ☑ No oils ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks

Turbidity: ☑ Clear ☐ Slightly Turbid ☐ Moderately Turbid ☐ Opaque | Water Color:

Periphyton

Substrate: ☐ Detached ☐ Epilithic (on rocks) ☐ Epipelic (on mud) ☐ Epiphitic (on plants)

Growth Form: ☐ Prostrate ☐ Strands Less Than 2 Inches ☑ Strands From 2 – 12 Inches ☑ Strands > 12 Inches

Density: ☐ Low Density (<25% of Substrate) ☑ Moderate Density (25-75% of Substrate) ☑ High Density (>75%)

Taxa: ☑ Green Filamentous ☐ Diatoms ☐ Blue-green

Macrophytes

Growth Form: ☑ Floating ☑ Submerged ☐ Emergent ☐ No Macrophytes

Density: ☐ Rare (<10% of Area) ☑ Common (10-50% of Area) ☐ Abundant ((> 50% of Area)

Length of Bank Having Emergent Vegetation: | Taxa:

Photography/Sketches

☑ Photos Taken | ☐ Photos Recorded in Data Log | ☐ Frame Numbers: | ☐ Sketch Drawn

Subject: Direction: 052 - Upstream
053 - Downstream

Miscellaneous Information: Difficult to distinguish stream bottom due to heavy benthic algae cover.

030

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Riffle/Pool Habitat Assessment Form

Date:	Analyst:	Station #: Dupage R. Sample #: 030	Location: Eaton Park off 135th St.
10/24/2010	JV, TA		

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
A. Epifaunal substrate/ available cover	Greater than 50% mix of cobble, large gravel, submerged logs, undercut banks, or other stable habitat. 20-16 _____	A 50-30.1% mix of cobble, large gravel, or other stable habitat. Habitat adequate for maintenance of populations. X 15-11 14	A 30-10.1% mix of cobble, large gravel, or other stable habitat. Habitat less than desirable. Substrate frequently disturbed or removed. 10-6 _____	Less than 10% mix of cobble, large gravel, or other stable habitat. Lack of habitat is obvious. Substrate unstable or lacking. 5-0 _____
B. Embeddedness I	Gravel, cobble, or boulders are between 0-25% surrounded by fine sediment or sand. 20-16 _____	Gravel, cobble, or boulders are between 25.1-50% surrounded by fine sediment or sand. 15-11 12	Gravel, cobble, or boulders are between 50.1-75% surrounded by fine sediment or sand. 10-6 _____	Gravel, cobble, or boulders are over 75% surrounded by fine sediment or sand. 5-0 _____
C Velocity/ depth regime	All four velocity/depth regimes present. Slow(< 0.3 m/s) - deep (> 0.5 m) ; slow- shallow (< 0.5 m) ; fast(> 0.3 m/s) - deep ; fast-shallow. 20-16 _____	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than if missing other regimes). 15-11 _____	X Only 2 of the 4 regimes present (if fast-shallow or slow-shallow are missing receive lower score). 10-6 7	Dominated by one velocity/depth regime (usually slow-deep). 5-0 _____
D. Sediment deposition	Little or no enlargement of islands or point bar and less than 5% of bottom affected by sediment deposition. 20-16 _____	Some new increase in bar formation, mostly from coarse gravel, sand or fine sediment From 5-30% of bottom affected by sediment deposits. Slight sediment deposition in pools. X 15-11 12	Moderate deposition of new gravel, sand, or sediment on old and new bars; pools partially filled with silt. From 30.1-50% of bottom affected. Deposits at obstructions, constrictions, and bends. Moderate deposition of pools prevalent 10-6 _____	Heavy deposits of fine material, increased bar development. More than 50% of the bottom changing frequently. Pools almost absent due to substantial deposition. 5-0 _____
E. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed 20-16 _____	Water fills 99.9-75% of the available channel; or <25% of channel substrate exposed. X 15-11 13	Water fills 74.9-25% of the available channel, and/or riffle substrates are mostly exposed 10-6 _____	Very little water in channel (<25%) and mostly present as standing pools 5-0 _____
F. Channel alteration	Channelization or dredging absent or minimal (<5%) stream with normal pattern X 20-16 16	Some channelization present (5-39.9%), usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 years) may be present, but recent channelization is not present. 15-11 _____	Channelization may be extensive; embankments or shoring structures present on both banks; and 40- 80% of stream reach channelizes or disrupted. 10-6 _____	Banks shored with gabion or cement; over 80% of the stream reach channelized or disrupted. Instream habitat greatly altered or removed entirely 5-0 _____

G. Riffle Quality	Well developed riffle and run; riffle is as wide as stream and length extends two times the width of stream; abundance of cobble.	Riffle is as wide as stream but length is less than two times width; abundance of cobble; gravel common.	Run area may be lacking; riffle not as wide as stream and its length is less than 2 times the stream width; gravel or bedrock prevalent; some cobble present.	Riffles or runs virtually nonexistent; bedrock prevalent; cobble lacking.
	20-16 _____	15-11 ~~11~~ 14	10-6 10	5-0 _____
H. Bank stability - Score each bank	Bank stable; evidence of erosion or bank failure absent or minimal; little potential for future problems; <5% of bank affected.	Moderately stable; infrequent, small areas of erosion, mostly healed over; 5-29.9% of bank in reach has areas of erosion.	Moderate unstable; 30-59.9% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "Raw" areas frequent along straight sections and bends; obvious bank sloughing ; 60- 100% of bank has erosion scars.
Left Bank	10-9 _____	8-6 8 ~~6~~ TA	5-3 _____	2-0 _____
Right Bank	10-9 _____	8-6 8 ~~6~~ TA	5-3 _____	2-0 _____
I. Vegetative protection – Score each bank	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory, or herbaceous growth; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	90-70% of the streambank surface covered by native vegetation; but one class of plants is not well represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	69.9-50% of the streambank surface covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surface covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
Left Bank	10-9 _____	8-6 7 ~~6~~ TA	5-3 _____	2-0 _____
Right Bank	10-9 _____	8-6 7 ~~6~~ TA	5-3 _____	2-0 _____
J. Riparian vegetative zonewidth - Score each bank	Width of riparian zones > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zones 17.9-12 meters; human activities have impacted zone minimally.	Width of riparian zones 11.9-6 meters; human activities have impacted zone a great deal.	Width of riparian zones <6 meters; little or no riparian vegetation due to human activities.
Left Bank	10-9 _____	8-6 _____	3-5 5	2-0 _____
Right Bank	10-9 _____	8-6 6	3-5 ~~5~~ TA	2-0 _____

Total ~~125~~ 124

APPENDIX C

Worksheet for Riffle/Pool or Glide/Pool Habitat Assessment Forms

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Worksheet for Riffle/Pool or Glide/Pool Habitat Assessment Forms

Date: 10/24/2010	Analyst: TA, JV	Station #: Dupage R. Sample #: 030	Location: Eaton Park off 135th St.

A. Epifaunal Substrate\Available Cover

Section	1	2	3	4	5	6	7	8	9	10
%	45	40	40	40	40	35	40	45	40	40

Total 405 (Sections 1-10) x .1 = Total Stream Reach Percentage 40.5%

B. Embeddedness

Cobble	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
% Emb	50	50	50	25	50	25	50	25	25	50	50	50	50	50	50	50
Cat.	II	II	II	I	II	I	II	I	I	II	II	II	II	II	II	II

Category I = 0-25% Embedded
Category II = 25.1-50% Embedded
Category III = 50.1-75% Embedded
Category IV = > 75% Embedded

Predominant Category II

D. Sediment Deposition

Section	1	2	3	4	5	6	7	8	9	10
%	25	25	30	25	25	25	10	25	25	25

Total 240 Sections (1-10) x .1 = Total Stream Reach Percentage 24%

H. Bank Stability

LB Section	1	2	3	4	5	6	7	8	9	10
Category	II									

RB Section	1	2	3	4	5	6	7	8	9	10
Category	II									

Category I = Stable. < 5% bank affected.
Category II = Moderately stable. 5-29.9% of bank reach has erosion.
Category III = Moderately unstable. 30-59.9% of bank reach has erosion.
Category IV = Unstable. Many eroded areas; 60-100% of bank reach has erosion.

LB Predominant Category II
RB Predominant Category II

I. Vegatative Protection

LB Section	1	2	3	4	5	6	7	8	9	10
%	80	80	80	80	90	70	70	80	90	80
RB Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
%	80	80	90	80	80	70	80	70	80	80

LB Total 800 Sections (1-10) x 0.1 = LB Stream Reach Percentage 80 %
RB Total 790 Sections (1-10) x 0.1 = RB Stream Reach Percentage 79 %

J. Riparian Vegetative Zone Width

LB Section	1	2	3	4	5	6	7	8	9	10
Category	III									
RB Section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Category	II									

Category I = > 18 meters
Category II = 17.9-12 meters
Category III = 11.9-6 meters
Category IV = < 6 meters

LB Predominant Category III
RB Predominant Category II

Lower bank width measurements are used to figure the 20X width sampling reach and the 10 transect segments for the Riffle/Pool or Glide/Pool worksheet. Five well-spaced measurements are taken within a stream segment.

Transect	1	2	3	4	5
Lower Bank Width	100				

Average Width = 100
Average width x 20 = 2000 sampling reach length
Average width x 2 = 200 transect segment length

[redacted]

Physical Characterization/Water Quality Data Form

Missouri Department of Natural Resources
Stream Habitat Assessment Procedure
Physical Characterization / Water Quality Data Form

General Information

Waterbody Name: Dupage River
Station #: 030
Investigators: TA, JV

Date: 10/ /2010
Time: 0830
Latitude: 41° 38' 5.5"
Longitude: 88° 11' 32.7"
Acc 5.6m

USGS#:
Reach #:
MDNR Reach #:
Legal Coordinates:

Physical Features

Drainage Area (sq. mi.):
Gradient (ft./mi.):
Velocity (ft./sec.)
Discharge (cu. ft./sec.)

Average Riffle Width (ft.)
Average Run Width (ft.) 100 ft.
Average Pool Width (ft.)

Average Riffle Depth (ft.)
Average Run Width (ft.) 2.5 ft.
Average Pool Depth (ft.)

High Water Mark (ft.)
Stream Order:

Predominant Land Use: ☑ Forest ☐ Hayfield ☐ Row Crop ☐ Pasture ☐ Animal Confinement
☐ Urban Commercial ☐ Urban Industrial ☑ Suburban Residential ☐ Suburban Commercial
Other:

Human Disturbance: ☐ Access Roads ☑ Footpaths ☑ Trash ☐ Livestock Watering ☐ RV Tracks
☐ Gravel Mining ☐ Camping Sites Other:

Local Watershed Erosion:
☐ None
☑ Moderate
☐ Heavy

Canopy Cover:
☐ Open
☑ Partly Shaded
☐ Shaded

Estimated Water Level:
☑ Low Flow
☐ Within Lower Bank
☐ Over Lower Bank

Stream Bank Vegetation:
☐ Raw ☐ Bare Areas
☑ Grasses and Forbes
☑ Large Trees ☑ Trees and Shrubs

Major Habitats Present: ☑ Flow Coarse Substrate ☐ Non-flow over Deposition ☐ Snags/Woody Debris
☑ Flow Fine Substrate ☐ Leaf Packs ☑ Root Mats

Channel: ☐ Dam Present ☐ Dam Absent ☐ Channelized ☑ Natural

Point Source Pollution: ☐ Discharge ☑ No Discharge Estimated Flow:
Type of Discharge:

Non-point Source Pollution (excluding erosion): ☐ Obvious ☑ Potential ☐ No Observable
Type of NPS Pollution: Stormwater Run-off
Source of NPS Pollution: Streets, Parking Lots

Sediment

Sediment Deposits: ☑ No Deposits ☐ Sewage Sludge ☐ Silt ☐ Sand ☐ Gravel
Other Types of Deposits: Deposit thickness: Deposit Area:

Sediment Odors: ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic
Other:

Sediment Odor Severity: ☑ Not Offensive ☐ Moderately Offensive ☐ Grossly Offensive

Substrate

Type	Approximate % of Area	Type	Approximate % of Area
Bedrock		Woody Debris (< 6 inch in diameter and 36 inches long)	~~10~~ 5
Boulder (>10 inch diameter)	10		
Cobble (2.5 - 10 inch diameter)	15	Snags (> 6 inches in diameter and 36 inches in length)	5
Gravel (0.1 – 2.5 inch diameter)	20		
Sand (< 0.1 inch diameter, gritty)	~~30~~ 35	Muck (Black with very fine organic Matter)	
Silt	~~15~~ 10		
Compact Clay		Total	100%

Water Quality

Temperature (C):	Dissolved Oxygen (mg/L):	pH:	Conductivity (umos/L):
Alkalinity (mg/L)	Hardness (mg/L):	Other:	

Water Odors: ☑ No Odor ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Other

Water Surface Oils: ☑ No oils ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks

Turbidity: ☑ Clear ☐ Slightly Turbid ☐ Moderately Turbid ☐ Opaque | Water Color:

Periphyton

Substrate: ☐ Detached ☑ Epilithic (on rocks) ☐ Epipelic (on mud) ☑ Epiphitic (on plants)

Growth Form: ☐ Prostrate ☐ Strands Less Than 2 Inches ☑ Strands From 2 – 12 Inches ☑ Strands > 12 Inches

Density: ☐ Low Density (<25% of Substrate) ☐ Moderate Density (25-75% of Substrate) ☑ High Density (>75%)

Taxa: ☑ Green Filamentous ☐ Diatoms ☐ Blue-green

Macrophytes

Growth Form: ☑ Floating ☑ Submerged ☐ Emergent ☐ No Macrophytes

Density: ☐ Rare (<10% of Area) ☑ Common (10-50% of Area) ☐ Abundant ((> 50% of Area)

Length of Bank Having Emergent Vegetation: | Taxa:

Photography/Sketches

☑ Photos Taken | ☐ Photos Recorded in Data Log | ☐ Frame Numbers: | ☐ Sketch Drawn

Subject: 092 - Upstream
Direction: 093 - Downstream

Miscellaneous Information: More or less a large run.

Appendix C

Upper Watershed Reconnaissance Summary Tables

Site ID	Priority	Land Use	Municipality	HOA/PM	Folder	Photos	Action Opportunity	Non-Structural	Non-Struct Notes	Structural	Basin Retrofit	Filtration	Conveyance	Infiltration-Bioretention	Rooftop Retrofits	Buffer Establishment	Notes	Other
18	H	SFRes	Naperville		7	59-70	Y			Y	Y	Y	Y	Y			New, upscale neighborhood. Manicured turf basin. Opportunity for large scale use of native veg or just along low flow channel. Creation of micro-pool wetland areas within dry basin.	
35	H	SFRes	Shorewood		7	409-425	Y			Y	Y	Y	Y	Y			Mowed turf basins. Appears to have periodic low flow. Section have installed concrete low flow channel. Opportunity for use of native veg. for low flow channel and wetland pocket creation in basins. Use of native veg. in upland portions of basins.	
19	H	SFRes	Will County		7	205-209; 210-212	Y			Y	Y	Y	Y			Y	Very narrow creek corridor through residential. Opportunity for buffer enhancement. Upstream trib area is ag. Pics show erosion in ag channel and creek through neighborhood. Adjacent basin has rock line shoreline & manicured turf for upper slope.	
6	H	SFRes	Joliet		7	302-313	Y	Y	Buffer Mgt	Y	Y	Y		Y			Wide streets & long driveways. Reduce roadway width, parallel ROW rain gardens. Detention Retrofits. N. Basin: no buffer near Sunmeadow. Basin retrofit South of Salma St - remove concrete channel. Consider maintaining native veg. along gas pipeline corridor	Seasonal Pool discharge management
24	H	SFRes	Joliet		7	237-247	Y			Y	Y	Y		Y			One basin has concrete low flow swale with remainder manicured turf. Other basins have mowed turf to water's edge. Opportunity for native veg for all basins.	Streets are very wide, little to no use of onstreet parking. Potential opportunity for curb line raingardens.
10	H	SFRes	Joliet		7	362-371	Y	Y	Buffer Mgt	Y	Y		Y			Y	Old, upscale private residential. Creek through neighborhood is all lined with 6-8" limestone rip-rap. Basins along river provide opportunity for retrofit. Old (unused tennis courts) appear to be in floodplain & buffer of DuPage River.	Owernship and current use of tennis courts is in question. Potential for nice buffer restoration if they are removed.
33	H	SFRes	Naperville		7	72-92	Y			Y	Y					Y	Appears to have wide buffer to Spring Brook, evaluate buffer management adjacent to park. Basins have manicured turf, showing signs of erosion & slumping. Opportunity to tie basin habitat to riparian corridor. Neighborhood has wide, wide streets.	
34	H	SFRes	Naperville		7	15-24	Y			Y	Y						Basins are manicured turf to waters edge. Showing signs of erosion along banks and slumping.	
26	H	SFRes	Joliet		7	334-362	Y			Y		Y	Y			Y	Creek is concrete lined through residential neighborhood. No detention in neighborhood. Channel appears stable upstream & downstream of concrete section. Opportunity to tie creek & neighborhood BMPs/enhancements.	
8	H	SFRes	Plainfield		No		Y	Y	Buffer Mgt							Y	Evidence of protected buffer. Evaluate current stream buffer management. Opportunity to connect to downstream corridor.	
44	H	Park	Bolingbrook		5	74-87; 70-73 88-91	Y	Y	Turf Mgt	Y		Y				Y	Establish and manage native veg buffer along north bank of Lily Cache in Jaycee Park, currently mowed. Incorporate stormwater BMPs & rain gardens at park to educate local residents. Neighborhood to north has no SW management.	Demonstration project at park may influence local residents to adopt & install onsite BMPs within older neighborhoods without SW detention. Pics: 70-73 & 88-91 are of adjacent neighborhood.
20	H	Park	Bolingbrook	Park Dist	5	160-171; 180-181	Y			Y			Y			Y	Lily Cache enhancement: Rt 53 to Canterbury Ln. Upstream of Lions Park has narrow buffer, manicured turf. Hard armored at Park. Severe encroachment & impacts South of Briarcliff. Opportunity for native restoration & grade control (riffle & pools).	
43	H	MFRes	Bolingbrook		5	248-292	Y	Y	Snow & Turf Mgt	Y	Y	Y	Y	Y	Y	Y	Nice opportunity for retrofit of online basins and open space use for dispersed BMPs for roof top & parking lot stormwater BMPs. Aesthetics would greatly improve with BMP implementation.	
17	H	MFRes	Naperville		7	25 - 36	Y			Y	Y	Y	Y	Y			Series of dry and partial open water basins. Manicured turf, does not appear to be used as park space (along roadway). Severe lowflow erosion in southern basin (pics 31 & 32)	
22	H	MFRes	Bolingbrook		5	192-198; 204-212; 199-203	Y			Y	Y	Y	Y		Y		All swales and stormwater conveyance/storage is lined by large limestone rip rap. Very unsightly, excessive trash. Opportunity to enhance aesthetics, incorporate native swales, buffers to treat & convey water. Across the street from nice native area.	
16	H	MFRes	Naperville		7	4 - 14	Y			Y	Y	Y			Y		Dense Multi; opportunity for native veg buffer around basin; direct asphalt overland to basin across buffer; opportunity for rain gardens or cisterns to collect roof runoff from combined garages. Downspouts are connected.	
21	H	MFRes	Joliet		7	327-329	Y			Y	Y						Aerials show basin with concrete low flow. At the time of site visit, basin was partially full. Opportunity to remove concrete low flow swale and create wetland type basin.	
7	H	MFRes	Joliet		7	287-301	Y	Y	Wetland Mgt	Y		Y				Y	Open space could be gem. Side slopes are manicured. Evidence of Algea blooms. Improve/establish Mgt program. Establish buffer around wetland, direct runoff from roadway across buffer. Now directly connected. Evaluate Salt use.	
14	H	Insti	Naperville	School	7	48-55	Y			Y	Y	Y	Y	Y	Y		Sections of open space could have native Veg. Parking lot retrofit: bio-swale retrofit into parking lot along drainage way (pic 55). East edge has to curb, could sheet flow over buffer strip into open space. Very visible & close prox. to creek.	
15	H	Insti	Naperville	Church	7	106,116-117	Y			Y		Y			Y	Y	Opportunity is for management of rooftop runoff & buffer management along adjacent creek.	
45	H	Comm	Bolingbrook		5	64-68; 92-103	Y			y	y	Y				Y	Church and commercial building appears to have dry basin along Lily Cache creek. Opportunity for enhancement of basin and incorporation of filtration BMPs at SE edge of church parking lot. Could tie basin into creek buffer management.	

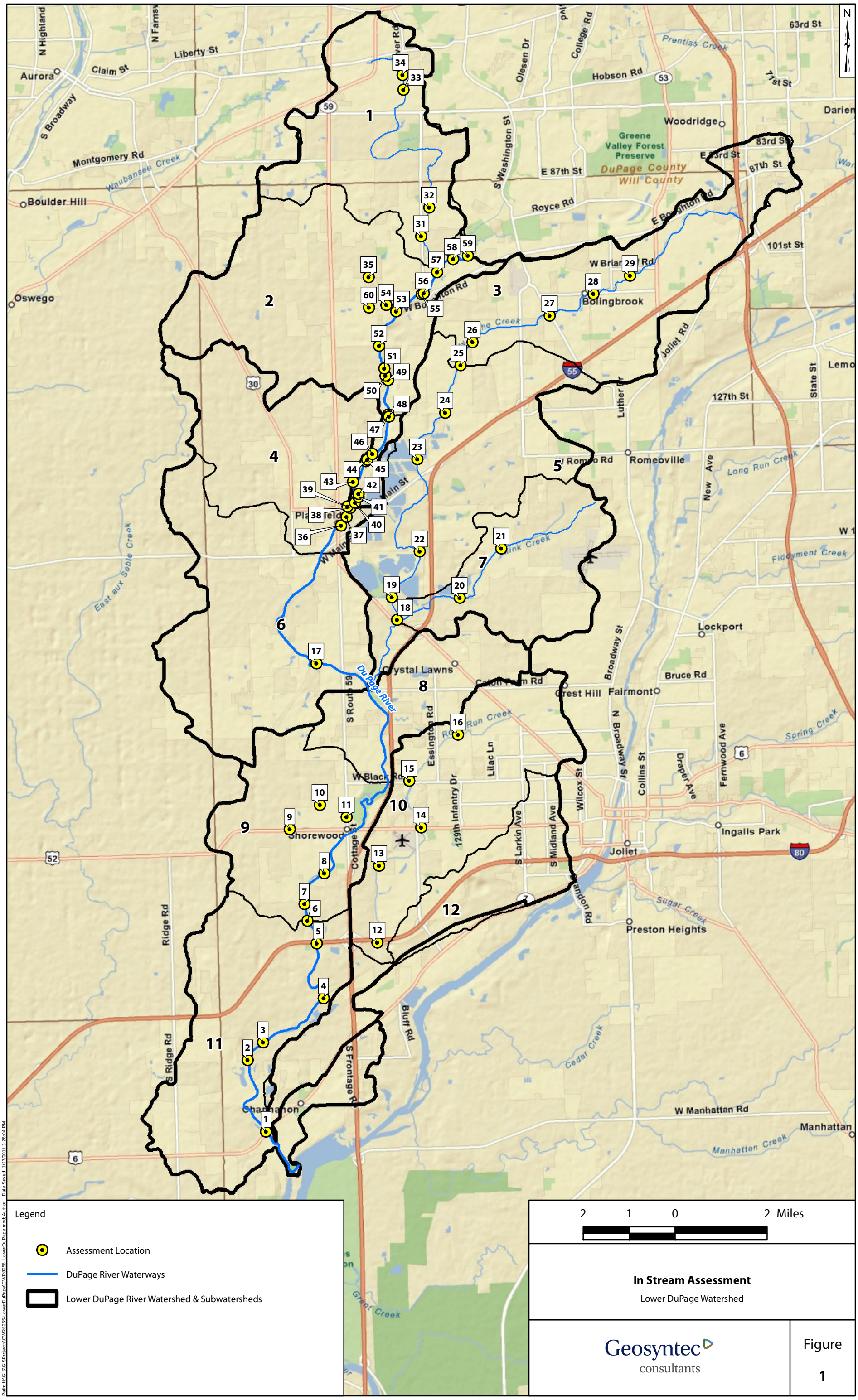
Site ID	Priority	Land Use	Municipality	HOA/PM	Folder	Photos	Action Opportunity	Non-Structural	Non-Struct Notes	Structural	Basin Retrofit	Filtration	Conveyance	Infiltration-Bioretention	Rooftop Retrofits	Buffer Establishment	Notes	Other
23	H	Comm	Bolingbrook		5	182-191	Y	Y	Alternative De-icing	Y		Y				Y	Lily Cache is piped from commercial area, daylights at commercial center (corner of Rt 53 & Northridge Ave). Opportunity for commercial BMPs and buffer enhancement. Current buffer is mowed turf, signs of erosion & sloughing.	
36	H	Comm	Joliet		No		Y			Y			Y				Concrete channels along Hennepin Dr. Evaluate opportunity for SW retrofits for Mall & complex. Complex appears to have no detention & minimal green space. Consider parking lot retrofits, urban BMP filtration devices (Filterra), roof retrofits.	
37	H	Comm	Will County		No			Y	Policy on redevelopment	Y						Y	Current use as storage yard encroaches on buffer, no apparent SW management. Evaluate opportunity to target redevelopment, require LID at time of redevelopment.	
9		SFRes	Will County		No		Y		Buffer Mgt	Y	Y	Y		Y		Y	Older Res. Online basins. Minimum to no pond buffers, mowed to waters edge. Evidence of erosion & slumping. Opportunity to connect to upstream and downstream corridor.	
3		SFRes	Shorewood		7	400-407	Y			Y	Y	Y					Basin buffer, parking filter strip	
4		SFRes	Shorewood		7	391-399	Y	Y	Buffer Mgt	Y	Y						Basin buffer on north	Seasonal Pool discharge management
29		SFRes	Plainfield		7	218-223	Y			Y	Y						Basins appear to have work being performed at water's edge, possible native installation? Opportunity to install native veg. & upland buffer with native veg. Very wide streets, opportunity for roadway rain gardens.	
25		SFRes	Joliet		7	248-267	Y			Y			Y			Y	Creek buffer through old small residential section is highly impacted. Each residence has small bridge over creek or armoring along creek. Downstream section flows through utility corridor.	
12		SFRes	Naperville		7	38-41	Y	Y	Turf Mgt	Y				Y	Y		No detention, adjacent to Spring Brook. Nice neighborhood, curb & gutter, wide streets. Potential opportunity for dispersed BMPs near inlets: i.e. parkway rain gardens	
13		SFRes	Naperville		7	44-47,56-58	Y	Y	Turf Mgt	Y				Y	Y		No detention, adjacent to Spring Brook. Nice neighborhood, curb & gutter, wide streets. Potential opportunity for dispersed BMPs near inlets: i.e. parkway rain gardens; potential to tie into demonstration project with adjacent middle school and greenway	
2		SFRes	Shorewood		No		Y			Y						Y	Opportunity for establishment & management of native veg. buffer along DuPage River. Pedestrian trial is present along east side. Area appears to be mowed.	
1		SFRes	Shorewood		No		N										New residential dev. Evidence of buffer encroachment along unnamed creeks to DuPage River, particularly at Woodland Way.	
30		MFRes	Naperville		7	228-235	Y			Y	Y						Basin has narrow water's edge with cattails. Upland area is mowed turf. Opportunity to install and manage native buffer. Trail along basins, opportunity to create native habitat along trail & tie into basin enhancement.	
46		Insti	Plainfield		7	193-197	Y			Y	Y	Y			Y		Plainfield North High School. Very massive, dry detention basins. No noticeable stormwater water quality BMPs. Opportunity for wetland pocket creation in basins. Potential filter strips for parking lot or water reuse from roof tops.	
42		Indust	Bolingbrook		No		N									Y	Several adjacent, active mines. Evaluate reclamation plan. Activities encroach into DuPage River buffer. Evaluate opportunities to expand green infrastructure with mine reclamation.	
11		Golf	Joliet	Park Dist	7	373-381	Y	Y	Turf Mgt	Y			Y			Y	Stream buffer is manicured turf. Showing significant signs of erosion, down cutting & bank erosion.	
38		Comm	Shorewood		7	385-387		Y	Trash management at rear of store	Y	Y						Dead or lack of vegetation at bottom of basin. Excessive bounce or high salt load from de-icing may be affecting vegetation. Minimal green space. Potential opportunity for parking lot retrofit with filtration BMPs (Filterras).	
5		Comm	Plainfield		7	179-192	Y			Y		Y					Recent commercial development (north & south of Ferguson Rd. Online & off-line detention. Appears to have preserved nice buffer to creek. No dispersed BMPs in commercial development. Nice use of grass swale along Ferguson Rd.	
47		Comm	Plainfield		7	214-216	Y			Y		Y					Recent Commercial development (north & south of W 127th. Riprap shoreline detention. No dispersed water quality BMPs in commercial development. Basins are wedged into site with rip-rap at water's edge, very little to no green space in development	
39		Comm	Naperville		7	159-167	N										Appears to have avoided impacts to adjacent buffer. Very minimal green space. Potential opportunity for parking lot retrofit with filtration BMPs (Filterras).	
40		Comm	Bolingbrook		5	282,294, 296-297	N										Appears to have avoided impacts to adjacent buffer. Very minimal green space. Potential opportunity for parking lot retrofit with filtration BMPs (Filterras).	
41		Comm	Joliet		7	315-324	N										Rip rap shoreline of basins. Very minimal green space. Potential opportunity for parking lot retrofit with filtration BMPs (Filterras).	

Table C2
Areas of Interest
Summary Table

Site ID	Priority	Land Use	Municipality	HOA/PM	Folder	Photos	Action Opportunity	Target/Focus	Action	Comments
1		Ag	Will County		LD	93-105; 107-115; 118-121	Y	Buffer	LID	Sole farm area within residental area, boarders creek. Opportunity to protect & enhance stream buffer. Conservation design. Corridor management. Includes pictures of upstream & downstream road crossing. (LID: Low Impact Development)
2		Ag	Plainfield				Y	Buffer	LID	West side of DuPage River. Opportunity to extend green infrastructure of the river corridor through protection or LID.
3		Ag	Shorewood		LD	400	Y	Buffer	LID	Well defined drainage way through ag field between to residential neighborhoods. Opportunity to protect and connect green coorridor/green infrastructure through LID.
4		Ag	Will County				Y			Appears to be farmed wetland area. Reports of adjacent water problems (flooding). Could be target to preserve, restore green corridor. Green infrastructure.
5		Ag	Will County				Y	Buffer	LID	West side of DuPage River. Opportunity to extend green infrastructure of the river corridor through protection or LID.
6		Ag	Plainfield				Y	Buffer	LID	North side of DuPage River. Floodplain & floodway area, has been looked at for development. Opportunity to extend green infrastructure of the river corridor through protection or LID.
7		Ag	Will County				Y	Buffer	LID	Opportunity to connect green cooridor along stream. Existing basins online. Future ones should be off line.
8		Ag	Plainfield				Y	Buffer	LID	Opportunity to connect green corridor along stream. Upstream corridor is protected as part of residential development.
9		Ag	Will County				Y	Buffer	Corridor protection	Opportunity to focus on corridor protection of stream. Evaluate policies to protect corridor & encourage/require LID immediately adjacent to stream.
10		Forest	Will County				Y	Buffer	Corridor protection	Both sides of DuPage River. Opportunity to preserve green infrastructure of the river corridor through protection (i.e. conservation easements) or LID.
11		Mix	Plainfield				Y	Buffer	Corridor protection	Opportunity to focus on corridor protection of stream. Evaluate policies to protect corridor & encourage/require LID immediately adjacent to stream.

Appendix D

Maps



In Stream Assessment

Lower DuPage Watershed

Geosyntec consultants

Figure 1

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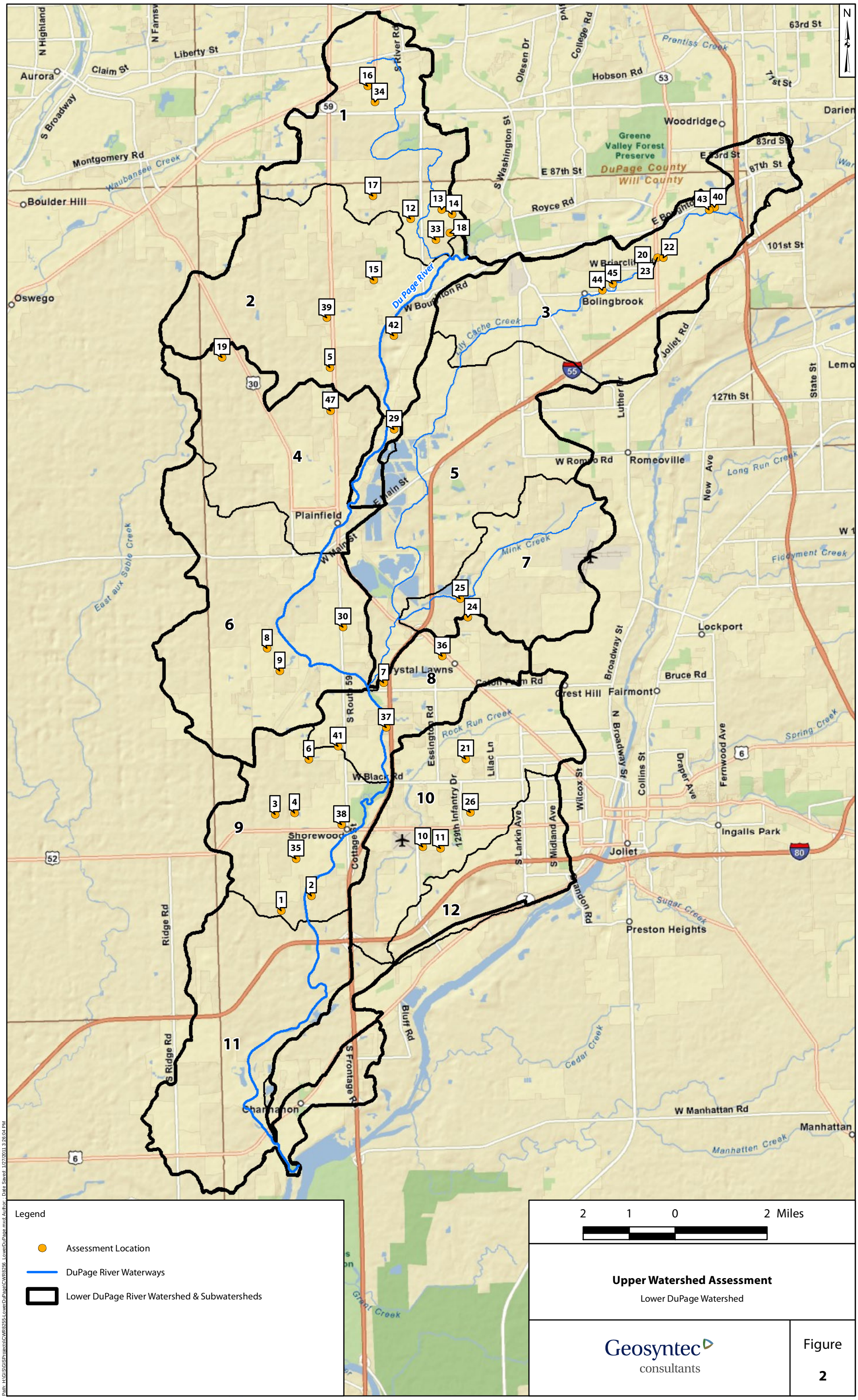
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101st St
W Briarcliff
Bolingbrook
Du Page River
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Romeoville
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Plainfield
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Mink Creek
Fiddyment Creek
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Broadway St
Bruce Rd
Crest Hill
Fairmont
Crystal Lawns
Rock Run Creek
Essington Rd
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Collins St
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Fernwood Ave
Spring Creek
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129th Infantry Dr
Wilcox St
Ingalls Park
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S Larkin Ave
S Midland Ave
Joliet
Sandon Rd
Sugar Creek
Preston Heights
Ridge Rd
S Ridge Rd
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Bluff Rd
Cedar Creek
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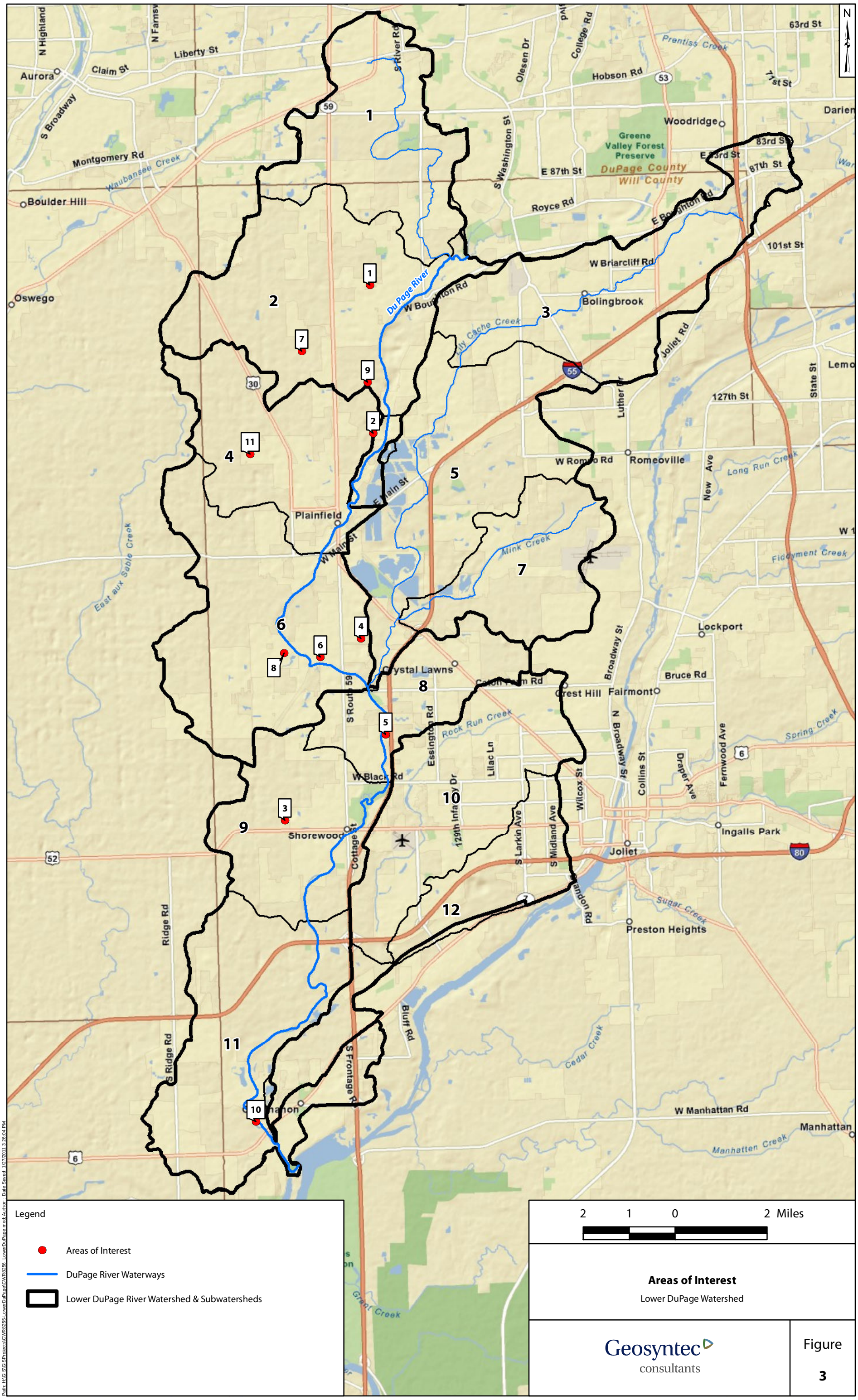
Legend
Assessment Location
DuPage River Waterways
Lower DuPage River Watershed & Subwatersheds
2 1 0 2 Miles
Upper Watershed Assessment
Lower DuPage Watershed
Geosyntec consultants
Figure
2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Ingalls Park
Joliet
Sugar Creek
Preston Heights
Ridge Rd
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Bluff Rd
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Legend
Areas of Interest
DuPage River Waterways
Lower DuPage River Watershed & Subwatersheds
2 1 0 2 Miles
Areas of Interest
Lower DuPage Watershed
Geosyntec consultants
Figure
3

Appendix E

CD-ROM of Files

APPENDIX C

CHAPTER 3

CODE AND ORDINANCE WORKSHEET

The Code and Ordinance Worksheet allows an in-depth review of the standards, ordinances, and codes (i.e., the development rules) that shape how development occurs in your community. You are guided through a systematic comparison of your local development rules against the model development principles. Institutional frameworks, regulatory structures and incentive programs are included in this review. The worksheet consists of a series of questions that correspond to each of the model development principles. Points are assigned based on how well the current development rules agree with the site planning benchmarks derived from the model development principles.

The worksheet is intended to guide you through the first two steps of a local site planning roundtable.

Step 1: Find out what the Development Rules are in your community.

Step 2: See how your rules stack up to the Model Development Principles.

The homework done in these first two steps helps to identify which development rules are potential candidates for change.

PREPARING TO COMPLETE THE CODE AND ORDINANCE WORKSHEET

Two tasks need to be performed before you begin in the worksheet. First, you must identify all the development rules that apply in your community. Second, you must identify the local, state, and federal authorities that actually administer or enforce the development rules within your community. Both tasks require a large investment of time. The development process is usually shaped by a complex labyrinth of regulations, criteria, and authorities. A team approach may be helpful. You may wish to enlist the help of a local plan reviewer, land planner, land use attorney, or civil engineer. Their real-world experience with the development process is often very useful in completing the worksheet.

Identify the Development Rules

Gather the key documents that contain the development rules in your community. A list of potential documents to look for is provided in Table 4. Keep in mind that the information you may want on a particular development rule is not always found in code or regulation, and may be hidden in supporting design manuals, review checklists, guidance document or construction specifications. In most cases, this will require an extensive search. Few communities include all of their rules in a single document. Be prepared to contact state and federal, as well as local agencies to obtain copies of the needed documents.

Table 4: Key Local Documents that will be Needed to Complete the COW

Zoning Ordinance
Subdivision Codes
Street Standards or Road Design Manual
Parking Requirements
Building and Fire Regulations/Standards
Stormwater Management or Drainage Criteria
Buffer or Floodplain Regulations
Environmental Regulations
Tree Protection or Landscaping Ordinance
Erosion and Sediment Control Ordinances
Public Fire Defense Masterplans
Grading Ordinance

Identify Development Authorities

Once the development rules are located, it is relatively

easy to determine which local agencies or authorities are actually responsible for administering and enforcing the rules. Completing this step will provide you with a better understanding of the intricacies of the development review process and helps identify key members of a future local roundtable.

Table 5 provides a simple framework for identifying the agencies that influence development in your community. As you will see, space is provided not only for local agencies, but for state and federal agencies as well. In some cases, state and federal agencies may also exercise some authority over the local development process (e.g., wetlands, some road design, and stormwater).

Using the Worksheet: How Do Your Rules Stack Up to the Model Development Principles?

Completing the Worksheet

Once you have located the documents that outline your development rules and identified the authorities responsible for development in your community, you are ready for the next step. You can now use the worksheet to compare your development rules to the model development principles.

The worksheet is presented at the end of this chapter. The worksheet presents seventy-seven site planning benchmarks. The benchmarks are posed as questions. Each benchmark focuses on a specific site design practice, such as the minimum diameter of cul-de-sacs, the minimum width of streets, or the minimum parking ratio for a certain land use. You should refer to the codes, ordinances, and plans identified in the first step to determine the appropriate development rule.

The questions require either a yes or no response or a specific numeric criteria. If your development rule agrees with the site planning benchmark, you are awarded points.

Calculating Your Score

A place is provided on each page of the worksheet to keep track of your running score. In addition, the worksheet is subdivided into three categories:

- Residential Streets and Parking Lots (Principles No. 1 - 10)
- Lot Development (Principles No. 11 - 16)
- Conservation of Natural Areas (Principles No. 17 - 22).

For each category, you are asked to subtotal your score. This **"Time to Assess"** allows you to consider which development rules are most in line with the site planning benchmarks and what rules are potential candidates for change.

The total number of points possible for all of the site planning benchmarks is 100. Your overall score provides a general indication of your community's ability to support environmentally sensitive development. As a general rule, if your overall score is lower than 80, then it may be advisable to systematically reform your local development rules. A score sheet is provided at end of the Code and Ordinance Worksheet to assist you in determining where your community's score places in respect to the Model Development Principles.

Once you have completed the worksheet, go back and review your responses. Determine if there are specific areas that

need improvement (e.g., development rules that govern road design) or if your development rules are generally pretty good. This review is key to implementation of better development: assessment of your current development rules and identification of impediments to innovative site design. This review also directly leads into the next step: a site planning roundtable process conducted at the local government level. The primary tasks of a local roundtable are to systematically review existing development rules and then determine if changes can or should be made. By providing a much-needed framework for overcoming barriers to better development, the site planning roundtable can serve as an important tool for local change.

Table 5: Local, State, and Federal Authorities Responsible for Development in Your Community

Development Responsibility		State/Federal	County	Town
Sets road standards	Agency:			
	Contact Name:			
	Phone No.:			
Review/approves subdivision plans	Agency:			
	Contact Name:			
	Phone No.:			
Establishes zoning ordinances	Agency:			
	Contact Name:			
	Phone No.:			
Establishes subdivision ordinances	Agency:			
	Contact Name:			
	Phone No.:			

Table 5: Local, State, and Federal Authorities Responsible for Development in Your Community (Continued)

Development Responsibility		State/Federal	County	Town
Reviews/establishes stormwater management or drainage criteria	Agency:			
	Contact Name:			
	Phone No.:			
Provides fire protection and fire protection code enforcement	Agency:			
	Contact Name:			
	Phone No.:			
Oversees buffer ordinance	Agency:			
	Contact Name:			
	Phone No.:			
Oversees wetland protection	Agency:			
	Contact Name:			
	Phone No.:			
Establishes grading requirements or oversees erosion and sediment control program	Agency:			
	Contact Name:			
	Phone No.:			
Reviews/approves septic systems	Agency:			
	Contact Name:			
	Phone No.:			
Reviews/approves utility plans (e.g., water and sewer)	Agency:			
	Contact Name:			
	Phone No.:			
Reviews/approves forest conservation/ tree protection plans?	Agency:			
	Contact Name:			
	Phone No.:			

Development Feature	*Your Local Criteria*

1. Street Width

What is the minimum pavement width allowed for streets in low density residential developments that have less than 500 average daily trips (ADT)? _____ feet

*If your answer is between **18-22 feet**, give yourself **4** points* ☞ [ ]

At higher densities are parking lanes allowed to also serve as traffic lanes (i.e., queuing streets)? YES/NO

*If your answer is **YES**, give yourself **3** points* ☞ [ ]

2. Street Length

Do street standards promote the most efficient street layouts that reduce overall street length? YES / NO

*If your answer is **YES**, give yourself **1** point* ☞ [ ]

3. Right-of-Way Width

What is the minimum right of way (ROW) width for a residential street? _____ feet

*If your answer is **less than 45 feet**, give yourself **3** points* ☞ [ ]

Does the code allow utilities to be placed under the paved section of the ROW? YES / NO

*If your answer is **YES**, give yourself **1** point* ☞ [ ]

4. Cul-de-Sacs

What is the minimum radius allowed for cul-de-sacs? _____ feet

*If your answer is **less than 35 feet**, give yourself **3** points* ☞ [ ]

*If your answer is **36 feet to 45 feet**, give yourself **1** point* ☞

Can a landscaped island be created within the cul-de-sac? YES / NO

*If your answer is **YES**, give yourself **1** point* ☞ [ ]

Are alternative turn arounds such as "hammerheads" allowed on short streets in low density residential developments? YES / NO

*If your answer is **YES**, give yourself **1** point* ☞ [ ]

Community Codes and Ordinances Worksheet *Subtotal Page 15* [ ]

5. Vegetated Open Channels

Are curb and gutters required for most residential street sections? YES / NO

*If your answer is **NO**, give yourself **2 points*** ☞

Are there established design criteria for swales that can provide stormwater quality treatment (i.e., dry swales, biofilters, or grass swales)? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞

6. Parking Ratios

What is the minimum parking ratio for a professional office building (per 1000 ft^2 of gross floor area)? _____ spaces

*If your answer is **less than 3.0 spaces**, give yourself **1 point*** ☞

What is the minimum required parking ratio for shopping centers (per 1,000 ft^2 gross floor area)?

*If your answer is **4.5 spaces or less**, give yourself **1 point*** ☞

What is the minimum required parking ratio for single family homes (per home)? _____ spaces

*If your answer is **less than or equal to 2.0 spaces**, give yourself **1 point*** ☞

Are your parking requirements set as maximum or median (rather than minimum) requirements? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞

7. Parking Codes

Is the use of shared parking arrangements promoted? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞

Are model shared parking agreements provided? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞

Are parking ratios reduced if shared parking arrangements are in place? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞

If mass transit is provided nearby, is the parking ratio reduced? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞

Community Codes and Ordinances Worksheet *Subtotal Page 16*

8. Parking Lots

What is the minimum stall width for a standard parking space? _____ feet

*If your answer is **9 feet or less**, give yourself **1** point* ☞ [ ]

What is the minimum stall length for a standard parking space? _____ feet

*If your answer is **18 feet or less**, give yourself **1** point* ☞ [ ]

Are at least 30% of the spaces at larger commercial parking lots required to have smaller dimensions for compact cars? YES / NO

*If your answer is **YES**, give yourself **1** point* ☞ [ ]

Can pervious materials be used for spillover parking areas? YES / NO

*If your answer is **YES**, give yourself **2** points* ☞ [ ]

9. Structured Parking

Are there any incentives to developers to provide parking within garages rather than surface parking lots? YES / NO

*If your answer is **YES**, give yourself **1** point* ☞ [ ]

10. Parking Lot Runoff

Is a minimum percentage of a parking lot required to be landscaped? YES / NO

*If your answer is **YES**, give yourself **2** points* ☞ [ ]

Is the use of bioretention islands and other stormwater practices within landscaped areas or setbacks allowed? YES / NO

*If your answer is **YES**, give yourself **2** points* ☞ [ ]

Time to Assess: Principles 1 - 10 focused on the codes, ordinances, and standards that determine the size, shape, and construction of parking lots, roadways, and driveways in the suburban landscape. There were a total of **40** points available for Principles 1 - 10. What was your total score?

Subtotal Page 15 _____ +Subtotal Page 16 _____ +Subtotal Page 17 _____ = [ ]

Where were your codes and ordinances most in line with the principles? What codes and ordinances are potential impediments to better development?

_____

_____

_____

_____

11. Open Space Design

Are open space or cluster development designs allowed in the community? YES / NO [ ]

*If your answer is **YES**, give yourself **3** points* ☞

*If your answer is **NO**, skip to question No. 12*

Is land conservation or impervious cover reduction a major goal or objective of the open space design ordinance? YES / NO [ ]

*If your answer is **YES**, give yourself **1** point* ☞

Are the submittal or review requirements for open space design greater than those for conventional development? YES / NO [ ]

*If your answer is **NO**, give yourself **1** point* ☞

Is open space or cluster design a by-right form of development? YES / NO [ ]

*If your answer is **YES**, give yourself **1** point* ☞

Are flexible site design criteria available for developers that utilize open space or cluster design options (e.g, setbacks, road widths, lot sizes) YES / NO [ ]

*If your answer is **YES**, give yourself **2** points* ☞

Community Codes and Ordinances Worksheet *Subtotal Page 18* [ ]

12. Setbacks and Frontages

Are irregular lot shapes (e.g., pie-shaped, flag lots) allowed in the community? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

What is the minimum requirement for front setbacks for a **one half (½) acre** residential lot? _____ feet

*If your answer is **20 feet or less**, give yourself **1 point*** ☞ [ ]

What is the minimum requirement for rear setbacks for a **one half (½) acre** residential lot? _____ feet

*If your answer is **25 feet or less**, give yourself **1 point*** ☞ [ ]

What is the minimum requirement for side setbacks for a **one half (½) acre** residential lot? _____ feet

*If your answer is **8 feet or less**, give yourself **1 points*** ☞ [ ]

What is the minimum frontage distance for a **one half (½) acre** residential lot? _____ feet

*If your answer is **less than 80 feet**, give yourself **2 points*** ☞ [ ]

13. Sidewalks

What is the minimum sidewalk width allowed in the community? _____ feet

*If your answer is **4 feet or less**, give yourself **2 points*** ☞ [ ]

Are sidewalks always required on both sides of residential streets? YES / NO

*If your answer is **NO**, give yourself **2 points*** ☞ [ ]

Are sidewalks generally sloped so they drain to the front yard rather than the street? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

Can alternate pedestrian networks be substituted for sidewalks (e.g., trails through common areas)? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

14. Driveways

What is the minimum driveway width specified in the community?

*If your answer is **9 feet or less (one lane) or 18 feet (two lanes)**, give yourself **2 points*** ☞ [ ]

Community Codes and Ordinances Worksheet *Subtotal Page 19* [ ]

Can pervious materials be used for single family home driveways (e.g., grass, gravel, porous pavers, etc)? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞ [ ]

Can a "two track" design be used at single family driveways? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

Are shared driveways permitted in residential developments? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

15. Open Space Management

Skip to question 16 if open space, cluster, or conservation developments are not allowed in your community.

Does the community have enforceable requirements to establish associations that can effectively manage open space? YES/NO

*If your answer is **YES**, give yourself **2 points*** ☞ [ ]

Are open space areas required to be consolidated into larger units? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

Does a minimum percentage of open space have to be managed in a natural condition? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

Are allowable and unallowable uses for open space in residential developments defined? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

Can open space be managed by a third party using land trusts or conservation easements? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞ [ ]

16. Rooftop Runoff

Can rooftop runoff be discharged to yard areas? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞ [ ]

Do current grading or drainage requirements allow for temporary ponding of stormwater on front yards or rooftops? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞ [ ]

Community Codes and Ordinances Worksheet *Subtotal Page 20* [ ]

Time to Assess: Principles 11 through 16 focused on the regulations which determine lot size, lot shape, housing density, and the overall design and appearance of our neighborhoods. There were a total of **36** points available for Principles 11 - 16. What was your total score?

Subtotal Page 18 _____ +Subtotal Page 19 _____ +Subtotal Page 20 _____ = [ ]

Where were your codes and ordinances most in line with the principles? What codes and ordinances are potential impediments to better development?

_____

_____

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_____

17. Buffer Systems

Is there a stream buffer ordinance in the community? YES / NO

*If your answer is **YES**, give yourself **2** point* ☞ [ ]

If so, what is the minimum buffer width? _____ feet

*If your answer is **75 feet or more**, give yourself **1** point* ☞ [ ]

Is expansion of the buffer to include freshwater wetlands, steep slopes or the 100-year floodplain required? YES / NO

*If your answer is **YES**, give yourself **1** point* ☞ [ ]

18. Buffer Maintenance

If you do not have stream buffer requirements in your community, skip to question No. 19

Does the stream buffer ordinance specify that at least part of the stream buffer be maintained with native vegetation? YES / NO

*If your answer is **YES**, give yourself **2** points* ☞ [ ]

Community Codes and Ordinances Worksheet *Subtotal Page 21* [ ]

Does the stream buffer ordinance outline allowable uses? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞

Does the ordinance specify enforcement and education mechanisms? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞

19. Clearing and Grading

Is there any ordinance that requires or encourages the preservation of natural vegetation at residential development sites? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞

Do reserve septic field areas need to be cleared of trees at the time of development? YES / NO

*If your answer is **NO**, give yourself **1 point*** ☞

20. Tree Conservation

If forests or specimen trees are present at residential development sites, does some of the stand have to be preserved? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞

Are the limits of disturbance shown on construction plans adequate for preventing clearing of natural vegetative cover during construction? YES / NO

*If your answer is **YES**, give yourself **1 point*** ☞

21. Land Conservation Incentives

Are there any incentives to developers or landowners to conserve non-regulated land (open space design, density bonuses, stormwater credits or lower property tax rates)? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞

Is flexibility to meet regulatory or conservation restrictions (density compensation, buffer averaging, transferable development rights, off-site mitigation) offered to developers? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞

22. Stormwater Outfalls

Is stormwater required to be treated for quality before it is discharged? YES / NO

*If your answer is **YES**, give yourself **2 points*** ☞

Development Feature	*Your Local Criteria*
Are there effective design criteria for stormwater best management practices (BMPs)?	YES / NO
*If your answer is **YES**, give yourself **1** point* ☞	
Can stormwater be directly discharged into a jurisdictional wetland without pretreatment?	YES / NO
*If your answer is **NO**, give yourself **1** point* ☞	
Does a floodplain management ordinance that restricts or prohibits development within the 100 year floodplain exist?	YES / NO
*If your answer is **YES**, give yourself **2** points* ☞	

Time to Assess: Principles 17 through 22 addressed the codes and ordinances that promote (or impede) protection of existing natural areas and incorporation of open spaces into new development. There were a total of **24** points available for Principles 17 - 22. What was your total score?

Subtotal Page 21 _____ +Subtotal Page 22 _____ +Subtotal Page 23_____ = [ ]

Where were your codes and ordinances most in line with the principles? What codes and ordinances are potential impediments to better development?

_____

_____

_____

_____

To determine final score, add up subtotal from each **Time to Assess**

Principles 1 - 10 (Page 18)	_____
Principles 11 - 16 (Page 21)	_____
Principles 17 - 22 (Page 23)	_____
TOTAL	[ ]

SCORING (A total of **100** points are available):

See Page 10 to determine where your community's score places in respect to the site planning roundtable Model Development Principles:

Your Community's Score		
90- 100	☞	Congratulations! Your community is a real leader in protecting streams, lakes, and estuaries. Keep up the good work.
80 - 89	☞	Your local development rules are pretty good, but could use some tweaking in some areas.
79 - 70	☞	Significant opportunities exist to improve your development rules. Consider creating a site planning roundtable.
60 - 69	☞	Development rules are inadequate to protect your local aquatic resources. A site planning roundtable would be very useful.
less than 60	☞	Your development rules definitely are not environmentally friendly. Serious reform of the development rules is needed.

APPENDIX D

Lower DuPage River Watershed Plan
Ordinance Review – Summary of Results

Background and Purpose

The purpose of this review is to evaluate the ordinances of the communities in the Lower DuPage River Watershed. The particular focus is how well the ordinances control the effects of development on water quality, hydrology, and aquatic habitat. In addition, the review considers ordinance provisions for sustainable development that can promote overall watershed health.

The ordinance review began with the development checklist to provide an objective template for the review of stormwater, subdivision, zoning, and related development ordinances. The checklist emphasizes key stormwater provisions, including detention, floodplain, erosion control, and stream/wetland protection. It also looks at relevant subdivision, zoning, landscaping, and conservation design provisions, if present.

This checklist is very similar to a checklist that was applied to the Hickory Creek watershed. It is based on a combination of local, regional, and national ordinances and resources, including:

- NIPC *Facility Planning Area Nonpoint Source Management* checklist
- Conservation-based provisions of local municipal ordinances, countywide stormwater ordinances, and other municipal or county conservation design ordinances
- NIPC/CMAP *Ecological Planning and Design Directory* (http://www.chicagowilderness.org/sustainable/directory_documents.php)
- *Blackberry Creek Watershed: Zoning Code Analysis and Ordinance Language Recommendation* report (Kane County, 2004, http://www.co.kane.il.us/kcstorm/blackberry/zoning/FinalReport.pdf)
- U.S. EPA *Water Quality Scorecard* (http://www.epa.gov/smartgrowth/pdf/2009_1208_wq_scorecard.pdf)
- Center for Watershed Protection, *Better Site Design (Code and Ordinance Worksheet and related publications)* (http://www.northinlet.sc.edu/training/media/resources/Better%20Site%20Design%20SW%20Code%20Ordinance%20Worksheet.pdf)

The ordinance review considers five major topical areas. These include:

1) Comprehensive Stormwater Standards
   a. Stormwater drainage and detention
   b. Soil erosion and sediment control
   c. Floodplain management
   d. Stream and wetland protection

2) Natural Area Standards

3) Landscaping Standards

4) Impervious Area Reduction: Street and Parking Requirement
5) Conservation Design: Zoning/Subdivision Standards

The review was performed for the following communities, as well as for the countywide *Will County Stormwater Management Ordinance*.

- Bolingbrook
- Channahon
- Crest Hill
- Joliet
- Minooka
- Naperville
- Plainfield
- Romeoville
- Shorewood
- Will County (unincorporated)

Results and Recommendations

1. Comprehensive Stormwater Standards

Will County has a well-written countywide stormwater ordinance that primarily focuses on the prevention of increased flood damages associated with stormwater quantity and floodplain development. This ordinance is not intended, however, to address water quality, natural hydrology, or aquatic resources of streams and wetlands. All watershed communities in Will County are required to have adopted stormwater standards that are at least equivalent to the countywide ordinance.

Survey Results -- Stormwater: The majority of the ordinances embrace protection of water quality and hydrology in their purpose statements. However, the ordinances are split over the level of encouragement or requirement of runoff BMPs. The majority of ordinances are strong in the following categories:

- Limiting discharge rates from the 2-year storm;
- Prohibiting detention in the floodway and limiting onstream detention;
- Prohibiting the discharge of undetained stormwater into wetlands; and
- Requiring maintenance plans for detention facilities.

Areas where significant improvements could be achieved in most ordinances include:

- Encouraging or requiring stormwater runoff BMPs and designs such as bio-swales, filter strips, permeable paving, and green roofs;
- Providing detention credit for practices such as permeable paving that store runoff in sub-surface void spaces of stone sub-bases;
- Requiring “naturalized” wet-bottom or wetland detention basins;
- Including numerical water quality performance criteria; and
- Specifying performance standards for maintenance of detention facilities.

Survey Results – Soil Erosion and Sediment Control: Most of the ordinances have relatively strong purpose statements for minimizing erosion. The majority of communities have adopted NIPC model ordinance language for site planning principles and specific site design requirements for sediment and erosion control. Most of the ordinances require routine maintenance and inspection and include a range of penalties for non-compliance. One area where significant improvement could be achieved in most ordinances is the addition of a specific reference to the *Illinois Urban Manual*.

Survey Results – Floodplain Management: Nearly all ordinances include strong purpose statements addressing water quality and aquatic habitat and also discourage stream channel modifications and require mitigation for unavoidable water quality or habitat impacts. However, most of the ordinances do not limit appropriate uses of the floodway to the NIPC-recommended list (e.g., they allow uses such as parking lots).

Survey Results – Stream and Wetland Protection: The ordinances are widely varying in their approach to stream and wetland protection. About half of the communities – including Minooka, Romeoville, Plainfield, Crest Hill, and Will County -- have adopted standards regarding wetland protection, generally based on provisions of the NIPC *Model Stream and Wetland Protection Ordinance*. Most of the ordinances have some basic provisions for pretreatment of stormwater prior to discharge into a wetland, protection of a 25-foot buffer strip adjacent to wetlands and stream channels, and prohibiting watercourse re-location except in special circumstances. None of the ordinance specifically encouraged stream restoration opportunities or appeared to have streamlined ordinance provisions to facilitate such projects.

Stormwater Ordinance Recommendations: All communities should strive to adopt comprehensive standards for the protection of water resources and related aquatic resources. In particular, ordinances should go beyond a core emphasis on stormwater rate and quantity, as required in the countywide *Will County Stormwater Management Ordinance*, to also emphasize holistic protection of water quality, natural hydrology, and aquatic habitat. These items can be addressed through an integrated approach to stormwater drainage and detention, soil erosion and sediment control, floodplain management, and stream and wetland protection.

This can largely be achieved by the adoption of the provisions of the following Northeastern Illinois Planning Commission (NIPC) model ordinances, as some watershed communities have already done. These ordinances can be found on the website of the Chicago Metropolitan Agency for Planning (CMAP) at: http://www.cmap.illinois.gov/wastewater-committee/about-fpa-requests.

- *Model Stormwater Drainage and Detention Ordinance*.
- *Model Soil Erosion and Sediment Control Ordinance*, 1991.
- *Model Floodplain Ordinance for Communities Within Northeastern Illinois*, 1996.
- *Model Stream and Wetland Protection Ordinance*, 1988.

Communities can acquire copies of ordinances from their neighboring municipalities. Alternatively, communities may wish to consider the provisions of the countywide stormwater ordinances of DuPage, Kane, Lake, and/or McHenry Counties. All of these countywide ordinances, to varying degrees, incorporate provisions addressing water quality, hydrology, and

aquatic habitat. If this latter approach is taken, it may be appropriate to for the Lower DuPage River Watershed communities to coordinate with other Will County communities to discuss possible changes and improvement to the countywide *Will County Stormwater Management Ordinance*. In particular, the communities in the Hickory Creek watershed also are engaging in an ongoing watershed planning process and may be supportive of this approach.

2. Natural Area Standards

This section focuses on protection, restoration, and management of natural areas. These recommendations address *remnant* landscapes as well as *restored/created* natural areas. Many of the municipal stormwater ordinances already address, to varying degrees, protection of streams, lakes, and wetlands and establishment of appropriate buffers. However, these ordinances do not specifically address associated upland natural areas – such as prairies, savannas, woodlands, steep slopes, sensitive recharge areas, and hydric soils – that buffer aquatic systems and provide critical landscape linkages for aquatic life and wildlife.

Survey Results: Very few of the ordinances include any provisions requiring the protection and management of natural areas, apart from streams and wetlands. The primary exceptions are Plainfield and Will County whose ordinances include natural area protection provisions, but only for conservation design subdivisions. These communities also have provisions for funding the long-term maintenance and management of protected natural areas and open spaces in developments. In addition, several communities have planned development provisions that allow clustering of residential around sensitive natural areas. While most of the communities do have some type of open space set-aside, most are not specifically focused on natural areas such as woodlands, wetlands, and prairies. About half of the ordinances also have requirements for identifying the ownership and long-term oversight of open space parcels associated with new developments.

Natural Area Protection Recommendations: All communities are encouraged to identify and inventory their natural resources and open spaces, including the various features referenced above. This can lead to the mapping of a community-wide (or watershed-wide) **"**green infrastructure" network that identifies aquatic and upland resources to be protected, along with appropriate buffers. This could be accomplished, for example, via a series of "natural area overlay districts." Identified natural areas could be protected via strict development prohibitions or through flexible zoning that allows for clustering around sensitive natural areas. Specific standards should address natural area identification, allowable uses and cover within the natural area, buffer transitions, and other design elements. These regulatory protections could be supplemented by the acquisition programs of park and forest preserve districts.

In addition, preparation of short- and long-term management plans should be required for designated natural areas. Further, vegetative performance criteria, qualified ownership and management entities, conservation easement provisions, and revenue sources for management activities should be clearly spelled out. Watershed communities should consider the progressive ordinance provisions of neighboring communities, such as Plainfield and Will County. Alternatively, a recently adopted conservation design ordinance in McHenry County is an excellent model to follow. See:
http://www.co.mchenry.il.us/departments/planninganddevelopment/Documents/Ordinances/Cons

ervation%20Design%20Addendum.pdf . This subject is further addressed below under Conservation Design Standards.

3. Landscaping Standards

Natural landscaping can greatly benefit the preservation of water quality and natural hydrology. Natural landscaping can be encouraged and/or required, where appropriate, in common areas in lieu of conventional turf grass landscapes. It also can be specifically targeted to BMP applications, such as bio-infiltration swales, rain gardens, filter strips, and naturalized detention basins.

Unfortunately, some landscaping ordinances may (unintentionally) discourage the use of natural landscaping via "weed" prohibition language. Some ordinances also require the physical separation of pervious and impervious surfaces on site, thereby effectively preventing runoff from impervious surfaces flowing onto pervious areas. A common example is the requirement to install raised landscape islands (vs. recessed islands) in parking lots.

Survey Results: Only a few watershed communities, including Minooka, Plainfield, and Will County, actively encourage the use of native vegetation for common areas in new developments. Several other communities encourage or require natural landscaping around naturalized detention facilities. Only Will County, however, has specific requirements for the long-term oversight, management, and funding of created natural landscapes. About half of the communities – including Bolingbrook, Channahon, Naperville, Romeoville, and Will County -- have tree protection and replacement requirements, and nearly all require planting of street trees. While the majority of communities have requirements for pervious landscaped areas associated with parking lots, none of them encourage the use of recessed landscape islands for stormwater filtering and infiltration.

Landscaping Recommendations: Landscaping ordinances should encourage the use of deep-rooted natural landscaping, where appropriate, in lieu of conventional, shallow-rooted turf grass landscaping. In particular, it is recommended that natural landscaping be required in detention basins and natural area buffers and encouraged in common areas and open spaces such as in conservation developments. Further, ordinances should include specific provisions for the maintenance of natural landscapes, including performance criteria. As a starting point, communities interested in upgrading their natural landscaping requirements should consider the Will County landscape maintenance provisions. A more detailed reference for natural landscape design and maintenance criteria is *Natural Landscaping for Local Officials: Design and Management Guidelines* (NIPC, 2004), which can be found at http://www.chicagowilderness.org/sustainable/naturallandscaping/installation_maintenance_guide.pdf .

Landscaping ordinances also should encourage and/or require the integration of pervious, landscaped areas with the impervious areas of the site to facilitate the routing of runoff across and through landscaped areas. Language to specifically allow or require integration of bio-infiltration into parking lot islands and street side landscape strips is recommended. Unfortunately, there are relatively few local ordinances that address this topic effectively. A suggested reference for ordinance approaches is the *Conservation Design Resource Manual*

(NIPC, 2003), which can be found at:
http://www.chicagowilderness.org/sustainable/conservationdesign/Manual/Conservation_Design_Resource_Manual.pdf .

Tree protection language is recommended to provide protection of desirable (e.g., native) trees and shrubs. Flexibility should be provided to allow removal of trees where appropriate for proper forest/natural area management, along with the inclusion of replacement criteria for the unavoidable removal of desirable species. There are a number of good local tree protection ordinances to model, including those referenced above.

4. Impervious Area Reduction: Street and Parking Requirements

A substantial portion of the impervious surface area in our communities is associated with streets and highways. Limiting the amount of impervious cover to that which is necessary is a key to reducing stormwater runoff, lowering installation and replacement costs, and encouraging ecologically sensitive design.

Similarly, parking facilities often create large impervious surfaces that result in an increase in stormwater runoff and related water quality impacts. Reduced parking area and alternative porous paving materials can help to reduce impervious surfaces and facilitate infiltration and groundwater recharge.

Survey Results: Nearly all of the watershed communities have taken a traditional approach to the planning and sizing of streets and parking lots. Correspondingly, there are relatively few examples of approaches that attempt to reduce impervious surface area associated with streets and parking lots. Some more specific findings are highlighted below.

Only Will County has provisions for narrow streets (24 feet for local streets). Other community requirements generally range from 28 to 36 feet (measured at back of curb) for residential neighborhoods. Parking standards – stall size and number of space -- vary significantly among communities. Permeable paving is not explicitly recognized as an option in any community. Several communities allow for shared parking to reduce new parking requirements, notably Crest Hill, Joliet, Channahon, Shorewood, Plainfield, and Will County. Plainfield also has flexible parking provisions to encourage downtown re-development.

Impervious Area Reduction Recommendations: It is recommended that communities evaluate their ordinances and consider revised design standards for narrower street widths, along with allowances for street designs that utilize naturalized stormwater infiltration and conveyance systems. Also, since stream crossings can cause significant stream impacts, recommended standards related to the number of crossings and the design of crossings should be considered.

Parking standards should be updated to allow for shared parking, parking credit programs (i.e., purchasing credits for public parking in lieu of creating private spaces), and preferred parking for compact cars and non-motorized vehicles. Parking stall dimensions should also be reevaluated, along with consideration of reducing required stall length to account for vehicle overhang onto landscape islands or perimeter landscaping. Specific language to allow permeable paving

technology, such as interlocking concrete pavers, porous asphalt, and porous concrete, should be considered for parking lots, driveways, and streets.

With the exceptions noted above, there are relatively few local ordinances that address this topic effectively. A suggested reference for ordinance approaches is the *Conservation Design Resource Manual* (NIPC, 2003), which can be found at: http://www.chicagowilderness.org/sustainable/conservationdesign/Manual/Conservation_Design_Resource_Manual.pdf .

5. Conservation Design: Zoning/Subdivision Standards

Some of the approaches and standards discussed above may be inconsistent with existing zoning and subdivision codes. Therefore, greater flexibility is needed in existing codes to allow, encourage, and/or require conservation-based site designs. This can provide a number of benefits, including allowing additional room for the incorporation BMPs; reducing mass grading; allowing shorter street networks; and protecting natural areas and open space without reducing the number of lots.

Conservation design provides the best framework for preserving sensitive natural areas, including stream corridors and wetlands. Conservation design would ideally incorporate a site design process that:

- Identifies sensitive natural resources and conservation areas;
- Locates buildable areas to minimize impacts on natural areas and to take advantage of open space and scenic views;
- Designs the street network to minimize encroachment in sensitive natural areas; and
- Establishes lot lines and lot sizes following a cluster development approach.

Survey Results: None of the ordinances reviewed require conservation design. Two ordinances, Plainfield and Will County, specifically designate conservation design as an allowable form of development. These communities also offer incentives for conservation design by providing potential density bonuses. Further, the Will County ordinance has specific requirements for percentage of open space, ranging from 30-60 percent, in its conservation subdivisions.

Most other communities allow for flexible subdivision designs via “planned development” provisions. Some, like Romeoville, specifically recommend natural resource and open space protection in their planned development provisions.

Conservation Design Recommendations: Conservation design should be encouraged or required in community zoning and/or subdivision codes, particularly in communities where development is projected in areas that contain significant natural resources. Communities should also consider offering density bonuses to encourage conservation design elements that exceed minimum ordinance requirements.

Communities choosing to embrace conservation design should evaluate existing ordinances, such as the Will County and Plainfield ordinances that allow conservation development by right. Communities should also consider more aggressive approaches that mandate conservation design for some types of development. One suggested approach is the Homer Glen conservation design

ordinance that mandates conservation design and common open space for most new residential development. Another approach, embodied in recent ordinances adopted by McHenry County, Woodstock, and Algonquin, mandated conservation design on sites that contain significant natural resources. These ordinances contain a specific trigger mechanism. The McHenry County conservation design ordinance is perhaps the most thorough and can be found at: http://www.co.mchenry.il.us/departments/planninganddevelopment/Documents/Ordinances/Conservation%20Design%20Addendum.pdf . The previously referenced Conservation Design Resource Manual also should be evaluated for ordinance suggestions.

Summary and Conclusions

Most of the individual municipal and county (unincorporated) ordinances exceed the minimum requirements of the Will County countywide *Stormwater Management Ordinance* in their protection of water quality, hydrology, and aquatic resources. Overall, there is a high degree of variability in the requirements of the various ordinances. A number of communities have embraced relatively progressive standards with respect to watershed protection priorities and sustainability, while other communities have relatively basic, traditional requirements.

With respect to subdivision, zoning, and landscaping ordinances, there also is considerable variability in provisions that are relevant to watershed protection. In nearly every ordinance category that was reviewed, there were generally at least one or two communities with standards that could be used as models for other communities that may desire to upgrade their own standards. Overall, though, the subdivision and zoning codes do not recognize non-traditional design practices such as natural landscaping, bio-infiltration, and permeable paving. It may be possible to utilize such approaches, but developers will generally need to proceed with variances or planned development approaches.

Numerous specific recommendations for ordinance improvements have been made above. It is understood that substantial ordinance improvements may be a challenge in many communities because of limited staffing and resources. At the same time, there are significant arguments in support of ordinance updates, beyond the obvious watershed protection benefits. Some of these are highlighted below.

- Most existing municipal codes are relatively prescriptive, encouraging or requiring traditional “gray infrastructure” design approaches. By providing greater ordinance flexibility and removing existing *barriers* to preferred “green infrastructure” designs, developers are more likely to willingly implement non-traditional BMP designs.
- Municipalities can provide *incentives* for innovation and sustainability. For example, stormwater detention credits can be applied to stormwater storage under permeable paving and density bonuses can be offered for non-traditional conservation designs.
- Communities can offer encouragement and flexibility during the annexation process to facilitate the consideration and inclusion of BMPs and watershed-friendly design approaches for new development.

- Communities can educate landowners and developers regarding the *cost-effectiveness* of watershed-friendly development and redevelopment. For example, recent evidence suggests that green infrastructure designs like permeable paving often have longer lives that traditional designs and, hence, lower life-cycle costs. Similarly, clustered conservation design subdivisions have been shown to have significantly lower infrastructure costs than conventional subdivisions.
- Progressive municipalities can be role models for developers. Currently, there are funding programs, like the IEPA Green Infrastructure Grants Program and Section 319 Nonpoint Source grants, that can enable municipalities to implement green infrastructure designs for new or retrofitted infrastructure and facilities.
- Help in updating ordinances is available from multiple sources. In addition to the specific references cited above, municipalities can seek assistance from CMAP and other local and regional resource organizations.
- If ordinance changes are done cooperatively with other communities on a watershed or countywide scale, a “level playing field” is preserved from the perspective of developers.
- A strong case can be made that preservation of natural resources through green infrastructure designs, conservation development, and open space and greenway preservation, can also enhance community character and quality of life. This, in turn, can attract desirable businesses and sustainable residential development.

APPENDIX E

Pollution Load Analysis

References

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Mitasova and Mitas: Modeling soil detachment with RUSLE3d using GIS, 1999; University of Illinois. http:/skagit.meas.ncsu.edu/~helena/gmslab/erosion/usle.html

Tetra Tech, Inc. 2006. Users Guide Spreadsheet Took for the Estimation of Pollutant Load (STEPL) Version 4.0, U.S. Environmental Protection Agency.

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U.S. Environmental Protection Agency. 2010. Polluted Runoff (Nonpoint Source Pollution). http://www.epa.gov/nps.

U.S. Environmental Protection Agency. 2002. Urban Stormwater BMP Performance Monitoring: A Guidance Manual for Meeting the National Stormwater BMP Database Requirements.

Schueler, T.R. 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Publ. No. 87703. Metropolitan Washington Council of Governments, Washington, DC.

Supplemental Non-Point Source Model Details

Formulas and selected variables were derived from STEPL (Spreadsheet Tool for Estimation of Pollutant Load) Version 3, Tetra Tech, 2004. For Coliform, Schueler's Simple Method (1987) was modified for calculating bacterial loads. The 2005 CMAP landuse layer was updated based on an interpretation of 2008 imagery to reflect changes in landuse.

Pollutant Model Values:

Model	Rain days	Correction Factor (precipitation)	Curve Number (by soil hydrologic group)	Runoff (by soil hydrologic group in inches)	N concentration in sediment (only used for erosion from ag. Ground)	P concentration in sediment (only used for erosion from ag. Ground)	EMC for N, P, Chloride, TSS, Coliform
All landuse	103.5 (used Will County data)	0.431	See attached table	Calculated using the following equation: $Q = \frac{((P-(IaXS))^2}{P + 0.8 X S}$ $S = \frac{1000}{CN} - 10$ Q = Runoff (inches) P = Precipitation (inches S = Potential max retention (inches CN = Curve Number Ia = Initial abstraction factor (set to 0)	0.0016 %	0.00062 %	See attached table

The following equations are incorporated into the model to estimate non-point source loadings:

Annual Runoff (ac/ft) = runoff (in) / 12 * area (acres) * rain days * correction factor

Pollutant Runoff (N, P, TSS, Chloride) = annual runoff * EMC * 4047 * 0.3048/454

Pollutant Runoff for Coliform = $1.03 X 10^{-2}$ * annual runoff * EMC

Sediment Nutrients = % soil concentration * total erosion with delivery ratio * 2000

RUSLE Soil Loss Model

Methodology modified by Jeff Boeckler from: Mitasova and Lubos Mitas: Modeling soil detachment with RUSLE3d using GIS, 1999; University of Illinois. http:/skagit.meas.ncsu.edu/~helena/gmslab/erosion/usle.html

- Obtained 1:24,000 SSURGO Digital Soils.
- Appropriate soil types selected and relevant RUSLE factors identified and calculated from SSURGO soils dataset.

GIS procedure:

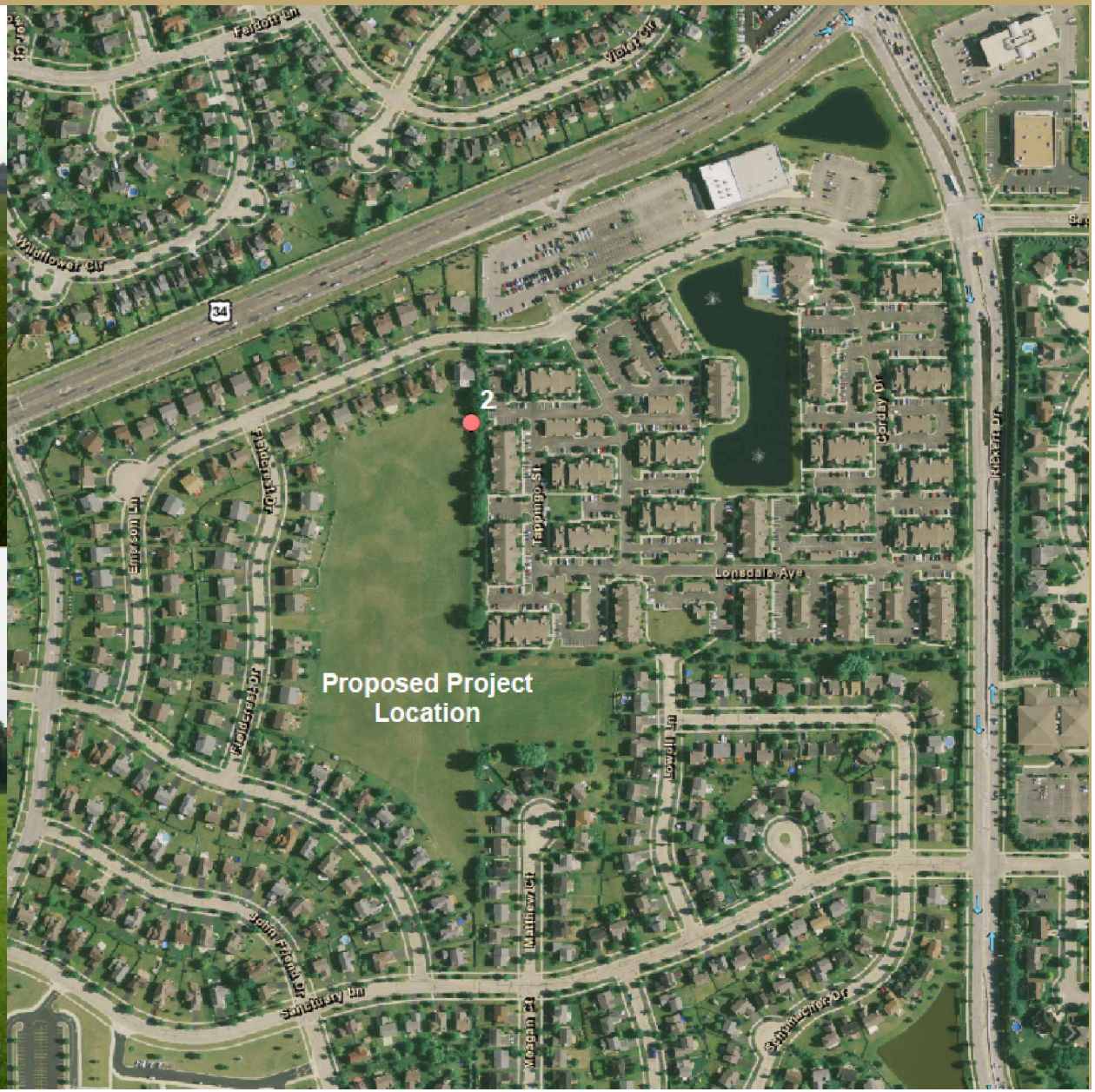
1) RUSLE factors

C factor	K factor	LS factor	R factor	P factor
A and B slopes = 0.21 C and D slopes = 0.1 E, F, G slopes = 0.001	Values included in SSURGO tabular data	Values included in SSURGO tabular data; calculated from slope and slope length values	USDA values for each county	1 used for all soil polygons

2) RUSLE equation was run on shapefiles multiplying LS, R, K, C, and P.
3) Applied Delivery Ratio; 0.21 and calculated total soil loss

BMP Location ID	Property Location	Municipality	County	BMP Type	Landowner	Nitrogen (lb)	Phosphor	Sediment	Chloride (lb)	Fecal coliform	Project cost
2	Southeast of Emerson Lane and Fieldcrest Drive	Naperville	DuPage	Wetland	Ivy Ridge Homeowners Associat	390	78	9.2	23,291	755	$463,750
7	Northeast of Rickert Drive and South River Road	Naperville	DuPage	Wetland	The Fields Community c/o 1st U	55	9	0.6	3,586	120	$218,750
8	Southwest of 87th Street and Book Road	Naperville	Will	Wetland	Stillwater Homeowners Associat	49	8	0.6	3,700	122	$75,800
9	Southwest of 87th Street and Foxboro Lane	Naperville	Will	Wetland	Stillwater Homeowners Associat	75	12	0.9	5,929	194	$135,625
11	Southeast of 95th Street and Naperville./Plainfield Roa	Naperville	Will	Streambank	Naperville Park District	31	5	0.4	3,314	42	$126,750
12	th Street and Knoch Knolls Road	Unincorporate	Will	Wetland	Mark R. & Denise L. Burke	69	11	0.9	3,267	66	$157,500
13	Southeast of Route 53 and Rockhurst Road	Bolingbrook	Will	Streambank	Bolingbrook Park District	111	28	16.9	6,528	61	$120,375
19	Northwest of Heggs Road and West Kelly Court	Unincorporate	Will	WASCB or	J. Greene TR 1099397	151	20	19	23	42	$47,875
20	Southeast of Wooley Road and Stewart Road	Unincorporate	Kendall	Grassed	J. Greene TR 1105082	214	39	36.8	1,216	71	$286,888
23	Southwest of 119th Street and Naper Plainfield Road	Plainfield	Will	Wetland	Plainfield CC Schools School Dist	49	10	2.2	2,308	26	$367,500
27	Northwest of Frontier Land and Mustang Road	Unincorporate	Will	Concrete Ditch	Plainfield Township Park District	73	11	0.8	3,532	76	$164,794
	Feeney Drive and Lexington Drive	Unincorporate	Will	Wetland	Plainfield Township	320	62	8.7	18,351	477	$25,463
30	Northwest of Feeney Drive and Howard Street	Plainfield	Will	Wetland	Plainfield Property Managemen	320	62	8.7	18,351	477	$25,463
33	West of County Line Road and Reflection Drive	Unincorporate	Kendall	WASCB	Schroeder Agricultural Invest	121	29	27.1	17	24	$2,813
34	Northwest of Green Trails Drive and Phelps Land	Joliet	Will	Wetland	First Midwest Bank TR6697 c/o	154	28	2.1	12,327	401	$275,625
37	East of Rushwood Avenue and Greenfield Road	Shorewood	Will	Stream	Village of Shorewood Countryw	56	10	0.7	4,341	142	$81,250
39	**Southwest of Ravinia Drive and Oxford Land**	**Shorewood**	**Will**	**Wetland**	**Village of Shorewood dry botto**	**225**	**45**	**12.6**	**7,051**	**246**	**$39,375**
40	Southwest of Seil Road and South River Road	Shorewood	Will	Wetland	Kipling Estates Homeowners As	55	10	0.7	4,443	145	$118,125
Cumberland Pond	Between Cumberland Lane and Canterbury Lane	Bolingbrook	Will	Streambank	Village of Bolingbrook	26	13	12.8	0	0	$200,000
Blackhawk Pond	Blackhawk Drive west of Schmidt Road	Bolingbrook	Will	Constructed	Village of Bolingbrook	12	6	6.0	0	0	$172,000
Hammel Woods Black Rd to Sunset Ridge	**East of Bronk from Black Road to Sunset Ridge Drive**	**Joliet**	**Will**	**Constructed**	**City of Joliet/FPDWC**	458	89	8.7	18,060	5,725	**$ 2,981,000**
Skateland Recreational Center Parking Lot	25334 W Eames Street	Channahon	Will	Permeable	Channahon Park District	2	0	0.1	219	5	$ 500,000
Ravine Woods	East of DuPage River, north of US 6, west of Bell	Channahon	Will	Streambank	Channahon Park District	153	77	76.5	0	0	$ 28,750
Lakewood Falls	Southeast of I-55, west of Weber Road	Unincorporate	Will	Wetland	Lakewood Falls Homeowners As	1080	201	16	28656	16414	$ 172,000
					Total Reduction and Cost	**3013**	**585**	**176**	**139635**	**9212**	**$ 6,787,471**

BMP Location ID 2



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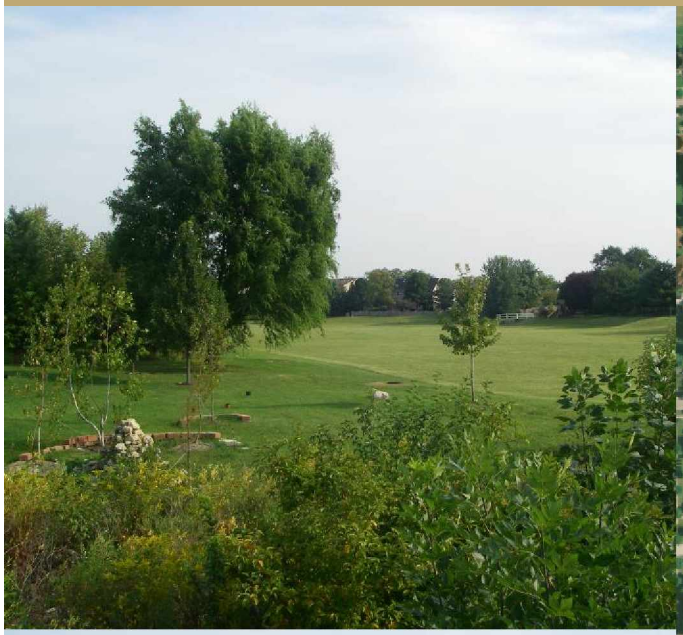

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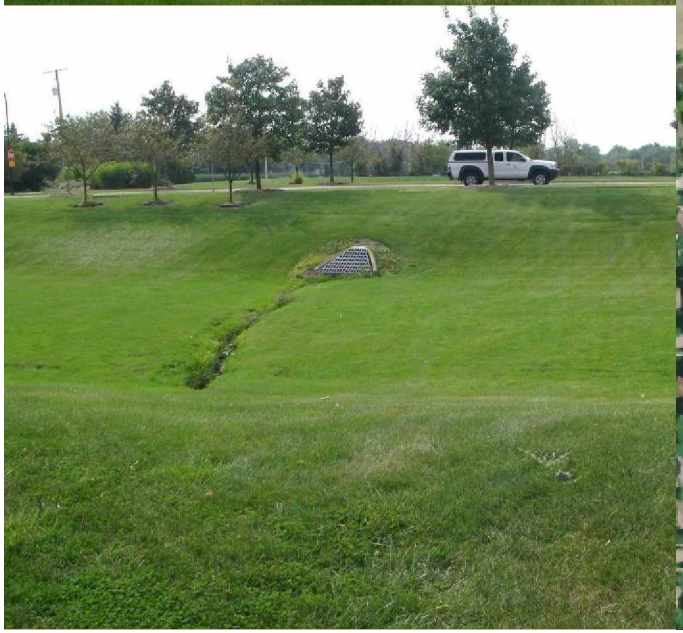

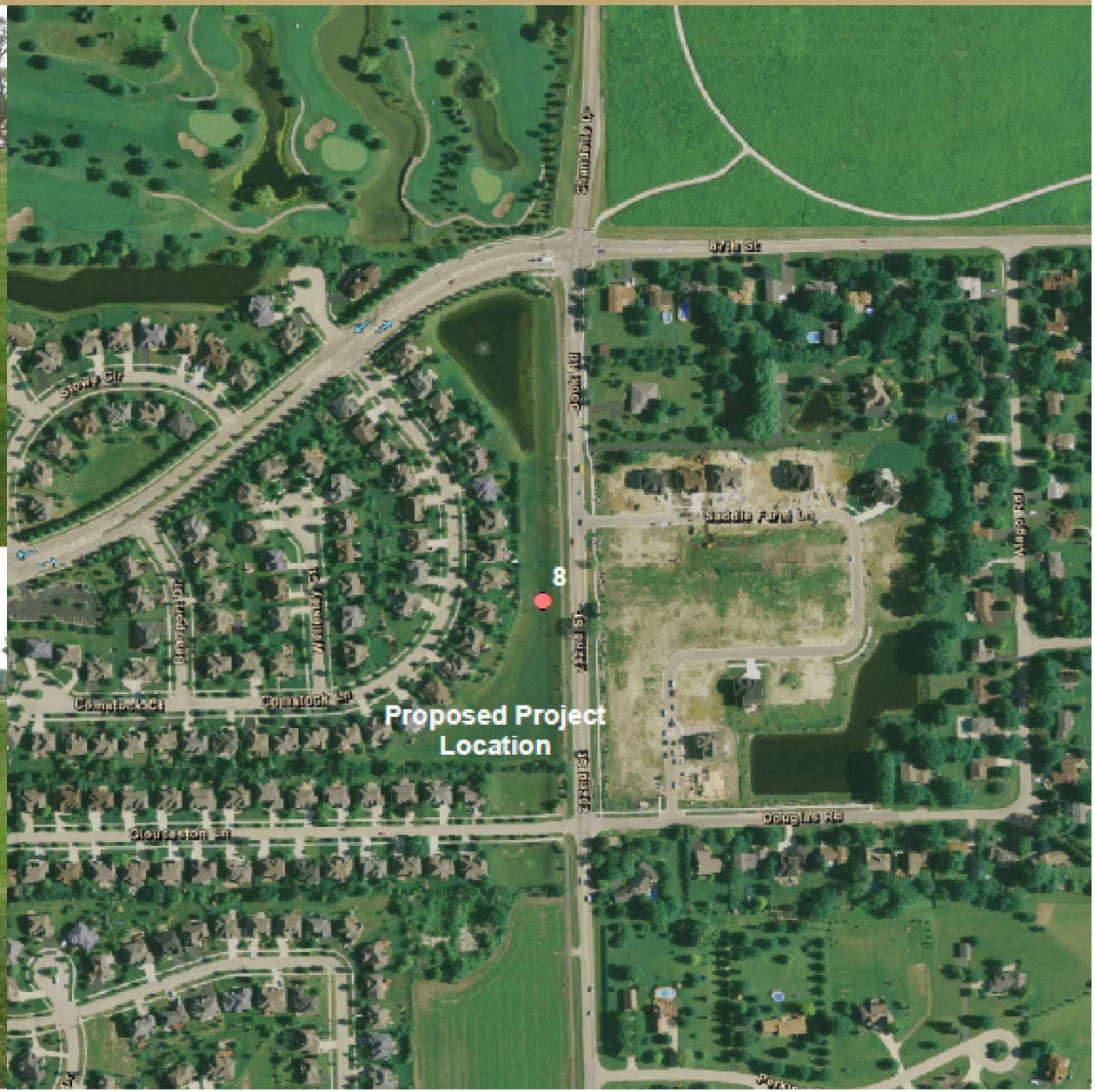

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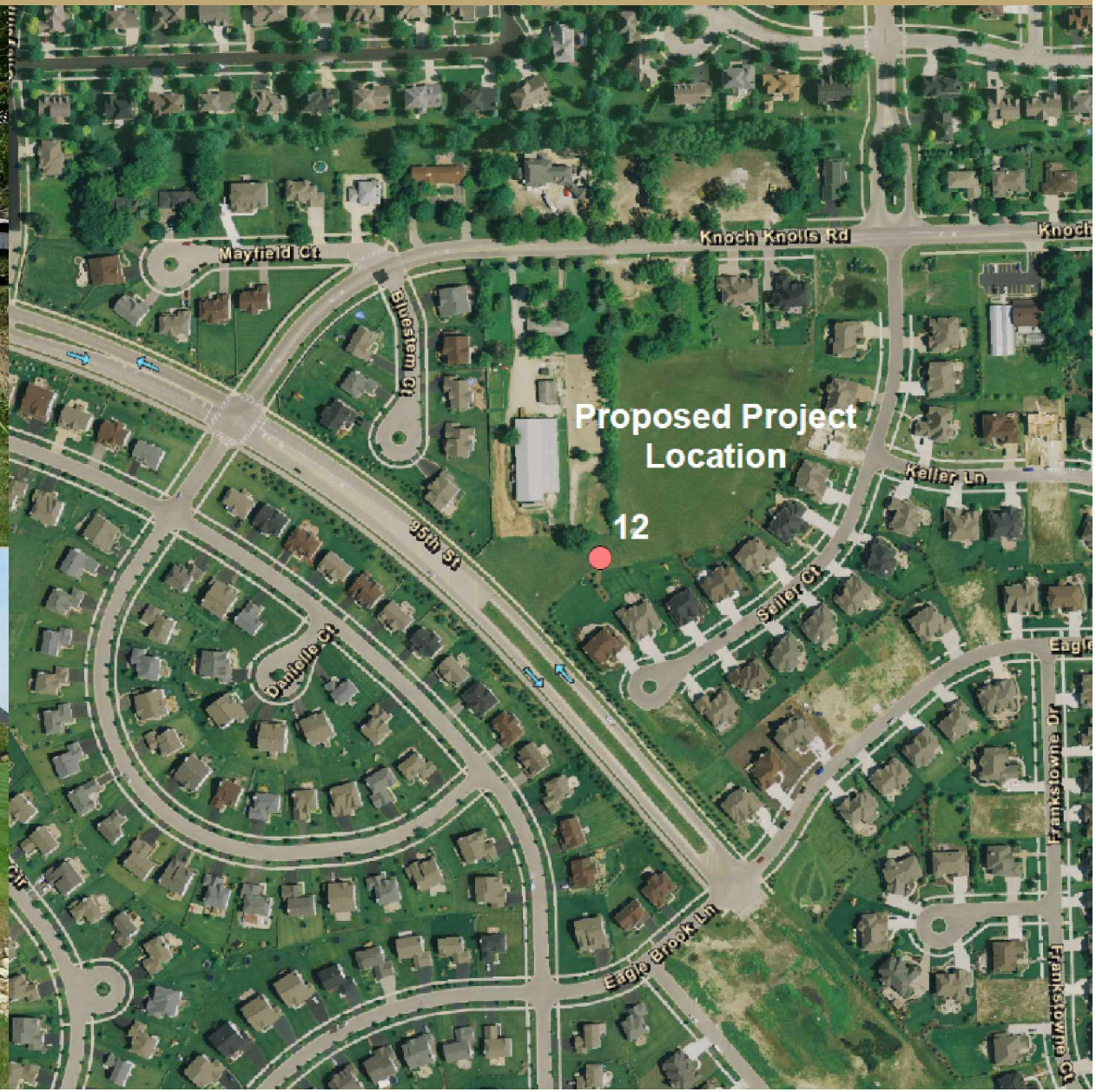

BMP Location ID 13

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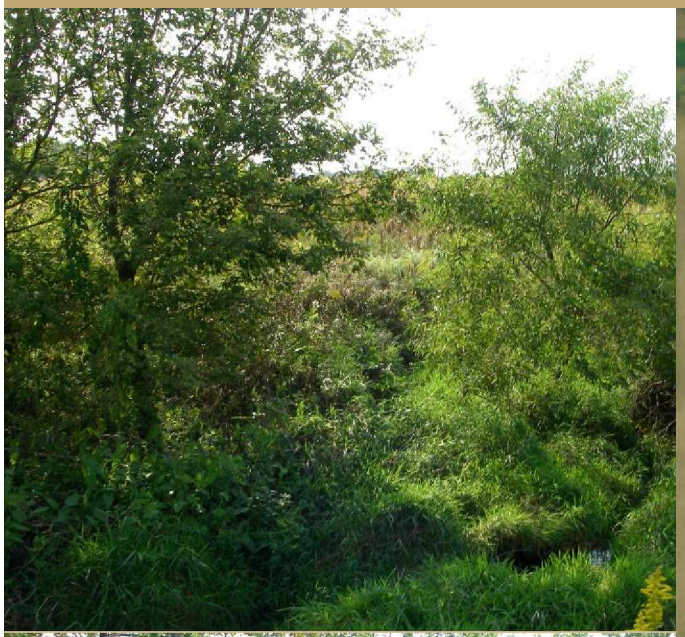

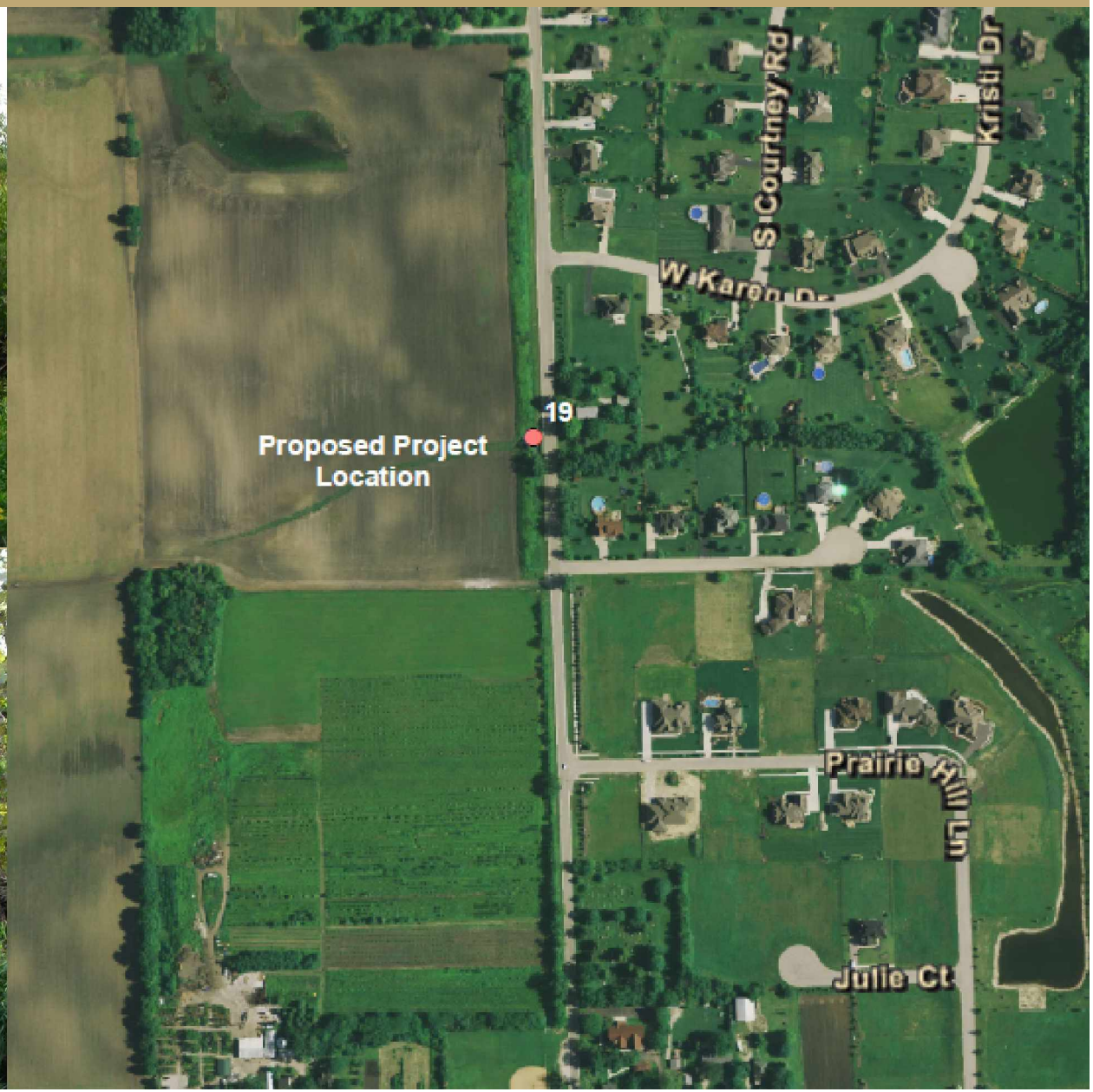

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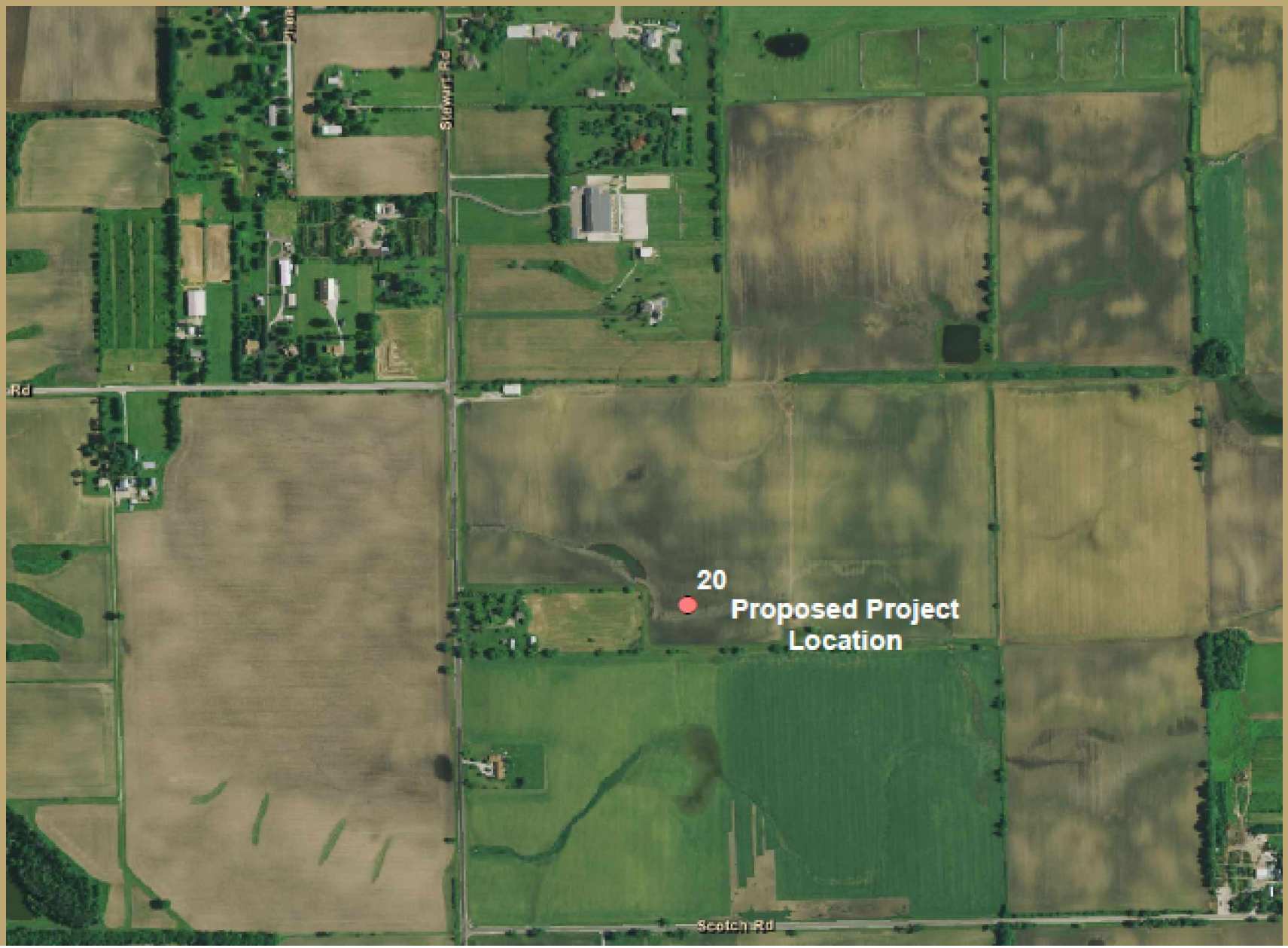

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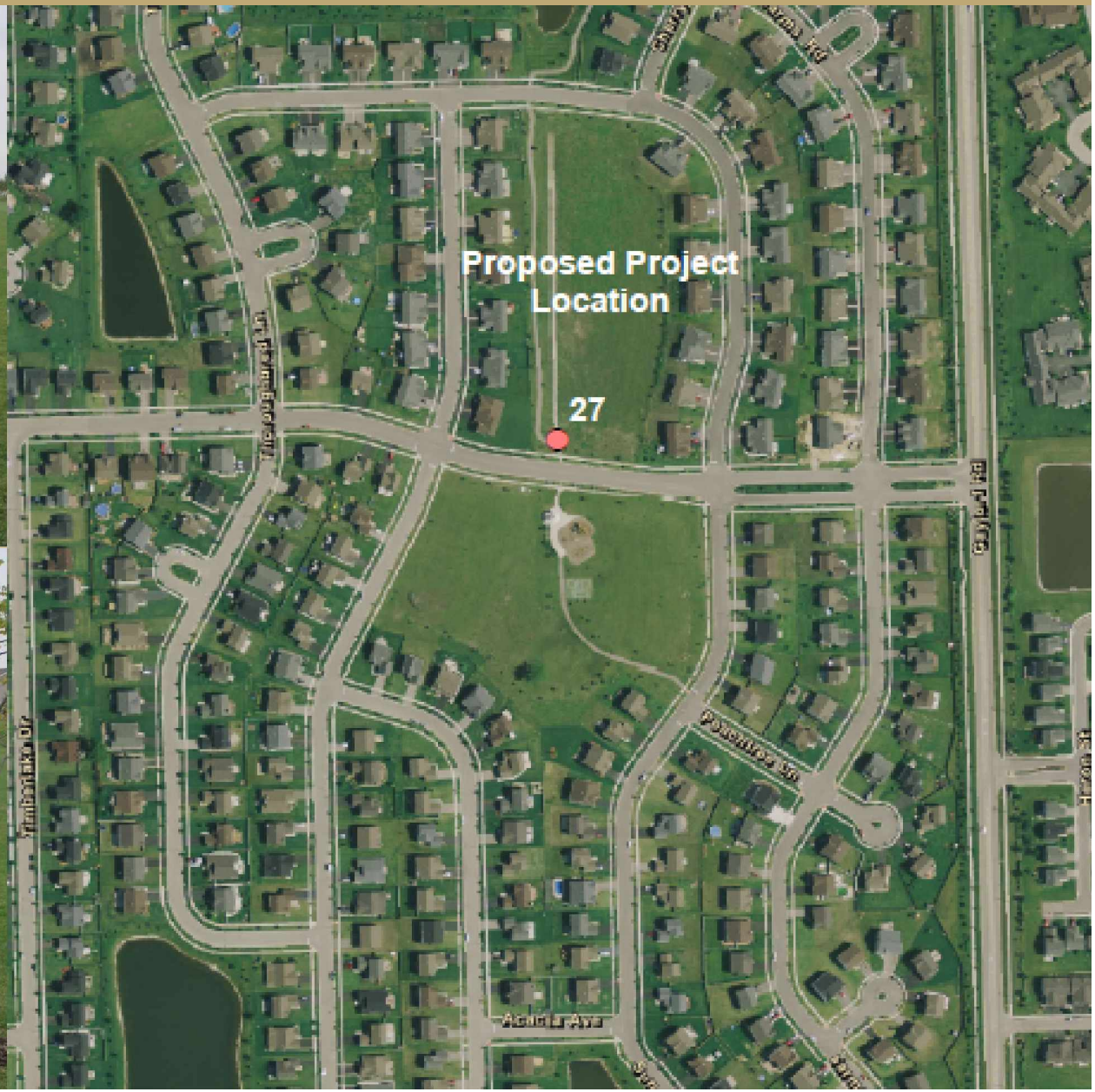

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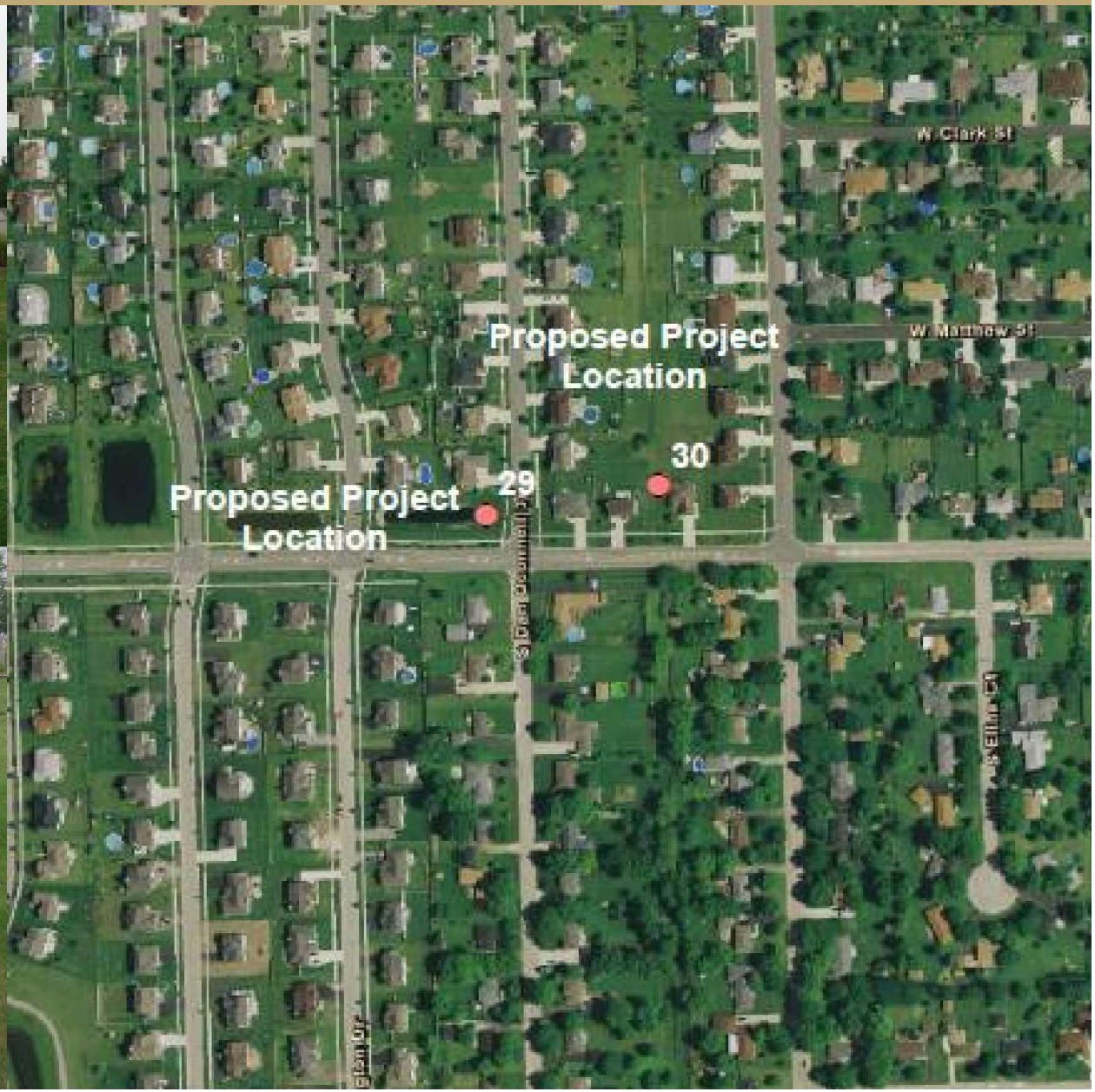

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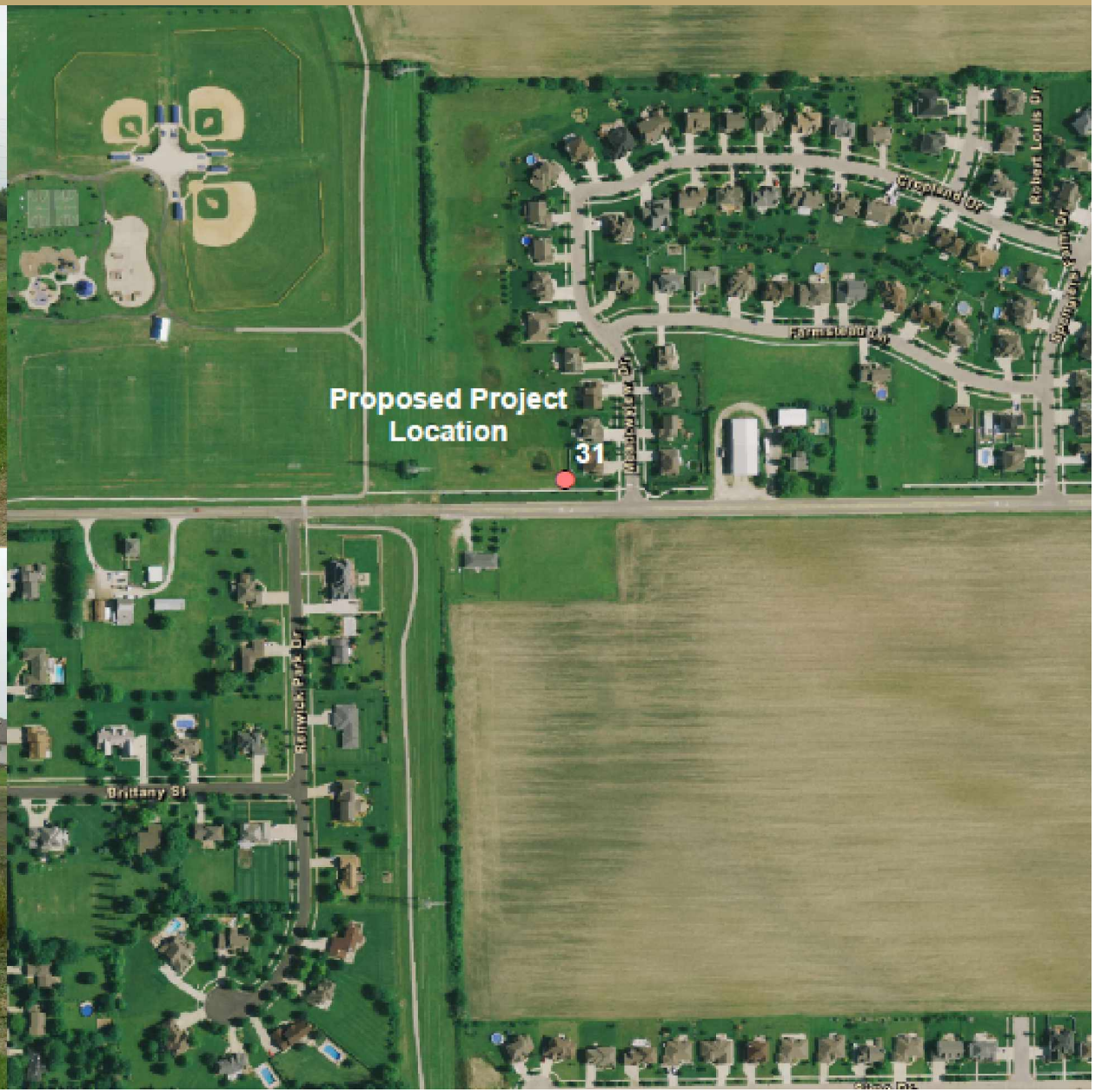

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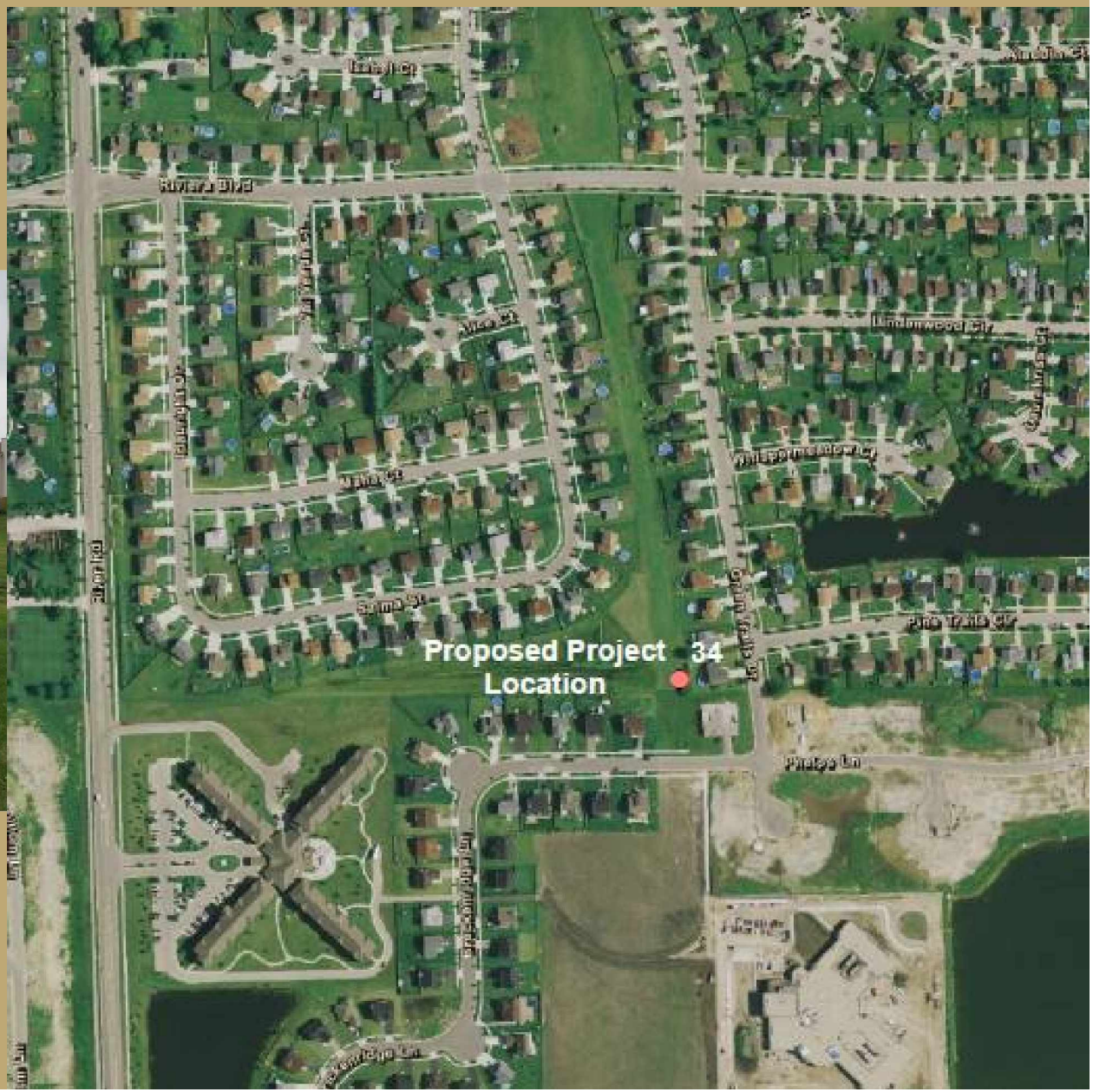

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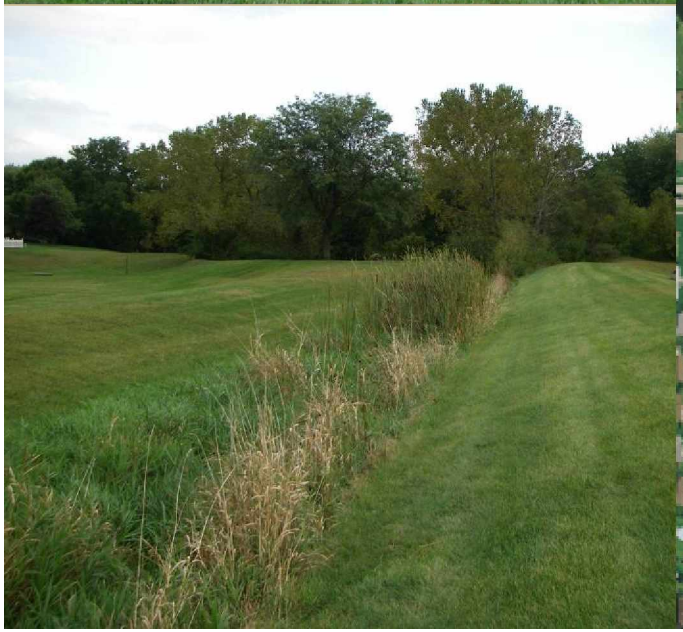

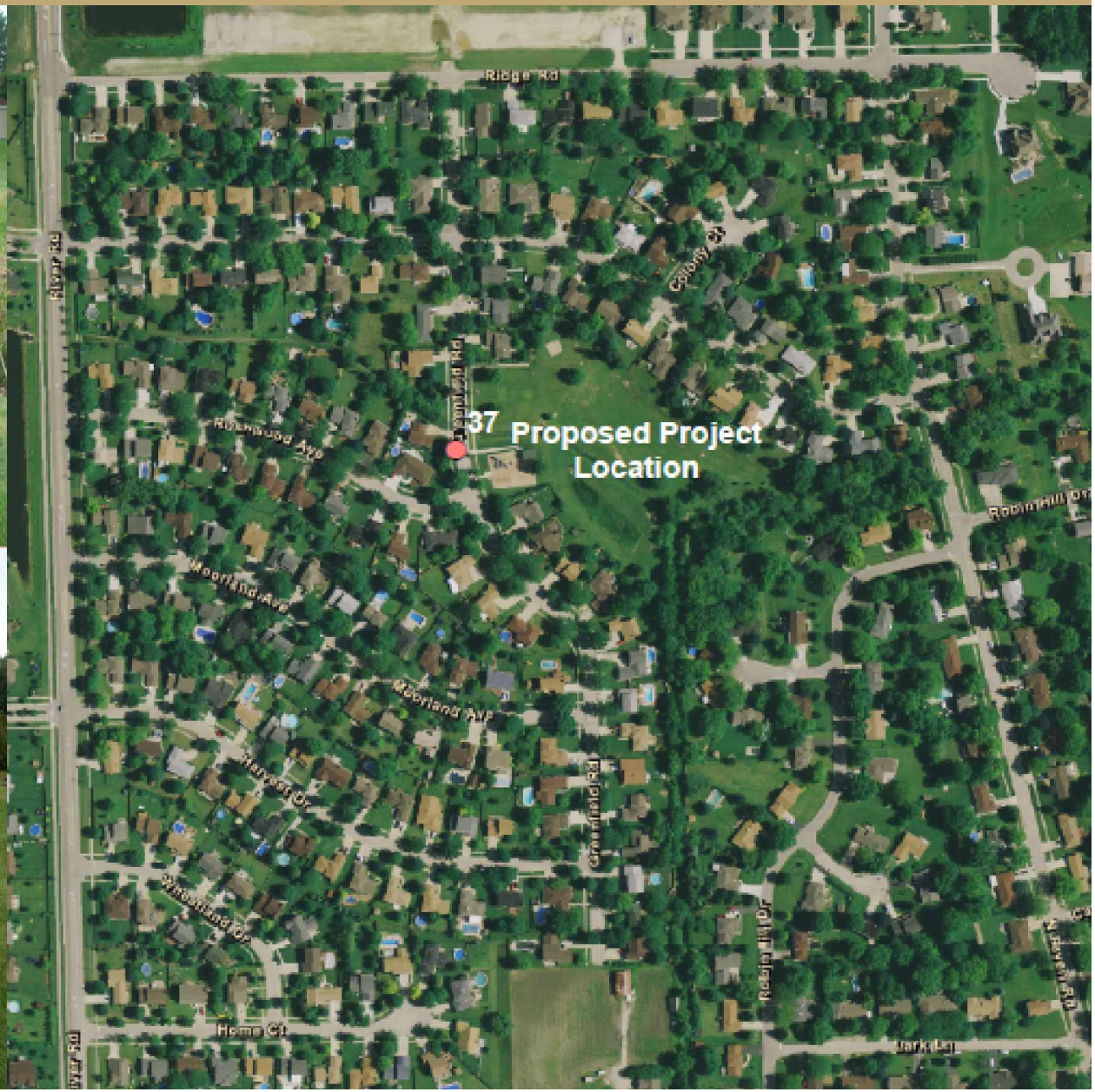

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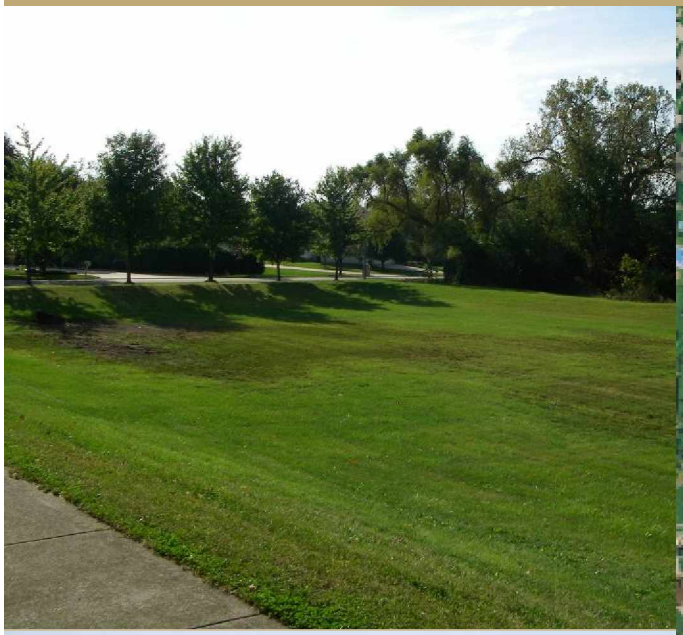

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 2

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	9,620	cy	$30.00	$288,585.00
1.02	Chemical Grass Application (side slopes only)	2.65	ac	$600.00	$1,590.00
				Section Subtotal:	**$290,175.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	2.65	ac	$2,500.00	$6,625.00
2.02	Wetland Seeding & Plugs (bottom of basin)	7.95	ac	$6,500.00	$51,675.00
2.03	Erosion Control Blanket (SC150BN on side slopes)	2.65	ac	$8,500.00	$22,525.00
				Section Subtotal:	**$80,825.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$290,175.00
2.00	Restoration		$80,825.00
		Sub Total	**$371,000.00**
		10% Design Contingency	$37,100.00
		15% Construction Contingency	$55,650.00
		TOTAL	**$463,750.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

1. Cost opinion does not include any utilities.
2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 7

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	4,538	cy	$30.00	$136,125.00
1.02	Chemical Grass Application (side slopes only)	1.25	ac	$600.00	$750.00
				Section Subtotal:	**$136,875.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	1.25	ac	$2,500.00	$3,125.00
2.02	Wetland Seeding & Plugs (bottom of basin)	3.75	ac	$6,500.00	$24,375.00
2.03	Erosion Control Blanket (SC150BN on side slopes)	1.25	ac	$8,500.00	$10,625.00
				Section Subtotal:	**$38,125.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$136,875.00
2.00	Restoration		$38,125.00
		Sub Total	**$175,000.00**
		10% Design Contingency	$17,500.00
		15% Construction Contingency	$26,250.00
		TOTAL	**$218,750.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 8

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	1,452	cy	$30.00	$43,560.00
1.02	Chemical Grass Application (side slopes only)	0.80	ac	$600.00	$480.00
				Section Subtotal:	**$44,040.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	0.80	ac	$2,500.00	$2,000.00
2.02	Wetland Seeding & Plugs (bottom of basin)	1.20	ac	$6,500.00	$7,800.00
2.03	Erosion Control Blanket (SC150BN on side slopes)	0.80	ac	$8,500.00	$6,800.00
				Section Subtotal:	**$16,600.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$44,040.00
2.00	Restoration		$16,600.00
		Sub Total	**$60,640.00**
		10% Design Contingency	$6,064.00
		15% Construction Contingency	$9,096.00
		TOTAL	**$75,800.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

1. Cost opinion does not include any utilities.
2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 9

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	2,813	cy	$30.00	$84,397.50
1.02	Chemical Grass Application (side slopes only)	0.78	ac	$600.00	$465.00
				Section Subtotal:	**$84,862.50**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	0.78	ac	$2,500.00	$1,937.50
2.02	Wetland Seeding & Plugs (bottom of basin)	2.33	ac	$6,500.00	$15,112.50
2.03	Erosion Control Blanket (SC150BN on side slopes)	0.78	ac	$8,500.00	$6,587.50
				Section Subtotal:	**$23,637.50**

	TOTALS		
1.00	Earthwork and Restoration Prep		$84,862.50
2.00	Restoration		$23,637.50
		Sub Total	**$108,500.00**
		10% Design Contingency	$10,850.00
		15% Construction Contingency	$16,275.00
		TOTAL	**$135,625.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

1. Cost opinion does not include any utilities.
2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 11

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Selective Tree and Brush Removal	1.50	ac	$5,000.00	$7,500.00
1.02	Stream Excavation (excavate 2ft of 3:1 side slopes)	180	cy	$30.00	$5,400.00
1.03	Herbicide Application	1.50	ac	$2,000.00	$3,000.00
				Section Subtotal:	**$15,900.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Stream Corridor Plantings (5,000 plugs/Ac)	0.25	ac	$20,000.00	$5,000.00
2.02	Stream Corridor Seeding	1.50	ac	$2,500.00	$3,750.00
2.03	Stream Corridor Erosion Control Blanket (SC150BN)	1.50	ac	$8,500.00	$12,750.00
2.04	Streambank Stabilization	1,200	lf	$50.00	$60,000.00
2.05	Native Tree & Shrub Plantings	50.00	each	$80.00	$4,000.00
				Section Subtotal:	**$85,500.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$15,900.00
2.00	Restoration		$85,500.00
		Sub Total	**$101,400.00**
		10% Design Contingency	$10,140.00
		15% Construction Contingency	$15,210.00
		TOTAL	**$126,750.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

1. Cost opinion does not include any utilities.
2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion does not include any drain tile installation, modification, or surfacing.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 12

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	3,267	cy	$30.00	$98,010.00
1.02	Chemical Grass Application (side slopes only)	0.90	ac	$600.00	$540.00
				Section Subtotal:	**$98,550.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	0.90	ac	$2,500.00	$2,250.00
2.02	Wetland Seeding & Plugs (bottom of basin)	2.70	ac	$6,500.00	$17,550.00
2.03	Erosion Control Blanket (SC150BN on side slopes)	0.90	ac	$8,500.00	$7,650.00
				Section Subtotal:	**$27,450.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$98,550.00
2.00	Restoration		$27,450.00
		Sub Total	**$126,000.00**
		10% Design Contingency	$12,600.00
		15% Construction Contingency	$18,900.00
		TOTAL	**$157,500.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

1. Cost opinion does not include any utilities.
2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 13

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Selective Tree and Brush Removal	1.25	ac	$5,000.00	$6,250.00
1.02	Stream Excavation (excavate 4ft of 3:1 side slopes)	360	cy	$30.00	$10,800.00
1.03	Herbicide Application	1.25	ac	$2,000.00	$2,500.00
				Section Subtotal:	**$19,550.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Stream Corridor Plantings (5,000 plugs/Ac)	0.25	ac	$20,000.00	$5,000.00
2.02	Stream Corridor Seeding	1.25	ac	$2,500.00	$3,125.00
2.03	Stream Corridor Erosion Control Blanket (SC150BN)	1.25	ac	$8,500.00	$10,625.00
2.04	Streambank Stabilization	1,000	lf	$50.00	$50,000.00
2.05	Native Tree & Shrub Plantings	100.00	each	$80.00	$8,000.00
				Section Subtotal:	**$76,750.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$19,550.00
2.00	Restoration		$76,750.00
		Sub Total	**$96,300.00**
		10% Design Contingency	$9,630.00
		15% Construction Contingency	$14,445.00
		TOTAL	**$120,375.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion does not include any drain tile installation, modification, or surfacing.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 19

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Selective Tree and Brush Removal	1.25	ac	$5,000.00	$6,250.00
1.02	Stream Excavation (excavate flat stream bottom)	360	cy	$30.00	$10,800.00
1.03	Herbicide Application	1.25	ac	$2,000.00	$2,500.00
				Section Subtotal:	**$19,550.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Stream Corridor Seeding and Plantings	1.25	ac	$6,500.00	$8,125.00
2.03	Stream Corridor Erosion Control Blanket (SC150BN)	1.25	ac	$8,500.00	$10,625.00
				Section Subtotal:	**$18,750.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$19,550.00
2.00	Restoration		$18,750.00
		Sub Total	**$38,300.00**
		10% Design Contingency	$3,830.00
		15% Construction Contingency	$5,745.00
		TOTAL	**$47,875.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion does not include any drain tile installation, modification, or surfacing.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 20

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.02	Stream Excavation (excavate flat stream bottom)	2,777	cy	$30.00	$83,310.00
1.03	Herbicide Application	8.60	ac	$2,000.00	$17,200.00
				Section Subtotal:	**$100,510.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Stream Corridor Seeding and Plantings	8.60	ac	$6,500.00	$55,900.00
2.03	Stream Corridor Erosion Control Blanket (SC150BN)	8.60	ac	$8,500.00	$73,100.00
				Section Subtotal:	**$129,000.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$100,510.00
2.00	Restoration		$129,000.00
		Sub Total	**$229,510.00**
		10% Design Contingency	$22,951.00
		15% Construction Contingency	$34,426.50
		TOTAL	**$286,887.50**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion does not include any drain tile installation, modification, or surfacing.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 23

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	7,623	cy	$30.00	$228,690.00
1.02	Chemical Grass Application (side slopes only)	2.10	ac	$600.00	$1,260.00
				Section Subtotal:	**$229,950.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	2.10	ac	$2,500.00	$5,250.00
2.02	Wetland Seeding & Plugs (bottom of basin)	6.30	ac	$6,500.00	$40,950.00
2.03	Erosion Control Blanket (SC150BN on side slopes)	2.10	ac	$8,500.00	$17,850.00
				Section Subtotal:	**$64,050.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$229,950.00
2.00	Restoration		$64,050.00
		Sub Total	**$294,000.00**
		10% Design Contingency	$29,400.00
		15% Construction Contingency	$44,100.00
		TOTAL	**$367,500.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

1. Cost opinion does not include any utilities.
2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 27

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Remove Concrete Ditch	726	sy	$30.00	$21,780.00
1.02	Earth Excavation (bottom of basin only @ 3" depth)	2,813	cy	$30.00	$84,397.50
1.03	Chemical Grass Application (side slopes only)	0.83	ac	$600.00	$495.00
				Section Subtotal:	**$106,672.50**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	0.83	ac	$2,500.00	$2,062.50
2.02	Wetland Seeding & Plugs (bottom of basin)	2.48	ac	$6,500.00	$16,087.50
2.03	Erosion Control Blanket (SC150BN on side slopes)	0.83	ac	$8,500.00	$7,012.50
				Section Subtotal:	**$25,162.50**

	TOTALS		
1.00	Earthwork and Restoration Prep		$106,672.50
2.00	Restoration		$25,162.50
		Sub Total	**$131,835.00**
		10% Design Contingency	$13,183.50
		15% Construction Contingency	$19,775.25
		TOTAL	**$164,793.75**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 30

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Chemical Grass Application	1.70	ac	$600.00	$1,020.00
				Section Subtotal:	**$1,020.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding	1.70	ac	$2,500.00	$4,250.00
2.02	Wetland Plugs	0.10	ac	$6,500.00	$650.00
2.03	Erosion Control Blanket (SC150BN)	1.70	ac	$8,500.00	$14,450.00
				Section Subtotal:	**$19,350.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$1,020.00
2.00	Restoration		$19,350.00
		Sub Total	**$20,370.00**
		10% Design Contingency	$2,037.00
		15% Construction Contingency	$3,055.50
		TOTAL	**$25,462.50**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

1. Cost opinion does not include any utilities.
2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 31

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	4,538	cy	$30.00	$136,125.00
1.02	Chemical Grass Application (side slopes only)	1.25	ac	$600.00	$750.00
				Section Subtotal:	**$136,875.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	1.25	ac	$2,500.00	$3,125.00
2.02	Wetland Seeding & Plugs (bottom of basin)	3.75	ac	$6,500.00	$24,375.00
2.03	Erosion Control Blanket (SC150BN on side slopes)	1.25	ac	$8,500.00	$10,625.00
				Section Subtotal:	**$38,125.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$136,875.00
2.00	Restoration		$38,125.00
		Sub Total	**$175,000.00**
		10% Design Contingency	$17,500.00
		15% Construction Contingency	$26,250.00
		TOTAL	**$218,750.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

1. Cost opinion does not include any utilities.
2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 33

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	4.5	ac	$500.00	$2,250.00
				Section Subtotal:	**$2,250.00**

	TOTALS		
1.00	Earthwork and Restoration		$2,250.00
		Sub Total	**$2,250.00**
		10% Design Contingency	$225.00
		15% Construction Contingency	$337.50
		TOTAL	**$2,812.50**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion does not include contaminated material clean up, haul off or disposal.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 34

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	5,717	cy	$30.00	$171,517.50
1.02	Chemical Grass Application (side slopes only)	1.58	ac	$600.00	$945.00
				Section Subtotal:	**$172,462.50**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	1.58	ac	$2,500.00	$3,937.50
2.02	Wetland Seeding & Plugs (bottom of basin)	4.73	ac	$6,500.00	$30,712.50
2.03	Erosion Control Blanket (SC150BN on side slopes)	1.58	ac	$8,500.00	$13,387.50
				Section Subtotal:	**$48,037.50**

	TOTALS		
1.00	Earthwork and Restoration Prep		$172,462.50
2.00	Restoration		$48,037.50
		Sub Total	**$220,500.00**
		10% Design Contingency	$22,050.00
		15% Construction Contingency	$33,075.00
		TOTAL	**$275,625.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 37

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Chemical Weed Control (stream only)	0.60	ac	$2,000.00	$1,200.00
1.02	Earth Excavation (bottom of basin only @ 3" depth)	1,543	cy	$30.00	$46,282.50
1.03	Chemical Grass Application (side slopes only)	0.43	ac	$600.00	$255.00
				Section Subtotal:	**$47,737.50**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Stream Restoration Seeding	0.60	ac	$6,500.00	$3,900.00
2.02	Stream Restoration Plugs	0.10	ac	$4,000.00	$400.00
2.03	Wetland Seeding (side slopes only)	0.43	ac	$2,500.00	$1,062.50
2.04	Wetland Seeding & Plugs (bottom of basin)	1.28	ac	$6,500.00	$8,287.50
2.05	Erosion Control Blanket (SC150BN on side slopes)	0.43	ac	$8,500.00	$3,612.50
				Section Subtotal:	**$17,262.50**

	TOTALS		
1.00	Earthwork and Restoration Prep		$47,737.50
2.00	Restoration		$17,262.50
		Sub Total	**$65,000.00**
		10% Design Contingency	$6,500.00
		15% Construction Contingency	$9,750.00
		TOTAL	**$81,250.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 38

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Remove Concrete Ditch	484	sy	$30.00	$14,520.00
1.02	Earth Excavation (bottom of basin only @ 3" depth)	2,239	cy	$30.00	$67,155.00
1.03	Chemical Grass Application (side slopes only)	0.65	ac	$600.00	$390.00
				Section Subtotal:	**$82,065.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	0.65	ac	$2,500.00	$1,625.00
2.02	Wetland Seeding & Plugs (bottom of basin)	1.95	ac	$6,500.00	$12,675.00
2.03	Erosion Control Blanket (SC150BN on side slopes)	0.65	ac	$8,500.00	$5,525.00
				Section Subtotal:	**$19,825.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$82,065.00
2.00	Restoration		$19,825.00
		Sub Total	**$101,890.00**
		10% Design Contingency	$10,189.00
		15% Construction Contingency	$15,283.50
		TOTAL	**$127,362.50**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 39

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	817	cy	$30.00	$24,502.50
1.02	Chemical Grass Application (side slopes only)	0.23	ac	$600.00	$135.00
				Section Subtotal:	**$24,637.50**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	0.23	ac	$2,500.00	$562.50
2.02	Wetland Seeding & Plugs (bottom of basin)	0.68	ac	$6,500.00	$4,387.50
2.03	Erosion Control Blanket (SC150BN on side slopes)	0.23	ac	$8,500.00	$1,912.50
				Section Subtotal:	**$6,862.50**

	TOTALS		
1.00	Earthwork and Restoration Prep		$24,637.50
2.00	Restoration		$6,862.50
		Sub Total	**$31,500.00**
		10% Design Contingency	$3,150.00
		15% Construction Contingency	$4,725.00
		TOTAL	**$39,375.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 40

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.01	Earth Excavation (bottom of basin only @ 3" depth)	2,450	cy	$30.00	$73,507.50
1.02	Chemical Grass Application (side slopes only)	0.68	ac	$600.00	$405.00
				Section Subtotal:	**$73,912.50**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Wetland Seeding (side slopes only)	0.68	ac	$2,500.00	$1,687.50
2.02	Wetland Seeding & Plugs (bottom of basin)	2.03	ac	$6,500.00	$13,162.50
2.03	Erosion Control Blanket (SC150BN on side slopes)	0.68	ac	$8,500.00	$5,737.50
				Section Subtotal:	**$20,587.50**

	TOTALS		
1.00	Earthwork and Restoration Prep		$73,912.50
2.00	Restoration		$20,587.50
		Sub Total	**$94,500.00**
		10% Design Contingency	$9,450.00
		15% Construction Contingency	$14,175.00
		TOTAL	**$118,125.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion for Wetland Seeding and Plugs includes 1,000 plugs/Ac.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Lower DuPage Watershed Management Plan

FOR CONCEPTUAL IMPROVEMENTS AS DESCRIBED IN THE WMP

BMP Location 41

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
1.00	**EARTHWORK AND RESTORATION PREP**				
1.03	Herbicide Application	4.48	ac	$2,000.00	$8,960.00
				Section Subtotal:	**$8,960.00**

Item	Description	Est. Qty.	Unit	Unit Cost	Subtotal
2.00	**RESTORATION**				
2.01	Stream Corridor Seeding and Plantings	4.48	ac	$6,500.00	$29,120.00
2.03	Stream Corridor Erosion Control Blanket (SC150BN)	4.48	ac	$8,500.00	$38,080.00
				Section Subtotal:	**$67,200.00**

	TOTALS		
1.00	Earthwork and Restoration Prep		$8,960.00
2.00	Restoration		$67,200.00
		Sub Total	**$76,160.00**
		10% Design Contingency	$7,616.00
		15% Construction Contingency	$11,424.00
		TOTAL	**$95,200.00**

This Engineer's Opinion of Probable Cost is based upon the conceptual planning-level improvements described in the Lower DuPage River Watershed Management Plan. Since V3 Companies has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, the Opinion of Probable Costs represents a best judgment as an experienced and qualified professional engineer, familiar with the construction industry; however, V3 Companies can not and does not guarantee that proposals, bids or actual construction costs will not vary from the Opinion of Probable Cost prepared by V3 Companies.

NOTES:

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2. Cost opinion does not include tree removal or tree replacement.
3. Cost opinion does not include annual maintenance or monitoring costs that may be required.
4. Cost opinion does not include any pavement patching or replacement.
5. Cost opinion for Earth Excavation includes cost for hauling clean material off-site.
6. Cost opinion does not include contaminated material clean up, haul off or disposal.
7. Cost opinion does not include any drain tile installation, modification, or surfacing.

FID	Shape *	Comment	Max_PDOP	Corr_Type	GPS_Height	Vert_Prec	Horz_Prec	Std_Dev	Northing	Easting	Point_ID
0	Point	bioswale or demo site	2.2	Real-time SBAS Corrected	582.011	1	0.5	49.746485	1858801.775	1026216.008	1
1	Point	wetland area potential large area big dr area	2.2	Real-time SBAS Corrected	592.607	0.9	0.6	0.112189	1853371.15	1022597.297	2
2	Point	prairie restoration	2.9	Uncorrected	589.571	1.2	0.9	0.805644	1854830.054	1028558.288	3
3	Point	buffer both sides of creek	3.6	Real-time SBAS Corrected	573.651	1.6	0.9	0.059791	1851535.984	1027486.099	6
4	Point	pretreatment wetland area	3.8	Real-time SBAS Corrected	576.419	1.7	0.9	0.197014	1851636.762	1027635.051	7
5	Point	move point north wetland restoration	2.8	Uncorrected	599.256	9.3	5.7	0.086449	1841313.628	1024055.985	8
6	Point	wetland conversion	3.1	Real-time SBAS Corrected	575.398	1.4	0.8	0.314662	1841575.022	1021278.647	9
7	Point	wetland area possible	4.2	Uncorrected	587.099	1.6	1.2	0.421427	1838859.36	1008196.508	10
8	Point	bank stabilization\wetland enhance	5.1	Real-time SBAS Corrected	536.155	2.2	1.3	2.508702	1836314.211	1029727.013	11
9	Point	wetland creation	2.6	Uncorrected	533.673	8.6	5.8	0.43963	1836622.586	1032348.398	12
10	Point	1500l 4h ero lrr .06 riparian rest	5.8	Uncorrected	565.091	9.6	6.3	3.128946	1835282.81	1057688.921	13
11	Point	wetland possibilities	2.8	Uncorrected	655.035	9.1	6	0.350907	1846158.876	1071285.618	14
12	Point	native filter strip/swale	3.4	Uncorrected	578.435	8.6	6.3	2.791442	1832903.448	1055018.82	15
13	Point	excavate/plant swale drainage	3.9	Uncorrected	579.464	9.2	6.7	1.641618	1832935.087	1055156.96	16
14	Point	ag field grass waterway 30-40ft to cornn	3.1	Uncorrected	585.787	9.4	5.9	0.215161	1826013.743	1007619.768	17
15	Point	wet field standing water	3.6	Uncorrected	592.934	10.2	6.1	0.116043	1827493.353	1006056.292	18
16	Point	50ft2ftwx1ftd gully wascob	2.2	Real-time SBAS Corrected	586.081	1	0.6	0.214864	1822334.344	1006177.425	19
17	Point	300x1.5x1 gully both sidesof road	2.2	Uncorrected	623.724	8.2	5.8	1.243977	1822581.047	1001592.53	20
18	Point	waterway on east side of road	2.1	Uncorrected	581.961	8.1	5.8	0.100472	1819903.475	1006299.079	21
19	Point	stream buffer right bank east of point	2.9	Uncorrected	532.952	9.5	5.8	0.109785	1821380.653	1033319.237	22
20	Point	dry det-wetland conv	5	Uncorrected	549.595	11.5	6.2	0.990013	1820838.302	1027068.5	23
21	Point	stream buffer and no till	4.4	Uncorrected	532.905	11.5	6.2	0.307571	1820673.768	1024856.251	24
22	Point	stream buffer crep	5.3	Uncorrected	544.865	11.6	6.3	3.629514	1817534.34	1024967.509	25
23	Point	dry det- wetland creation possible	3.5	Uncorrected	532.469	1.7	0.7	0.14613	1811556.976	1012364.578	26
24	Point	veg swale remove conc wetland rest	4.1	Real-time SBAS Corrected	507.843	1.1	1.2	2.207327	1792807.085	1035451.032	27
25	Point	dry det drains direct to stream	5	Uncorrected	476.92	10.6	6.6	5.13735	1788186.051	1033764.201	28
26	Point	wetland creation 2 cell treatment	3.6	Uncorrected	486.454	10	6.2	0.129592	1792168.785	1022500.086	29
27	Point	concrete swale	3.5	Real-time SBAS Corrected	481.862	1.5	1	0.144687	1792214.402	1022771.642	30
28	Point	high priority wetland creation sed source	2	Uncorrected	492.06	8	5.7	0.263264	1794693.084	1017803.364	31
29	Point	illegal dumping vol cleanup	5.7	Uncorrected	532.289	11.1	6.4	1.67511	1789168.882	1003228.955	32
30	Point	25lx10wx4d gully wascob/dry dam	5.3	Uncorrected	529.474	11.7	6.5	1.362817	1787516.188	1005280.586	33
31	Point	wetland potential	5.9	Uncorrected	498.721	10	6.2	3.53274	1776180.139	1016892.706	34
32	Point	dry det across intersection	1.9	Uncorrected	497.571	7.9	5.7	0.37152	1776513.344	1034448.364	35
33	Point	restoration potential low priority cost high	3.4	Uncorrected	466.065	9.6	6.1	2.039163	1763667.514	1046183.39	36
34	Point	possible wetland cell/demo site	5.4	Uncorrected	489.259	9.7	6.8	8.299989	1770013.524	1016665.025	37
35	Point	veg swale or wetland creation	5.8	Uncorrected	492.247	1.5	0.8	0.320343	1764526.276	1015406.52	38
36	Point	dry det possiblewetland creation	3.4	Uncorrected	480.132	10	6	0.400663	1763877.272	1016790.397	39
37	Point	dry det pos wetland creation	3.7	Uncorrected	484.868	10.5	6	0.128714	1762537.068	1015546.611	40
38	Point	waterway in field	5.5	Uncorrected	480.361	13.5	5.9	0.230979	1757633.942	1015249.207	41
39	Point	possible enhancement low priority	4.7	Uncorrected	414.74	12	6.1	0.184329	1739141.451	1015572.408	42
40	Point	drydet lo	3.9	Uncorrected	424.083	10.4	6.3	0.125135	1751177.149	1023993.664	43